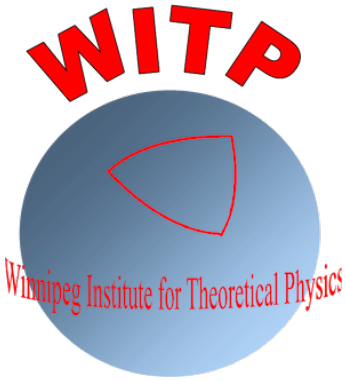
The Winnipeg Institute for Theoretical Physics

2018 Review



February 2018

Website: http://www.physics.umanitoba.ca/WITP/witp.html

Expectation of centre/institute	**page number**
Have clearly identified goals and objectives	5
Have some degree of permanence, transcending collaboration on a particular, limited project	3, 5
Bring together scholars from different disciplines and/or areas of specialization within a particular discipline	3, 5, 14-17, 18-21
Maintain high levels of research productivity	8-13, 23-67
Foster the training of future researchers, especially in regard to research skills	9-11, 14-17, 18-20, 68-75
Attract post-doctoral fellows, visiting professors, and other scholars	10-11, 14-20, 68-69, 74-75
Cooperate with scholars at other universities and/or institutions	12-13, 18-20, 23-67, 76-80
Seek external funding in order to operate on a cost recovery basis	8, 18-21, 81

Contents

1 General Background

1.1 History

The Winnipeg Institute for Theoretical Physics (WITP) is a type III research Institute and is a joint Institute between the University of Manitoba (UM) and the University of Winnipeg (UW) with support by Brandon University. The past year was the 27th year of the Institute's existence. The community of theoretical physicists in Manitoba was growing in the late 1980s, and the Institute was created in 1990 to support theoretical physics research in Manitoba. The purpose of the Institute was to increase the cooperation and collaboration between the theoretical physicists in Manitoba, thereby strengthening the community, and to initiate and sustain research collaborations between members of the Institute and first class researchers from all over the world. There are no national labs in theoretical physics thus larger structures have to be formed and supported locally. The WITP is one of several local research institutes in Canada which serves this purpose; others include e.g. the Pacific Institute for Theoretical Physics (PITP) based in Vancouver, and—as a larger structure—the Centre de Recherche Mathematique (CRM) based in Montreal. The activities of the WITP help to expose the graduate students of its Members to different people and ideas, through seminars, lecture series, and summer schools, thereby increasing the quality of training provided, and in the long term also attracting further high quality students from Canada and abroad. The long-term success of the WITP in achieving these goals as well as a strong community of theoretical physicists in the province provide a strong reason for its continued existence as a research institute. The Institute is located in the physics departments of UM and UW but has no physical facilities independent of those departments. Secretarial services, such as sending out notices of seminars, meetings, letters of invitation to visitors, applications for funding, etc., are shared by the secretaries of the physics departments at both Universities. The physics departments of the two Universities have agreed to provide office space for visitors.

1.2 Membership and Administrative Structure

The Members of the Institute fall into four categories:

- Permanent Members (referred to as Members) include all theoretical physicists and some mathematicians on the faculty of either UM or UW as well as Brandon University. These include Senior Scholars.
- Associate Members include all postdoctoral fellows, research associates, and long term visitors (12 months or longer) to the Institute.
- Student Members include all graduate students supervised by Permanent Members as well as summer undergraduate research students.
- Visitors include all short term visitors (less than 12 months) for the duration of their stay.

The last 5 years have seen a significant growth in the number of permanent and student members as shown in Figure 1.

Executive The Executive consists of a Director, a Past-Director, and a Director-Elect. The Director-Elect is elected from the Permanent Members by the Policy Committee. There is at least one representative from each of the two Universities (UM and UW) on the Executive at all times. The Executive spends less than 10% of their time with the administrative aspects of the Institute. The duties of the executive are as follows:

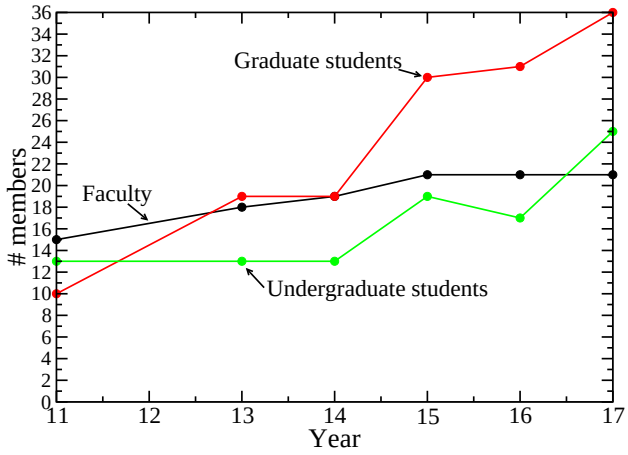


Figure 1: Number of permanent members, graduate students, and undergraduate summer students from 2011-2017.

- Director (term is typically two years)
  - chair Policy Committee meetings
  - budget preparation and control
  - report to and interact with administrators at both Universities
  - receive applications in writing for funding
  - approve (in consultation with the Executive) applications of $1,000 or less
  - assist Past-Director with preparation of Annual Report
  - submit applications for funding on behalf of the Institute to the Universities and external funding agencies, as required
  - assume office as Past-Director in the following term
- Past-Director
  - prepare Annual Report
  - advise Director
  - assume responsibilities of Director if required
- Director-Elect
  - organize seminar series
  - assist Director in budget preparation
  - fill in as Director if Director and Past-Director unavailable
  - assume office as Director in the following term

Policy Committee This committee consists of all Permanent Members. Its duties include:

- election of Director-elect
- approve expenditure of more than $1,000
- elect new Permanent Members as appropriate
- decide on direction and policy of Institute

- plan and approve future programs, workshops, long-term visitors

Funding Sources The purpose and the activities of the Institute are designed to ensure that virtually all funds go directly towards research, in the form of visitors, seminars, workshops, and summer schools. The structure of the Institute is such that it does not incur or depend on any fixed annual cost. Since the Institute is a collection of theorists, we have no expensive equipment to maintain or technicians to employ. There are virtually no direct infrastructure costs. Funding for the Institute originally came from seed money from both the University of Manitoba ($40,000) and the University of Winnipeg ($25,000) as well as a grant of $1,000 from Brandon University. More recently, the Faculties of Science at UM and UW have each committed $8000 while Brandon University committed $5000 to the WITP for 2013-2017. This lead to an annual budget of the WITP for the last 5 fiscal years of $4200 p.a. In addition to the supporting funds indicated above, it should be pointed out that the members of the Institute use their individual NSERC discovery grants to subsidize Institute activities. This substantial commitment of funds is typically greater than the sum of other WITP expenditures in a given fiscal year. Since the last review, the number of graduate and summer students has more than doubled while the number of permanent members has increased as well. Funding at a level commensurate with the larger number of members and students it serves, is essential for a successful future of the WITP.

2 Mission and Objectives

2.1 Original Objectives

In the original proposal for the creation of WITP, the objectives were listed as:

1. Enhance research output
2. Increase visibility nationally and internationally
3. Increase cooperation and collaboration amongst researchers
4. Enhance facilities for training of highly qualified research personnel, such as graduate students and postdoctoral fellows
5. Enhance the ability of Members to attract external research support

Also in the proposal, the specific activities and functions of the Institute designed to achieve the above objectives were defined as follows:

- Facilitate long-term scientific visitors
- Bring in seminar speakers on a variety of hot topics
- Organize workshops, conferences of topics on interest to members

Note that "facilities" for HQP training means the capabilities of members to train HQP in an effective manner. The WITP, as a collection of theorists, has no independent physical facilities.

2.2 Achievement of Objectives

The WITP has carried out the above mandate by encouraging collaboration between members of the Institute and by financially supporting workshops, visiting colloquium speakers, short- and long-term visits by research collaborators of international standing, and an annual summer school or summer workshop for our summer and graduate students.

The Institute has produced annual reports summarizing the activities, which are available at `http://www.physics.umanitoba.ca/WITP/reports.html` Details of how these objectives have been achieved are given in the sections listed below (objectives are identified in order as given above):

1. See sections 3.1, 3.4, 5.1, and appendix I.1.
2. See sections 3.4, 5.2, and appendices I.2, I.3, and I.5.
3. See sections 3.3, 3.4, and appendices I.2 and I.3.
4. See sections 3.3, 3.4, 4.1, 4.2, 5.2, 6.1, and appendix I.4.
5. See section 3.2 and appendix II.

The WITP's strategies to achieve its objectives over the next five years are given in sections 7.1 and 7.2.

2.3 Changes to Objectives

The WITP objectives, in general, have not changed. An important addition to our activities, however, has been the annual summer school/workshop which offers our students the possibility to present their own research. Furthermore, we have invited lecturers of international standing to present topics at the forefront of theoretical physics research at the annual summer school/workshop. In addition to faculty members of the Physics departments of the participating universities we have in recent times also added faculty members from the Mathematics department at UM and are anticipating that interdisciplinary research will play an even more important role within the WITP in the future.

3 Research Accomplishments

3.1 Publications & Presentations

According to its mandate, the WITP exists to enhance the research of its individual Members in theoretical physics. Therefore, there is no distinction between Institute research and the research of individual members. The work of WITP Members has been extremely productive, representing the high activity level of theoretical physics in Manitoba, which spans many disciplines in physics, including string theory, gravitational physics, condensed matter physics, mesoscopic physics, quantum optics, particle physics, astrophysics, and mathematical physics. In the five year period 2013 through 2017, WITP members have more than **300** refereed journal articles. Many of these publications have involved WITP Student Members as co-authors, and several are published in prestigious journals, such as *Nature*, *Physical Review Letters*, and the *Astrophysical Journal*.

In addition, the WITP Permanent Members have given a total of about **200** scientific presentations, including invited and contributed conference presentations, and colloquia at physics departments. These presentations at locations throughout the world have served to increase the visibility of theoretical research in Manitoba.

3.2 Funds Received

The most important source of funding for WITP events comes from its Members; the Members use their individual research grants to subsidize WITP activities. The members from the three universities draw upon more than $700,000 of individual NSERC Research Grants (and excluding CFI grants) in the 2016-17 fiscal year alone (a detailed listing is given in appendix II). It is worth noting that, since theoretical physics requires only minor equipment costs (such as computing), this figure represents a very successful level of funding. These funds have a significant fortifying effect on the level of activities in which we are able to engage. The financial contribution of the members associated with the expenses of visiting guest theorists and supports the activities and goals of the Institute but does not appear in the WITP budget. Since the cost of a single visitor typically exceeds $1000 even for a short three-day visit, the contributions of WITP members to the visitor program is generally greater than other WITP expenditures.

UW and UM have together contributed $16,000 from 2013 to 2017, and Brandon University has contributed $5000. For the fiscal years 2018 to 2022 the Faculty of Science at UM has committed $15,000, the Faculty of Science at UW $10,000, and Brandon University $5000.

A small fraction of these funds will be used for the WITP visitor program, specifically providing partial support for visits that individual Members are unable to fund entirely from their own research grants or to extend the term of a visit. This is an important means by which the WITP promotes research collaboration (see below). The majority of funds in the WITP budget will be used for activities outside the usual purview of individual research grants, such as the WITP Student Symposium and Summer School (see section 4.2 and appendix I.4), conference support, and public outreach.

The Institute has neither endowment nor trust fund support. The Institute has no significant space requirements nor independent physical facilities. Since it is a collection of theorists, there is no expensive equipment or infrastructure to support.The occasional long term visitor requires a desk, but these needs have been accommodated by the space available to the physics departments at the member Universities. The host departments also supply occasional secretarial support such as that required for the preparation of seminar notices and research papers.

3.3 Initiatives Promoting Research Collaboration

Institute activities are designed to create a congenial atmosphere for discussion of topics in theoretical physics of interest to the WITP membership. As such, they have fostered collaboration in research. For example, the WITP supports short- and long-term visitors to Winnipeg. These visits generally led to or were a consequence of collaborations between the visitors and at least one member of the WITP. Being able to meet in person provided an enhanced opportunity for collaboration (as opposed to by telephone or email); examples of these visits include those by Freilikher and Maeda, see App. I.3. More generally, WITP research seminars have helped encourage numerous undergraduate students to join research collaborations (and continue in graduate education, in some cases). The seminars also enabled WITP members to learn about the research programs of the WITP members hosting the visitors, thereby fostering discussion and potential collaboration. See appendices I.2 and I.3 for a complete list of seminars and visitors. The physics departments at both UM and UW have committed to provide office space for WITP visitors, and individual Members make a substantial contribution to visitor funding from their grants.

3.4 Research Promotion

Per its mandate, the WITP undertook the following main initiatives in recent years to promote research: Hosting visitors, conducting a research seminar series, organizing Summer Schools, supporting the CAP PhD thesis prize (Division of Theoretical Physics), and sponsoring conferences, both in Manitoba and elsewhere in the country. The visitor and seminar programs serve similar purposes in promoting a stimulating environment for research. For one, they provide members with insight into theoretical physics research outside their current interests and breadth to the education of our trainees, including grad students and postdocs. In addition, they help members keep abreast of current research worldwide and generate discussions needed to sustain strong research. It is very important to note that there is no other forum for technical presentations on theoretical physics in Manitoba. The WITP seminars are therefore critically important in exposing graduate student and postdoctoral trainees to current research, which in turn makes them more attractive for future employment in physics. I.3 for a complete list of seminars and visitors over the 5-year period 2013-2017.

For relatively small amounts of money contributed to national conferences, we were able to broadly advertise the existence of the WITP across Canada and, through foreign conference participants, internationally as well. This increased "global presence" has been extremely beneficial to the overall research environment leading to increased interest from researchers and graduate students outside the province. The Theory Canada conferences were particularly useful in this regard since they brought together theorist in diverse fields from all over Canada to present their research. Even more significant was the impact of conferences that were held here in Manitoba, such as the 2014 Canadian Conference on General Relativity and Relativistic Astrophysics. Furthermore, we sponsored CASCA2016, the annual meeting of the Canadian Astronomical Society, which was held in Winnipeg (May 30 - June 2, 2016) and organized by WITP members from U of M and UW. Such events bring experts on various subjects to Manitoba from all over the world. This invariably leads to collaborations and raises the profile of theoretical physics at all three member Universities. Furthermore, the WITP is sponsoring a PhD thesis prize together with the Division for Theoretical Physics of the Canadian Association of Physicists (CAP). This prize helps us to make the WITP known among graduate students and is a good recruiting tool for future graduate students and Postdocs.

4 Training Accomplishments

4.1 Summary of Trainees

The faculty members of WITP are active in research and in the training of highly qualified personnel (research associates, postdoctoral fellows, graduate students, and undergraduate research students). The following table shows the numbers of HQP associated with WITP in the past five years. Note that both the number of graduate and the number of undergraduate students have doubled!

	Research Associates & Postdoctoral Fellows	**Graduate Students**	**Undergraduate Students**
2011	11	10	13
2013	7	19	13
2014	12	19	13
2015	9	30	19
2016	10	31	17
2017	9	36	25

The following students associated with the WITP graduated in the past five years:

- Emrul Hasan (M.Sc., Southern, 2017)
- Martin Heusen (PhD, Shalchi,2017)
- Philipp Jager (Diploma, Sirker, 2017)
- Maximilian Kiefer-Emmanouilidis (Diploma, Sirker, 2017)
- Mirko Miorelli (PhD, Bacca, 2017)
- Mykhailo Akhtariev (M.Sc., Schippers, 2016)
- Chelsea Braun (M.Sc., Safi-Harb,2016)
- Will Grafton (M.Sc., Shamseddine, 2016)
- Jennifer West (PhD, Safi-Harb,2016)
- Felix Andraschko (PhD, Sirker, 2015)
- Oscar Javier Hernandez (M.Sc., Bacca, 2014)
- Darren Flynn (M.Sc., Shamseddine, 2014)
- Heather Matheson (PhD, Safi-Harb,2014)
- Paul Mikula (M.Sc., Carrington/Kunstatter,2014)
- Bradley Cownden (M.Sc., Frey, 2014)
- Erica Franzmann (M.Sc., Fiege, 2014)
- Siranush Avetisyan (M.Sc., Chakraborty, 2014)

- Harsha S. Kumar (PhD, Safi-Harb, 2013)
- Heather Champion (M.Sc., Fiege, 2012)
- Alex Mirza (M.Sc., Carrington, 2012)

In total there have been 14 M.Sc. and 6 PhD theses supervised.

4.2 Unique Training Situations

Since the WITP includes all theoretical physicists in the province of Manitoba and includes experts in a broad range of subjects, it presents a few unique opportunities for our HQP. For instance, the WITP's seminar series (see sections 3.3, 3.4) exposes HQP trainees to topics outside their own specialization and to research in the broader physics community.

In addition, the WITP is itself large enough to provide extra training opportunities for our students. The Student Symposia and Summer Schools—typically held in August—have been a great success, giving our graduate and undergraduate students the experience of presenting their research in a conference-like setting with world-leading experts in the field in the auditorium. Furthermore, it provides the students, and the WITP, an opportunity to showcase the world-class research in theoretical physics that is being undertaken in Manitoba. More information on last years meeting is found in Appendix I.4.

The WITP also provides training opportunities for HQP through its support of regional and national conferences. Specifically, in addition to funding provided from the Member's grants, the WITP's contributions towards the conferences in many cases leverage significantly more travel funds for our students and postdoctoral fellows to attend these events.

5 Research Dissemination & Service

5.1 Research Dissemination

We re-emphasize that the WITP exists to support and enhance the research programs of its Members, so there is no distinction between Institute research and the research of individual Members. As can be seen from the list of research accomplishments in this review submission and previous WITP reports, the theoretical physics community in Manitoba is extremely strong and productive. The research, which encompasses many different areas of theoretical physics, was disseminated primarily through refereed research publications in the top journals in the respective fields (while these vary somewhat from field to field, they generally include the *Physical Review* series of journals, which is well-represented in our Members' publications). As well, members have given talks, both invited and contributed, at national and international conferences. These in turn have led to published contributions in conference proceedings. Members also disseminate their research through technical seminars presented at universities and other research facilities throughout Canada and around the world. For more details, see section 3.1 above and appendix I.1.

5.2 Service

The WITP provides service to the physics community in Manitoba and throughout Canada. By sponsoring visitors and seminars within Manitoba, the WITP has substantially enhanced the research and learning environment of undergraduate and graduate students in the province. In addition, the WITP serves the Canadian physics community by providing (modest) financial support to several national theoretical physics conferences. Since 2008, these have included

- Graphene Canada Conference, Banff, AB, 2008 ($500).
- Theory Canada IV, CRM, Montréal, QC, 2008 ($480).
- Theory Canada V, UNB, Fredericton, NB, 2009 ($517.39).
- Canadian Conference on General Relativity and Relativistic Astrophysics, Calgary, AB, 2009 ($200).
- Canadian Prairie Theoretical Physics Network meeting, Lethbridge, AB, 2010 ($1,000).
- Theory Canada VII, Lethbridge, AB, 2012 ($400).
- Theory Canada IX, Waterloo, ON, 2014 ($500).
- 15th Canadian Conference on General Relativity and Relativistic Astrophysics, U of Winnipeg, 2014, organized by WITP members: A. Frey, R. Danos,G. Kunstatter, and D. Vincent ($2,000).
- CASCA 2016: the annual meeting of the Canadian Astronomical Society which was held in Winnipeg (May 30- June 2, 2016) and organized by WITP members from U of M and UW ($2,000).
- 16th Canadian Conference on General Relativity and Relativistic Astrophysics, SFU (July 6-8, 2016). G. Kunstatter and A. Frey were members of the organizing committee ($500).
- Theory Canada XIII, Thunder Bay, 2018 ($500).

These conferences are an important means for the Canadian theoretical physics community to exchange ideas and disseminate results. By providing funding, the WITP helps stimulate theoretical physics work in Manitoba and throughout Canada. In addition, these conferences provide an opportunity for WITP students to gain experience presenting their results to an audience of peers and senior researchers in a professional setting. They are also exposed to cutting-edge research, improving their education. In light of this, the WITP often specifies that its funds support student travel to conferences. As an ancillary benefit of this service, WITP conference support increases the visibility of theoretical physics in Manitoba, which helps to attract graduate students to the province.

During the last three years, two major conferences were organized in Manitoba by WITP members: the 15th Canadian Conference on General Relativity and Relativistic Astrophysics and CASCA 2016, the annual meeting of the Canadian Astronomical Society. For the conference poster of the latter event, see Sec.I.6.

The WITP also likes to invite prominent physicists to provide a series of public lectures. In the past 5 years has supported two highly visible public lectures by eminent scientists: 1) The WITP co-sponsored a public lecture in 2014 with the 15th Canadian Conference on General Relativity and Relativistic Astrophysics, which was held in Eckhardt-Gramatte Hall at the University of Winnipeg. The lecture, titled "Higgs Bang" was presented by Neil Turok, the Director and Niels Bohr Chair of the Perimeter Institute and the 2013 CBC Massey Lecturer. This was a rare event for Winnipegers to see one of the leading minds of cosmology, and close to 200 people attended. 2) As part of the CASCA 2016 conference, co-sponsored by the WITP, the winner of the 2015 Nobel Prize in Physics, Dr. Art McDonald gave a public lecture 'The Sudbury Neutrino Observatory: Observing the Sun from 2 km Underground', on June, 1, 2016.

5.3 Impact on Programs and Policies

The WITP's mandate is to enhance the research of its Members, raise the visibility of theoretical physics research in Manitoba, and improve the training of highly qualified personnel in theoretical physics. As such, the WITP has not attempted to change the policies of other institutions.

6 Current Membership

6.1 List of Members

Following is a list of the WITP membership as of Jan. 2018. Members are affiliated with the physics departments (or, in some cases, the mathematics departments) of their home universities.

Permanent (Faculty) Members

- M.E. Alexander[2], *Ph.D. (Manchester University, UK)*
- S. Bacca[14], *Ph.D. (Trento, Italy & Mainz, Germany)*
- P.G. Blunden[1], *Ph.D (Queen's)* [Director, 93-94]
- M.E. Carrington[3], *Ph.D. (SUNY, Stony Brook)*
- T. Chakraborty[1], *Ph.D. (Dilbrugarh University, India)*
- J. D. Fiege[1], *Ph.D. (McMaster)*
- A.R. Frey[2] *Ph.D. (UCSB)* [Director, 13-14]
- T.D. Fugleberg[3], *Ph.D. (UBC)*
- D. Krepski[1], *Ph.D. (Toronto)*
- G. Kunstatter[2], *Ph.D. (Toronto)* [Director, 91-92, 09-12]
- C. O'Dea[1], *Ph.D. (Massachusetts)*
- S. Plosker[3], *Ph.D. (Guelph)*
- A. Prymak[1], *Ph.D. (Kyiv National Taras Schevchenko)*
- S. Safi-Harb[1], *Ph.D. (Wisconsin-Madison)*
- E. Schippers[1], *Ph.D. (Toronto)*
- A. Shalchi[1], *Ph.D. (Ruhr-Universität Bochum)*
- K.M. Shamseddine[1], *Ph.D. (Michigan State)* [Director, 15-16]
- J. Sirker[1], *Ph.D. (Universität Dortmund)* [Director, 17-18]
- R. Stamps[1], *Ph.D. (Colorado State University)*
- D.W. Vincent[2], *Ph.D. (Toronto)* [Director, 94-95]
- J.G. Williams[3], *Ph.D. (Birmingham)* [Director, 96-97]

[1]University of Manitoba
[2]University of Winnipeg
[3]Brandon University
[4]Home Institution: TRIUMF

Senior Scholars

- B. Bhakar[1], *Ph.D. (Delhi)* [Director, Jan. - June 00]
- P.D. Loly [1], *Ph.D. (London)* [Director, Fall 99, 00-01]
- M. Whitmore[1], *Ph.D. (McMaster)*
- T.A. Osborn[1], *Ph.D. (Stanford)* [Director, 92-93, 01-04]
- B.W. Southern[1], *Ph.D. (McMaster)* [Director, 90-91, 07-09]
- J.P. Svenne [1], *Ph.D. (M.I.T.)* [Director, 95-96]
- G.C. Tabisz [1], *Ph.D. (Toronto)*
- J.M. Vail [1], *Ph.D. (Brandeis)* [Director, 98-99]

Associate Members *Research Associates*

- Rebecca Danos (Frey/Kunstatter)
- Nir Nevo Dinur (TRIUMF) (Bacca)

Postdoctoral Fellows

- Wenchen Luo (Chakraborty)
- Amin Naseri (Chakraborty/Sirker)
- Noemi Rocco (TRIUMF) (Bacca)
- Adam Rogers (Safi-Harb)
- Kiyoumars Sohrabi (Carrington)
- Jennifer Vaughan (PIMS postdoctoral fellow) (Krepski/Schippers)
- Sarka Wykes (O'Dea)

Graduate Students

- J. Ahmed (Ph.D.) (Blunden)
- Mykhailo Akhtariiev (M.Sc.) (Schippers, co-supervised with Chipalkatti, Manitoba)
- Bassel Alkadour (Ph.D.) (Southern, co-supervised with van Lierop, Manitoba)
- Victor Arendt (M.Sc.) (Schalchi)
- Kelvin Au (M.Sc.) (Fiege)
- Chelsea Braun (M.Sc./Ph.D.) (Safi-Harb)
- Angel Barria Comicheo (Ph.D.) (Shamseddine, co-supervised with R. Craigen, Manitoba)

- Ye Cheng Chen (M.Sc.) (Sirker)
- Bradley Cownden (Ph.D.) (Frey)
- Chetna Dugal (Ph.D.) (O'Dea)
- Darren Flynn (Ph.D.) (Shamseddine)
- Erica Franzmann (Ph.D.) (Fiege)
- Ajay Gill (M.Sc.) (O'Dea)
- Robert Gleisinger (M.Sc.) (O'Dea)
- William Grafton (M.Sc.) (Shamseddine)
- Benson Guest (Ph.D.) (Safi-Harb)
- Javier Hernandez-Melgar (PhD) (Bacca)
- Martin Heusen (Ph.D.) (Shalchi)
- P. Jäger (Ph.D.) (Sirker)
- M. Kiefer (Ph.D.) (Sirker)
- Jordan Lasuik (M.Sc.) (Shalchi)
- Daniel Maciel (M.Sc.) (Southern)
- Brett Meggison (M.Sc.) (Carrington/Frey)
- Paul Mikula (Ph.D.) (Carrington/Kunstatter)
- Mirko Miorelli (Ph.D.) (Bacca)
- Kyle Monkman (M.Sc.) (Sirker)
- Mitulkumar Patel (M.Sc.) (Frey)
- Andrew Senchuk (Ph.D.) (Shamseddine, co-supervised with G. Gwinner, Manitoba)
- K. Shiells (Ph.D.) (Blunden)
- Mohammad Shirazi (Ph.D.) (Schippers)
- Mainak Singha (Ph.D.) (O'Dea)
- Andrew Urichuk (Ph.D.) (Sirker)
- Olena Usoltseva (Ph.D.) (Prymak)
- Dennis Wagner (Ph.D.) (Sirker)
- Xiaohong Zhang (Ph.D.) (Plosker, co-supervised with S. Kirkland, Manitoba)
- L.J. Zhou (Ph.D.) (Carrington/Kunstatter)

Undergraduate Research Students 2016-17

- Melissa Anderson (Safi-Harb)
- Yashashvi Bharani (O'Dea)
- Brynne Blaikie (O'Dea)
- Changying Ding (Shamseddine)
- Jeremy Friesen (Shamseddine)
- Seth Friesen (Carrington)
- Michael Gammon (Shalchi)
- Taylor Hanson (Alexander)
- Raphael Hoult (Frey)
- Yuxiang Hu (Prymak)
- Cam Lawlor-Forsythe (O'Dea)
- Austin MacMaster (Safi-Harb)
- Darian McLaren (Plosker)
- Michael Ramsey (Safi-Harb)
- Craig McRae (O'Dea)
- Kyle Monkman (Sirker)
- Christopher Phillips (Carrington)
- Justin Roznik (Prymak)
- Apoorva Sinha (Frey)
- Samantha Taylor (Frey)
- Cole Treyturik (Safi-Harb)
- Jakob Weirathmueller (Alexander)
- Brayden Yarish (High School) (Frey)
- Sina Zabanfahm (Krepski)
- Yibo Zhong (Frey)

6.2 Reporting Structure

In the past year, the Institute's Executive Committee has consisted of J. Sirker (Director, Manitoba), A. Frey (Director-elect, Winnipeg), and K. Shamseddine (Past-Director, Manitoba). The Executive normally spends less than 5% of its time with the administrative aspects of the Institute, and the Director reports directly to the Deans of Science at the University of Manitoba and the University of Winnipeg.

7 Five-Year Plan

7.1 Future Research Direction and Development Strategies

Rather than following a fixed research direction, the WITP's mandate is to provide a supportive and stimulating environment for its Members to pursue their own research programs within theoretical physics. In order to provide this support, the WITP will maintain and improve its core activities (discussed separately below).

Visitors The visitor program is one of the WITP's major activities and supports collaboration with physicists outside Manitoba. In the past five years, the WITP has had five to seven visitors per year, including several who stayed for a week or longer. See appendix I.3 for a complete listing of these visitors. In addition to promoting collaboration, the visitor program provides a source of speakers for WITP seminars; having external speakers is important in maintaining a vital research community and is crucial for exposing theoretical physics students to cutting-edge research in theoretical physics beyond Manitoba.

These visits are primarily funded by Member grants with office space provided by the Physics Departments at UM and UW when required, and the WITP will continue to encourage Members to invite their visitors to give a technical seminar as part of the WITP seminar program. In addition, the WITP will use its funds when available to extend visitor stays and to allow Members to invite visitors when the cost is prohibitive for their own individual grant. These measures will allow the WITP to maintain and increase what is already a successful program.

Seminars WITP seminars are the primary activity by which the WITP promotes a congenial atmosphere for theoretical physics research and collaboration among Members; a lively discussion of current developments in physics is an important stimulus to theoretical physics research. The existence of an active seminar series is a helpful recruiting point for new faculty hires, and the WITP provides the only forum for technical seminars on theoretical physics in Manitoba. WITP seminars are a vital resource for increasing the breadth of education of theoretical physics students and postdoctoral fellows, especially on current topics in physics, and they represent one means of knowledge transfer within the WITP. Many WITP visitors are willing to speak in the seminar series, so there is a strong synergy between the two Institute activities. WITP seminars have virtually no associated cost; the Physics Departments at UM and UW provide both space and advertising. The seminars for the past five years are listed in appendix I.2.

In the last five years, we have substantially increased the frequency of the WITP seminars and have been able to attract many outstanding speakers. Another way in which the WITP has been trying to improve the existing seminar series is to make them more convenient for our members in Brandon. Due to the distances involved, it is difficult for WITP members at Brandon University to attend WITP seminars, which are usually held at UM (and sometimes at UW). However, modern technology makes it fairly easy to broadcast meetings to either a selected group of people or openly on the web with virtually no cost. The WITP has broadcasted several of its seminars to Brandon and plans to continue doing so.

Conference Support For relatively small amounts of money contributed to national conferences in theoretical physics, the WITP is able to advertise its existence broadly across Canada and, through foreign conference participants, internationally as well. This increased visibility has been extremely beneficial to the overall research environment leading to increased interest from researchers and prospective graduate students outside the province. This promotes collaboration between WITP Members and other researchers as well as graduate student recruitment. The Theory Canada series of conferences have proven especially

beneficial since they have become the main meeting of Canadian theoretical physicists and bring together theorists to present research in diverse fields. As a result, the WITP plans to provide financial support for the Theory Canada conference next year and also in the future.

The WITP will also support national and international theoretical physics conferences which are held in Manitoba. These events bring a large number of experts from around Canada and the world to Manitoba and improve the profile of theoretical physics research in the province. Informal discussions with colleagues throughout the conference leads to collaborations, the large number of visitors allows WITP students to meet leading international scientists and to gain exposure to a wide variety of research, and the formal conference activities allow local researchers an opportunity to disseminate research to a wide audience. The WITP hopes to have the opportunity to support at least one major conference in Manitoba every other year. The WITP provided funding to the 15th Canadian Conference on General Relativity and Relativistic Astrophysics,U of Winnipeg, 2014, organized by WITP members A. Frey, R. Danos,G. Kunstatter, and D. Vincent. In addition, the WITP also supported CASCA 2016, the annual meeting of the Canadian Astronomical Society which was held in Winnipeg (May 30- June 2, 2016) and organized by WITP members from U of M and UW.

Student Workshop and Summer School The WITP instituted a new activity, the Summer Student Symposium, in August 2012. This was a one-day meeting of WITP Members which gave WITP Student Members, especially undergraduate students, the opportunity to present their research in a conference-style talk but a more relaxed setting. As discussed above, this is a necessary skill that requires practice. In addition to giving students the opportunity to give technical presentations, the Student Symposium allows the Permanent Members, through their students, to share their work with the rest of the WITP, promoting collaboration. Since then, we have organizes a summer symposium for our students every year. In 2017 we organized a summer school with internationally renowned experts in condensed matter theory (Ian Affleck, UBC, FRSC, FRS London and Onsager prize recipient of the American Physical Society), string theory (Keshav Dasgupta, McGill), cosmology (Scott Watson, Syracuse), mathematical physics (Jose Aguayo, Concepcion, Chile), and quantum optics (Fabian Grusdt, Harvard). More information on last years summer school is given in appendix I.4. The response to the summer school, held at UM, was uniformly enthusiastic with more than 40 participants, and the WITP plans to continue to have an annual workshop and—every 2-4 years—a summer school. These annual events will rotate among UW, UM, and Brandon University. The amount listed in the budget allows the WITP to cover the costs for invited lecturers, as well as coffee and lunch for the participants.

Public Lectures Five years ago, the WITP was planning to initiate a public lecture series, ideally held every other year. Unfortunately, the very limited funding has handcuffed the WITP in this regard in the past. However, even with the limited funds available the WITP has been able to co-sponsor lectures by two outstanding physicists: Dr. Neil Turok, the Director and Niels Bohr Chair of the Perimeter Institute and the 2013 CBC Massey Lecturer, and Dr. Art McDonald the 2015 Nobel Prize winner in Physics.

These events have been extremely successful and at the envisioned increased funding level we are planning to hold such public lectures more regularly. These talks by prominent visiting scientists would not only increase the profile of the WITP in Winnipeg (and Brandon if funding and schedule allow) but also provide WITP members the opportunity to consult with leading minds.

Miscellaneous Activities The WITP has taken a few additional steps to increase its profile within Canada. One important element has been the co-sponsoring of the yearly PhD thesis award by the Division of Theoretical Physics of the Canadian Association of Physicists (CAP). The prize not only increases the visibility of the WITP but is also a good recruitment tool for graduate students and Postdocs.

We also prepare an annual report on activities; printing and mailing copies of this report to theoretical physics research groups in Canada has increased the WITP's visibility. In conjunction with emailed PDF copies, the hard copy report will reach a large number of physicists throughout Canada, showcasing the world-class research carried out in Manitoba.

Growth The WITP membership includes all of the theoretical physicists in the province. Hence its growth relies upon the Associate and Student Members that it can attract (i.e. graduate students, post-doctoral fellows, and research associates), along with occasional new faculty hires. The number and quality of these Associate and Student Members is dependent on the Institute being able to create a positive research atmosphere. This in turn depends strongly upon the level of funding that the Institute receives. In view of its overall research productivity, in terms of published papers and supervised graduate students, and the demonstrated ability to attract excellent visiting scientists, the Institute is achieving its goals, and the five-year plan presented above will continue and improve upon the WITP's ability to attract new Associate and Student Members. The Deans of Science at UM and UW have indicated their strong support of this plan, as indicated in the letters found in appendix IV.

There are two other potential areas of growth. One is identifying new Permanent Members at UM, UW, and Brandon University among current faculty members in related fields. For example, experimental physicists who work closely with theorists may be candidate members, as may mathematicians whose research is closely related to mathematical physics. The other potential avenue is at the institutional level. Specifically, the WITP has indicated its interest in formalizing its relationship with Brandon University by becoming an official institute of that university (making it an official institute of all three major universities in the province). We hope to have productive conversations with Brandon University administrators on this matter.

We would like to note that the WITP is already an interdisciplinary Research Centre including scientists from Physics and Mathematics Departments. As part of the five year plan, we want to grow our membership among colleagues in mathematics who work in fields which intersect with theoretical physics. We also want to explore possibilities to work more closely with the Pacific Institute for the Mathematical Sciences (PIMS) which UM has joined in 2015.

7.2 Budget

The WITP does not incur or depend on any fixed annual cost. Further, the purpose and the activities of the Institute are designed to ensure that virtually all funds go directly towards research, in the form of visitors, seminars, summer schools, etc. Since the WITP is a collection of theorists, we have no expensive equipment to maintain or technicians to employ, and there are virtually no no direct infrastructure costs. This allows the WITP to tailor its operations to match the level of funding it receives. However, in order for the WITP to create visibility for the theoretical physics community in Manitoba and in order to provide adequate training for our HPC, a certain minimum funding level is required as outlined below.

The following represents a minimal budget for WITP activities in the five-year period from 2018 to 2022. It is important to note that the most costly WITP activity, the visitor program, is primarily funded by Member research grants (over $700,000 total for 2016-2017), and those funds are not included in the proposed budget. The following expenditures are for activities that fall outside the usual purview of a research grant and which are more properly and efficiently organized as a collective. In addition, a small fraction of WITP funding will be used to supplement the visitor program by providing partial funding to extend the stay of some visitors or to make it possible for Members to extend an invitation.

- Conference support: $1500

  Advertises theoretical physics in Manitoba throughout Canada, promotes research collaborations and dissemination of results, provides opportunity to recruit graduate students

  - Theory Canada conferences: $500
    Main annual conference for Canadian theoretical physics
  - National & international conferences held in Manitoba and surrounding region: $1000
    Average annual amount

- Summer School and Summer Symposium for graduate and undergraduate student researchers: $3000

  One of the most important tasks of the WITP is to provide support in the adequate training of HQP. Contrary to other areas in physics such as nuclear physics, there are no large national labs or large research collaborations where students would be exposed to broader cutting-edge research outside of what is done in the group of their supervisor. Furthermore, the percentage of faculty members working in theoretical physics is—at last at UM—much smaller than at most other U15 universities and also much smaller than the international average. This leads to a relative lack of advanced courses in theoretical physics. The WITP plays an important role in filling this gap by bringing together students from all three Manitoban universities. The annual summer school/summer symposium, in particular, provides lectures by world-leading scientists and the opportunity for our students to present their research to a larger community.

- Visitor Support: $3000

  - Prominent visiting scientist for public lecture: $2000 every other year
    Outreach to the public, as well as scientific discussion
  - Support for other WITP visitors: $2000
    The WITP visitor program is primarily funded by Members; this funding is to allow visits that individual Members may not otherwise be able to afford or to increase the length of time that visitors can stay in Manitoba.

- DTP/WITP PhD Thesis Prize: $500

  The WITP is sponsoring a thesis prize in theoretical physics together with the Division of Theoretical Physics (DTP) of the Canadian Association of Physicists (CAP). This sponsorship increases the visibility of the WITP and is also a recruiting tool to attract students and Postdocs to Manitoba.

- Miscellaneous: $500

  Printing, advertising of study opportunities at Canadian Undergraduate Physics Conference and other venues

Total: $8500 per annum

The WITP currently has approximately $1300 available in its accounts (see section 3.2 and appendix III) and has already received commitments of $25,000 from the Faculties of Science at UM and UW and $5000 from Brandon University for the coming five-year period, which positions the WITP to achieve the modest goals outlined above. In addition, the WITP is pursuing additional funding opportunities. Any funding shortfalls will be made up by distributed reductions in conference support and a reduction to the number of public lectures, followed by cuts to the Institute support for visitors and miscellaneous expenses.

8 External Reviewers

Senior members of the Canadian theoretical physics community who can provide reviews can be named upon request.

I Knowledge Transfer

I.1 Publications & Presentations of Permanent Members: 2013-2017

M.E. Alexander

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2. I. Halilovic, J. Wu, M. Alexander, F. Lin. "Neutrophil migration under spatially-varying chemoattractant gradient profiles". Biomed. Microdevices **17**, 57-63, 2015.

3. M. Laskowski, P. Dubey, M.E. Alexander, S. Collinson, J.M. Heffernan, S.M. Moghadas. "What is the Optimal Level of Information Dissemination during an Epidemic?" BIOMAT 2014, Proceedings International Symposium on Mathematical and Computational Biology, Poznan, Poland, World Scientific, 2014.

4. M.E. Alexander, M. Mercredi. "A model for cell migration in competing chemotactic fields." Canadian Applied Math Quarterly **21**(2): 121-144, (Summer 2013).

5. B. Dietz, E. Elhami, M. Alexander, "Registration of positron emission tomography and magnetic resonance imaging for use in stem cell quantification studies of the infarcted myocardium," Accepted: Life Sciences OMICS Group (Oct. 2014).

6. R. Bergen, H. Lin, M. Alexander, and C. Bidinosti. "4-D MR phase and magnitude segmentations with GPU parallel computing." Magnetic Resonance Imaging **33**:134-146, 2015.

7. Q. Zhang, M.E. Alexander, L. Ryner. "Multimodality Neurological Data Visualization with Multi-VOI Based DTI Fiber Dynamic Integration." IEEE Journal of Biomedical and Health Informatics, **PP** Issue 99, 2014.

8. Q. Zhang, M. Alexander, L. Ryner. Synchronized 2D/3D optical mapping for interactive exploration and real-time visualization of multi-function neurological images. Computerized Medical Imaging and Graphics, **37** (7-8): 552 (2013).

S. Bacca

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J. Simonis, A. Schwenk,
Nature Physics **12**, 186-190 (2016).

5. Structure models: from shell model to ab initio methods
S. Bacca
Eur. Phys. J Plus **131**, 107 (2016).

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7. Examination of the first excited state of ^{4}He as a potential breathing mode
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C. Ji, N. Nevo Dinur, S. Bacca, N. Barnea,
Phys. Rev. Lett. **111**, 143402 (2013).

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Spokeperson: F. Cappuzzello
Co-spokesperson: S. Bacca
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P.G. Blunden

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4. A. Sibirtsev and P. G. Blunden, *Q^2 evolution of the electric and magnetic polarizabilities of the proton,* Phys. Rev. C **88**, 065202 (2013).

5. N. L. Hall, P. G. Blunden, W. Melnitchouk, A. W. Thomas and R. D. Young, *Constrained γZ interference corrections to parity-violating electron scattering,* Phys. Rev. D **88**, 013011 (2013).

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9. *From $\mathcal{A}_{PV} \to Q_W^p \to \sin^2\hat{\theta}_W(0)$,* QWEAK Collaboration Meeting, Jefferson Lab, Newport News, VA, November 15, 2016.

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11. *Hadronic effects in parity-violating electron-proton scattering*, **Invited talk**, Workshop on Precision for New Discoveries, TRIUMF, Vancouver, BC, June 9, 2016.

12. *Two-boson exchange for parity-violating electron scattering*, **Invited talk**, Precision Radiative Corrections for New Experiments, Jefferson Lab, Newport News, VA, May 16, 2016.

13. *Overview of recent advances in calculations of two-photon exchange effects*, **Invited talk**, Intense Electron Beams Workshop, Cornell, NY, June 18, 2015.

14. *Hadronic effects in parity-violating electron-proton scattering*, **Invited talk**, Theory Canada 10, Calgary, AB, June 12, 2015.

15. *Hadronic effects in precision electroweak physics*, Colloquium, Department of Physics, University of Winnipeg, Winnipeg, MB, September 26, 2014.

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17. *Constrained γZ interference corrections to parity-violating electron scattering,* **Invited talk**, γZ Box(ing): Workshop on Radiative Corrections to Parity-Violating Electron Scattering, Jefferson Lab, December 16, 2013.

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M. E. Carrington

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4. *Energy Loss in Unstable Quark-Gluon Plasma,* M.E. Carrington, K. Deja and S. Mrówczyński, Phys. Rev. **C92**, 044914 (2015).

5. *On the geometric measure of entanglement for pure states,* M.E. Carrington, G. Kunstatter, J. Perron, S. Plosker, J. Phys. A: Math. Theor. 48 (2015) 435302.

6. *Renormalization group methods and the 2PI effective action,* M.E. Carrington, Wei-Jie Fu, D. Pickering, and J.W. Pulver, Phys. Rev. **D91**, 025003 (2015) .

7. *Plasmons in Anisotropic Quark-Gluon Plasma,* M.E. Carrington, K. Deja, S. Mrówczyński, Phys. Rev. **C90**, 034913 (2014).

8. *4-point vertices from the 2PI and 4PI Effective Actions,* M.E. Carrington, Wei-Jie Fu, P. Mikula, D. Pickering, Phys. Rev. **D89**, 025013 (2014).

9. *Bethe-Salpeter Equations from the 4PI effective action,* M.E. Carrington, WeiJie Fu, T. Fugleberg, D. Pickering, I. Russell, Phys. Rev. **D88**, 085024 (2013).

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20. *Energy loss in unstable quark-gluon plasma with extremely prolate momentum distribution,* M.E. Carrington, K. Deja, S. Mrówczyński, Acta Phys. Polon. Supp. 6 (2013) 545-550.

21. *Energy loss in unstable QGP - problem of the upper cut-off,* M.E. Carrington, K. Deja, S. Mrówczyński, EPJ Web Conf. 71 (2014) 00095.

22. *Renormalization group flow equations from the 4PI equations of motion,* M.E. Carrington, Acta Phys. Polon. Supp. 7 (2014) 1, 91-97.

23. *Energy loss in unstable quark-gluon plasma with extremely prolate momentum distribution,* M.E. Carrington, K. Deja and S. Mrówczyński, Acta Phys. Polon. Supp. 6, 545 (2013).

24. *Parton Energy Loss in the Extremely Prolate Quark-Gluon Plasma,* M.E. Carrington, K. Deja and S. Mrówczyński, (contribution to the proceedings of the conference Xth Quark Confinement and the Hadron Spectrum, October 8-12, 2012, Munich, Germany) - arXiv:1301.4563.

25. *Parton Energy Loss in Two-Stream Plasma System,* M.E. Carrington, K. Deja and St. Mrówczyński, Acta Physica Polonica B, Proceedings Supplement 5, 343 (2012) - arXiv:1201.1486.

26. *Parton Energy Loss in an Unstable Quark-Gluon Plasma,* M.E. Carrington, K. Deja and S. Mrówczyński, Acta Physica Polonica B, Proceedings Supplement 5, 947 (2012) - arXiv:1110.4846.

T. Chakraborty

No update provided for this report

1. T. Chakraborty, A. Manaselyan, & M. Barseghyan J. Phys.: Condens. Matter 29, 075605 (2016)
2. Wenchen Luo & T. Chakraborty Phys. Rev. B 94, 161101 (R) (Rapid Commun.) (2016)
3. T. Chakraborty, A. Manaselyan, & M. Barseghyan arXiv:1606.04554 (2016)
4. S. Avetisyan, T. Chakraborty & P. Pietilinen Physica E 81, 334 (2016)
5. A. Ghazaryan, A. Manaselyan, & T. Chakraborty Phys. Rev. B 93, 245108 (2016)
6. Wenchen Luo & T. Chakraborty Phys. Rev. B 93, 161103 (R) (Rapid Commun.) (2016)
7. P. K. Pyatkovskiy & T. Chakraborty Phys. Rev. B 93, 085145 (2016)
8. A. Ghazaryan & T. Chakraborty Phys. Rev. B 92, 235404 (2015)
9. Wenchen Luo & T. Chakraborty J. Phys.: Condens. Matter 28, 015801 (2015)
10. Wenchen Luo & T. Chakraborty Phys. Rev. B 92, 155123 (2015)
11. A. Ghazaryan & T. Chakraborty , Phys. Rev. B 92, 165409 (2015)

12. V.M. Apalkov & T. Chakraborty, Phys. Rev. B 91, 235447 (2015)

13. A. Ghazaryan & T. Chakraborty, Phys. Rev. B 92, 115138 (2015)

14. A. Ghazaryan & T. Chakraborty, Phys. Rev. B 91, 125131 (2015)

15. A. Ghazaryan, T. Chakraborty & P. Pietiläinen, J. Phys.: Condens. Matter 27, 183501 (2015)

16. T. Chakraborty & Vadym M. Apalkov, IET Circuits, Devices & Systems (Invited article) 9, 19 (2015)

17. V. Apalkov & T. Chakraborty, Phys. Rev. B90, 245108 (2014)

18. A. Ghazaryan, A. Manaselyan, & T. Chakraborty, Physica E66, 157 (2014)

19. T. Chakraborty & V. Apalkov, IET Circuits, Devices & Systems (2014)

20. V. Apalkov & T. Chakraborty, J.Phys. Condensed Matter 26, 475302 (2014)

21. V. Apalkov & T. Chakraborty, Phys. Rev. Lett. 112, 176401 (2014)

22. T. Chakraborty & V. Apalkov, Solid State Commun. 175-176, 123 (2013)

23. T. Chakraborty & V. Apalkov, chapter in Physics of Graphene, H. Aoki & M. Dresselhaus (Eds), Springer (2013)

24. M. Zarenia, B. Partoens, T. Chakraborty, & F.M. Peeters, Phys. Rev. B88, 245432 (2013)

25. A. Manaelyan, A. Ghazaryan, & T. Chakraborty, Solid State Commun. 181, 34 (2013)

26. S. Avetisyan, P. Pietiläinen, & T. Chakraborty, Phys. Rev. B88, 205310 (2013)

27. V. Apalkov & T. Chakraborty, Solid State Commun. 177, 128 (2013)

28. Vadim Apalkov & T. Chakraborty, Europhys. Lett. 100, 67008 (2012)

29. V. Apalkov & T. Chakraborty, Europhys. Lett. 100, 17002 (2012)

30. Vadim Apalkov & T. Chakraborty, Phys. Rev. B 86, 035401 (2012)

31. A. Manaselyan, A. Ghazaryan & T. Chakraborty, Europhys. Lett. 99, 17009 (2012)

32. S. Avetisyan, P. Pietiläinen, & T. Chakraborty, Phys. Rev. B 85, 153301 (2012) (Erratum: Phys. Rev. B 86, 269901 (E))

33. Vadim Apalkov & T. Chakraborty, Phys. Rev. Lett. 108, 169702 (2012)

J. Fiege

No update provided for this report

1. Pattle, K.; Ward-Thompson, D., et al., MNRAS. 450(1): 1094-1122, The JCMT Gould Belt Survey: first results from the SCUBA-2 observations of the Ophiuchus molecular cloud and a virial analysis of its prestellar core population

2. Salji, C. J.; Richer, J. S., et al., MNRAS. 449(2): 1769-1781, The JCMT Gould Belt Survey: constraints on prestellar core properties in Orion A North

3. Rumble, D.; Hatchell, J., et al., MNRAS. 448(2): 1551-1573, The JCMT Gould Belt Survey: Evidence for radiative heating in Serpens MWC 297 and its influence on local star formation

4. Hull, Charles L.H.; Plambeck, R., et al., ApjS. 213(1): 13, TADPOL: A 1.3 mm Survey of Dust Polarization in Star-forming Cores and Regions

5. Danos, R. J., Fiege, J. D., & Shalchi, A. 2013, Ap.J., 772, 35, Numerical Analysis of the Fokker-Planck Equation with Adiabatic Focusing: Isotropic Pitch-angle Scattering

6. Hull, C. L. H., Plambeck, R. L., Bolatto, A. D., et al. 2013, Ap.J., 768, 159, Misalignment of Magnetic Fields and Outflows in Protostellar Cores. ApJ.

7. Rogers, A. and Fiege, J. D., 2011, Ap.J., 743, 68, Strong Gravitational Lens Modeling with Spatially Variant Point Spread Functions

Proceedings

8. McIntosh, B. Fiege, J. Pistorius, S. Goertzen, A.M10-79 Rapid Automated PET Detector Optimization with a Genetic Algorithm. IEEE Xplore Digital Library. IEEE Nuclear Science Symposium, Seattle, WA, , 2014-11-08. IEEE Xplore Digital Library

9. Masen Lamb ; David R. Andersen ; Jean-Pierre Vran ; Carlos Correia ; Glen Herriot ; Matthias Rosensteiner ; Jason Fiege. (2014). Non-common path aberration corrections for current and future AO systems. Proceedings of the SPIE, Volume 9148. Proceedings of the SPIE, Volume 9148, Adaptive Optics Systems IV, id. 914857 13 pp. (2014), Montreal, , 2014-06-22 (1-13)

Talks & Colloquia

10. "Modeling molecular cloud cores and turbulent magnetic fields using submillimetre polarization", Fiege, J., Franzmann, E., Ramacieri, G., Au, K., Srinivason, S., 2015, Colloquium, DRAO, Penticton, Canada

11. "Rapid Automated PET Detector Optimization with a Genetic Algorithm", McIntosh, B. Fiege, J. Pistorius, S. Goertzen, A., 2014, IEEE Nuclear Science Symposium, Seattle, United States

A. R. Frey

Refereed Publications

1. N. Deppe, A. Kolly, A. R. Frey and G. Kunstatter, "Black Hole Formation in AdS Einstein-Gauss-Bonnet Gravity," JHEP **1610**, 087 (2016) [arXiv:1608.05402 [hep-th]].

2. N. Deppe and A. R. Frey, "Classes of Stable Initial Data for Massless and Massive Scalars in Anti-de Sitter Spacetime," JHEP **1512**, 004 (2015) [arXiv:1508.02709 [hep-th]].

3. N. Deppe, A. Kolly, A. Frey and G. Kunstatter, "Stability of Anti-de Sitter in Einstein Gauss Bonnet Gravity," Phys. Rev. Lett. **114**, 071102 (2015) [arXiv:1410.1869 [hep-th]].

4. J. M. Cline and A. R. Frey, "Consistency of dark matter interpretations of the 3.5 keV x-ray line," Phys. Rev. D **90**, no. 12, 123537 (2014) [arXiv:1410.7766 [astro-ph.CO]].

5. J. M. Cline and A. R. Frey, "Nonabelian dark matter models for 3.5 keV X-rays," JCAP **1410**, no. 10, 013 (2014) [arXiv:1408.0233 [hep-ph]].

6. A. R. Frey and J. Roberts, "The Dimensional Reduction and Kähler Metric of Forms In Flux and Warping," JHEP **1310**, 021 (2013) [arXiv:1308.0323 [hep-th]].

7. A. R. Frey and N. B. Reid, "Cosmic Microwave Background Constraints on Dark Matter Models of the Galactic Center 511 keV Signal," Phys. Rev. D **87**, 103508 (2013) [arXiv:1301.0819 [hep-ph]].

8. J. M. Cline, A. R. Frey and G. D. Moore, "Composite magnetic dark matter and the 130 GeV line," Phys. Rev. D **86**, 115013 (2012) [arXiv:1208.2685 [hep-ph]].

9. J. M. Cline and A. R. Frey, "Abelian dark matter models for 511 keV gamma rays and direct detection," Annalen Phys. **524**, 579-590 (2012) [arXiv:1204.1965 [hep-ph]].

10. R. J. Danos, A. R. Frey and Y. Wang, "Canny Algorithm: A New Estimator for Primordial Non-Gaussianities," Phys. Rev. D **86**, 043526 (2012) [arXiv:1108.2265 [astro-ph.CO]].

11. J. M. Cline and A. R. Frey, "Light dark matter versus astrophysical constraints," Phys. Lett. B **706**, 384 (2012) [arXiv:1109.4639 [hep-ph]].

Media Appearances

2016 newspaper interview for *PROFile* in The Uniter, University of Winnipeg, 21 Jan 2016.

12. CJOB radio *morning news*, 7 Oct 2014, discussing the 2014 Nobel Prize in Physics.

13. CJOB radio *Charles Adler's morning broadcast*, 11 Sept 2014, discussing Stephen Hawking's comments on the Higgs boson and the end of the universe.

14. CKUW radio *Dark Matter, Defined* science talk show, 17 Oct 2013 (with G. Chernitsky, J. Enns, and N. Reid).

15. CTV Winnipeg news segment, 14 March 2013.

Talks

16. "Talk Back" discussion of physics with Rebecca Danos and Vesna Milosevic-Zdjelar and actors for performance of *Constellations* by Nick Payne by Theatre by the River, Winnipeg, 2016.

17. "Black Hole Formation in Anti-de Sitter Spacetime (And What It Means)," Winnipeg Institute for Theoretical Physics & University of Manitoba, 2016.

18. "Dynamics of Gravitational Collapse in AdS Space-Time," 2015 CAP Congress hosted by University of Alberta, 2015.

19. "Gravitational Collapse and Far-From-Equilibrium Dynamics in AdS/CFT," University of Alberta, 2015.

20. "Stringy Corrections from (Almost) Classical Supergravity," Canadian Conference on General Relativity and Relativistic Astrophysics (at Univ of Winnipeg), McGill University, 2014, & University of Alberta, 2015.

21. "Learning by Cosmosis" panel discussion with Ken Freeman, Jayanne English, and Chris O'Dea, Tallest Poppy restaurant, Winnipeg, 2014.

22. "The Astounding Universe of String Theory," public lecture at University of Manitoba "Dream Big" event, 2014.

23. "Not-So-Dark Matter," York University & University of North Dakota, 2013.

24. "What is String Theory?" public lecture at the Millennium Library, Winnipeg, 2012; Fred Douglas Place, Winnipeg, 2014; Wellington Retirement Residence, Winnipeg, 2015; Charleswood Senior Centre & Portsmouth Retirement Residence, Winnipeg, 2016.

25. "Gamma Rays at 130 GeV and How They Might Come from Dark Matter," McGill, 2012, & Perimeter Institute, 2013.

26. "Warped Dimensional Reduction," McGill University, Canadian Conference on General Relativity and Relativistic Astrophysics hosted by Memorial University, 2012.

T. D. Fugleberg

No update provided for this report

1. M. E. Carrington, W. Fu, T. Fugleberg, D. Pickering and I. Russell, "Bethe-Salpeter Equations from the 4PI effective action," Phys. Rev. D **88**, 085024 (2013)

D. Krepski

No update provided for this report
Refereed publications

1. Prequantization of the moduli space of flat $PU(p)$-bundles with prescribed boundary holonomies, Symmetry, Integrability and Geometry: Methods and Applications, 10 (2014), 109, 13 pages.

2. (with R. Goldin, M. Harada, and D. Johannsen) The inertia groups of a toric DM stack, fake weighted projective stacks, and labelled sheared simplices, to appear in Rocky Mountain Journal of Mathematics.

3. (with M. Harada) Global quotients among toric Deligne-Mumford stacks, Osaka Journal of Mathematics, 52 (2014), no. 1, pp. 236-269.

4. (with E. Meinrenken) On the Verlinde formulas for $SO(3)$, Quarterly Journal of Mathematics, 64 (2013), no. 1, pp. 235-252.

G. Kunstatter

1. J. Ziprick, J. Gegenberg and G. Kunstatter, "Polymer Quantization of a Self-Gravitating Thin Shell", to appear in PRD, accepted Nov. 14 2016 [arXiv:1609.06665]

2. P. Mikula, M.E. Carrington, G. Kunstatter, "Gradient Flow in the Ginzburg-Landau Model of Superconductivity". Phys. Rev. B 94, 184501 Published 3 November 2016 [arXiv:1511.03714]

3. Nils Deppe, Allison Kolly, Andrew R. Frey, Gabor Kunstatter, "Black Hole Formation in AdS Einstein-Gauss-Bonnet Gravity", JHEP, to appear (accepted Oct. 6, 2016) [arXiv:1608.05402].

4. G. Kunstatter, H. Maeda and T. Taves, "New 2D dilaton gravity for nonsingular black holes" Classical and Quantum Gravity, 102342.R1 2016 [arXiv:1509.06746].

5. M.E. Carrington, G. Kunstatter, J. Perron and S. Plosker,"On the geometric measure of entanglement for pure states", Journal of Physics A: Mathematical and Theoretical, 48, 435302, 2015.

6. Nils Deppe, Allison Kolly, Andrew Frey and Gabor Kunstatter, " Antide Sitter Space in Einstein Gauss Bonnet Stability of Einstein-Gauss-Bonnet Gravity", Phys. Rev. Lett. 114, 071102 ; arXiv:1410.1869.

7. Tim Taves and Gabor Kunstatter, "Modelling the evaporation of nonsingular black holes ",Phys. Rev. D 90, 124062 (2014) ; arXiv:1408.1444.

8. Gabor Kunstatter and Hideki Maeda, "Throat quantization of the SchwarzschildTangherlini(-AdS) black hole " Class. Quantum Grav. 31 115009 (2014).

9. G. Kunstatter, H. Maeda and T. Taves, "Hamiltonian dynamics of Lovelock black holes with spherical symmetry", Class. Qu. Grav. **30** 065002 (2013) ; arXiv:1210.1566.

10. N. Deppe, C. D. Leonard, T. Taves, G. Kunstatter and R. B. Mann, "Critical Collapse in Einstein-Gauss-Bonnet Gravity in Five and Six Dimensions",

    Phys. Rev. D 86, 104011 (2012); arXiv:1208.5250.

11. G. Kunstatter and J. Louko, "Polymer quantization on the half line", J. Phys. A. 422651/PAP/8788 (2012).

12. G.Kunstatter and T. Taves and H. Maeda, "Geometrodynamics of spherically symmetric Lovelock gravity", Class. Quantum Grav. 29 (2012) 092001 (Fast Track Communication); arXiv:1201.4904

13. J. Gegenberg and G. Kunstatter, "Local hamiltonian for spherical collapse: geometrodynamics approach" Phys. Rev. D 85, 084011 (2012); arXiv:1112.3301.

14. J. Gegenberg, G. Kunstatter and T. Taves, "Singularity Resolution Inside Radiating 2-D Black Holes", Phys. Rev. **D85** 024025 (2012); arXiv:1111.279 .

    Chapters in Books

15. J. Gegenberg and G. Kunstatter, "Midi-superspace models for quantum black holes", **(invited)** *Recent Research in Quantum Gravity*, (Nova Scientific, 2012) ed. A. Dasgupta.

    Invited papers presented at meetings

16. G. Kunstatter, "Birth and Death of Regular Black Holes", CAP Congress, Ottawa, 2016.

17. G. Kunstatter, "Polymer quantized spherical thin shell collapse", Theory Canada, Carleton University, Ottawa, June 2016.

18. G. Kunstatter, "Formation and Evaporation of Regular Black Holes in New 2D Gravity", **Invited** BIRS Workshop on Black Holes: New Horizons, Oaxaca, Mexico, May 2016.

19. G. Kunstatter, "Non-singular black holes from new 2D gravity" **invited**, Mann Fest, University of Waterloo, December 2015.

20. G. Kunstatter, "(In-)stability of AdS Space-time in Einstein-Gauss-Bonnet Gravity", **Invited**, Focus Week on Black Hole Stability, Fields Institute, Toronto, June 2015.

21. G. Kunstatter, "(In-)stability of AdS Space-time in Einstein-Gauss-Bonnet Gravity", **Invited**, Atlantic Meeting on General Relativity, University of Fredericton, May 2015.

22. G. Kunstatter, "Spherically Symmetric Black Hole Formation in Lovelock Gravity"**Invited**, Black Holes IX, Saskatoon, May, 2013.

23. "Boundary Conditions for Quantum Mechanics on the Discretized Half Line" **Invited**, CAP Congress, Montreal, May, 2013.

24. G. Kunstatter, "Lovelock gravity: geometrodynamics and quantum mechanics", **Invited**, CAP Congress, U. Calgary, June, 2012.

25. G. Kunstatter, "Quantum Mechanics on the Discretized Half Line"

    Invited, CMS Meeting, Regina, June 2012.

    Invited Lectures

26. "Formation and Evaporation of Nonsingular Black Holes in New 2D Gravity",

    - CECS, Chile, January 2016
    - Simon Fraser University, February 2016
    - University of Lethbridge, March 2016
    - University of Victoria, March 2016;
    - University of Calgary, March 2016

27. "Black hole information loss: is there light at the end of the tunnel?", University of Lethbridge, March 2016.

28. "Black hole information loss: is there light at the end of the tunnel?"Canadian Association of Physicists 2015 Lecture Tour, March 2-5, 2015 given at:

    - University of Guelph
    - University of Waterloo
    - McMaster University
    - University of Western Ontario.

29. "Black hole information loss: is there light at the end of the tunnel?", UWinnipeg, October, 2014; SFU, October, 2014.

30. "Stability of AdS Spacetime in Einstein-Gauss-Bonnet Gravity", SFU, October, 2014.

31. "Black hole information loss: let's lose the singularity instead of the information", UNB, July, 2014.

32. "Quantum Mechanics of the Interior of Radiating 2D Black Holes", Rykkyo University, Tokyo, June, 2013.

33. "Lovelock Gravity: Geometrodynamics and Quantum Mechanics", Univerite de Montreal, March 2012.

34. "Singularity resolution inside radiating black holes", McGill University, March, 2012.

P.D. Loly

No update provided for this report

1. Ian Cameron, Adam Rogers & Peter Loly, "Signatura of magic and Latin integer squares: isentropic clans and indexing", Discussiones Mathematicae Probability and Statistics, xx (xxxx) 129, online c. December 2013, in paper 2014.

Talks

2. Peter Loly (speaker), with Ian Cameron and Adam Rogers, "Shannon entropy of small matrices for physicists", Colloquium, 7 Nov. 2014, Department of Physics and Astronomy, University of Manitoba.

3. Peter Loly (speaker), with Adam Rogers and Ian Cameron, "Knut Vik Designs are Multimagic"", CMS Summer 2014, 7 June, Winnipeg.

4. Peter Loly (presenter) "Board Games on a square grid - Sudoku, chess, and magic squares - from refereed papers to personal web pages or vice versa", at the August 2012 University of Iceland - University of Manitoba 2012 Partnership Conference, on "Origins", Reykjavik.

5. Ian Cameron, Adam Rogers & Peter Loly (all presenters) Bewedlo, "Signatura of magic and Latin integer squares: isentropic clans and indexing", IWMS21 and LINSTAT2012 conferences at Bedlewo, Poland.

C. O'Dea

Refereed Articles

1. **C. P. O'Dea**, "The infrared properties of the GPS and CSS radio sources," *Astronomische Nachrichten*, 337, 141-147 (2016)

2. **C. P. O'Dea** & A. Siemiginowska, "Summary," *Astronomische Nachrichten*, 337, 205-208 (2016)

3. S. Vaddi, **C. P. O'Dea**, S. A. Baum, S. Whitmore, R. Ahmed, K. Pierce, S. Leary, "Constraints on Feedback in the Local Universe: The Relation between Star Formation and AGN Activity in Early-type Galaxies," *Astrophysical Journal*, 818, 182-200 (2016)

4. H. R. Russell, B. R. McNamara, A. C. Fabian, P. E. J. Nulsen, A. C. Edge, F. Combes, N. W. Murray, I. J. Parrish, P. Salomé, J. S. Sanders, S. A. Baum, M. Donahue, R. A. Main, R. W. O'Connell, **C. P. O'Dea**, J. B. R. Oonk, G. Tremblay, A. N. Vantyghem, G. M. Voit, "ALMA observations of cold molecular gas filaments trailing rising radio bubbles in PKS 0745-191," *Monthly Notices of the Royal Astronomical Society*, 458, 3134-3149 (2016)

5. G. R. Tremblay, J. B.R. Oonk, F. Combes, P. Salomé, **C. P. O'Dea**, S. A. Baum, G. M. Voit, M. Donahue, B. R. McNamara, T. A. Davis, M. A. McDonald, A. C. Edge, T. E. Clarke, R. Galván-Madrid, M. Maury, H. R. Russell, A. C. Quillen, C. M. Urry, J. S. Sanders, M. W. Wise, "Cold, clumpy accretion onto an active supermassive black hole," *Nature*, 534, 218-221 (2016)

6. J. P. Kotayla, M. Chiaberge, S. A. Baum, A. Capetti, B. Hilbert, F. D. Macchetto, G. K. Miley, **C. P. O'Dea**, E. S. Perlman, W. B. Sparks, G. R. Tremblay, "The Environment of $z > 1$ 3CR Radio Galaxies and QSOs: From Proto-Clusters to Clusters of Galaxies?" *Astrophysical Journal*, 826, 46-58 (2016)

7. B. Hilbert, M. Chiaberge, J. P. Kotayla, G. R. Tremblay, C. Stanghellini, W. B. Sparks, S. A. Baum, A. Capetti, F. D. Macchetto, G. K. Miley, **C. P. O'Dea**, E. S. Perlman, A. C. Quillen, "Powerful Activity in the Bright Ages. I. A Visible/IR Survey of High Redshift 3C Radio Galaxies and Quasars," *Astrophysical Journal Supplements*, 225, 12-28 (2016)

8. B. Punsly, C. Reynolds, P. Marziani, **C. P. O'Dea**, "The Extreme Ultraviolet Spectra of Low Redshift Radio Loud Quasars," *Monthly Notices of the Royal Astronomical Society*, 459, 4233-4239 (2016)

9. A. Maselli, F. Massaro, G. Cusumano, V. La Parola, D. E. Harris, A. Paggi, E. Liuzzo, G. R. Tremblay, S. A. Baum, **C. P. O'Dea**, "Swift observations of unidentified radio sources in the revised Third Cambridge Catalogue," *Monthly Notices of the Royal Astronomical Society*, 460, 3829-3837 (2016)

10. J. F. Gallimore, M. Elitzur, R. Maiolino, A. Marconi, **C P. O'Dea**, D. Lutz, S. A. Baum, R. Nikutta, C. M. V. Impellizzeri, R. Davies, Amy E. Kimball, and E. Sani "High-velocity Bipolar Molecular Emission from an AGN Torus," *Astrophysical Journal Letters*, 829, 7-12 (2016)

11. B. Punsly, P. Marziani, S. Zhang, S. Muzahid, and **C. P. O'Dea** "The Extreme Ultraviolet Variability of Quasars," *Astrophysical Journal*, 830, 104-123 (2016)

12. D. Sales, A. Robinson, D. Axon, J. Gallimore, P. Kharb, R. Curran, **C. O'Dea**, S. Baum, M. Elitzur, and R. Mittal, "An embedded active nucleus in the OH megamaser galaxy IRAS16399-0937," *Astrophysical Journal*, 799, 25-53 (2015)

13. E. C. Stanley, P. Kharb, M.L. Lister, H. L. Marshall, **C. O'Dea**, S. Baum, "A Multiwavelength Study of Three Hybrid Blazars," *Astrophysical Journal*, 807, 48-59 (2015)

14. G. R. Tremblay, **C. P. ODea**, S. A. Baum, R. Mittal, M. A. McDonald, F. Combes, Y. Li, B. R. McNamara, M. N. Bremer, T. E. Clarke, M. Donahue, A. C. Edge, A. C. Fabian, S. L. Hamer, M. T. Hogan, J. B. R. Oonk, A. C. Quillen, J. S. Sanders, P. Salom, and G. M. Voit, "Far Ultraviolet Morphology of Star Forming Filaments in Cool Core Brightest Cluster Galaxies," *Monthly Notices of the Royal Astronomical Society*, 451, 3768-3800 (2015)

15. F. Massaro, D. E. Harris, E. Liuzzo, M. Orienti, R. Paladino, A. Paggi, G. R. Tremblay, B. J. Wilkes, J. Kuraszkiewicz, S. A. Baum, & **C. P. ODea**, "The Chandra survey of extragalactic sources in the 3CR catalog: X-ray emission from nuclei, jets and hotspots in the Chandra archival observations," *Astrophysical Journal Supplements*, 220, 5-19 (2015)

16. B. Punsly, P. Marziani, P. Kharb,**C. P. O'Dea**, & M. Vestergaard, "The Extreme Ultraviolet Deficit: Jet Connection in the Quasar 1442+101," *Astrophysical Journal*, 812, 79-88 (2015)

17. J. A. White, R. E. A. Canning, L. J. King, B. E. Lee, H. R. Russell, S. A. Baum, D. I. Clowe, J. E. Coleman, M. Donahue, A. C. Edge, A. C. Fabian, R. M. Johnstone, B. R. McNamara, **C. P. O'Dea**, J. S. Sanders, "Dynamical analysis of galaxy cluster merger Abell 2146," *Monthly Notices of the Royal Astronomical Society*, 453, 2718-2730 (2015)

18. S. L. Hamer, A. C. Edge, A. M. Swinbank, J. B. R. Oonk, R. Mittal, B. R. McNamara, H. R. Russell, M. N. Bremer, F. Combes, A. C. Fabian, N. P. H. Nesvadba, **C. P. O'Dea**, S. A. Baum, P. Salom, G. Tremblay, M. Donahue, G. J. Ferland, C. L. Sarazin, "Cold gas dynamics in Hydra-A: evidence for a rotating disk," *Monthly Notices of the Royal Astronomical Society*, 437, 862-878 (2014)

19. A. Bogdan, R. J. van Weeren, R. P. Kraft, W. R. Forman, S. Randall, S. Giacintucci, E. Churazov, **C. P. O'Dea**, S. A. Baum, J. Noel-Storr, and C. Jones "Young AGN Outburst Running Over Older X-ray Cavities," *Astrophysical Journal Letters*, 782, L19-24 (2014)

20. H.R. Russell, B.R. McNamara, A.C. Edge, P.E.J. Nulsen, R.A. Main, A.N. Vantyghem, F. Combes, A.C. Fabian, N. Murray, P. Salome, R.J. Wilman, S.A. Baum, M. Donahue, **C.P. O'Dea**, J.B.R. Oonk, G.R. Tremblay, G.M. Voit "Massive molecular gas flows in the Abell 1664 brightest cluster galaxy," *Astrophysical Journal*, 784, 78-86 (2014)

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T.A. Osborn

No update provided for this report

1. Karl-Peter Marzlin and T. A.Osborn, "Quantum Collapse Bell Inequalities", Phys. Rev. A 89, 032123, (2014)

Talks

2. T. A.Osborn, New and Old Bell Inequalities, Department of Physics and Astronomy Colloquium, November, 20th, 2015.

3. T. A.Osborn, Aharonov-Bohm Effect without Potentials, Theory Canada 7, Lethbridge, AB, June 9, 2012 (Invited talk).

S. Plosker

Peer-Reviewed Journal Articles

1. D. Farenick, M. J. Kozdron, and S. Plosker. *Spectra and variance of quantum random variables.* Journal of Mathematical Analysis and Applications **434**, pp. 1106-1122, 2016.

2. M. E. Carrington, G. Kunstatter, J. Perron, and S. Plosker. *On the geometric measure of entanglement for pure states.* Journal of Physics A: Mathematical and Theoretical, **48**, 435302, 2015.

3. J. Li, R. Pereira and S. Plosker. *Some geometric interpretations of quantum fidelity.* Linear Algebra and its Applications, **487**, pp. 158-171, 2015.

4. R. Pereira and S. Plosker. *Extending a characterization of majorization to infinite dimensions.* Linear Algebra and its Applications, **468**, pp. 80-86, 2015.

5. T. Jochym-O'Connor, D. W. Kribs, R. Laflamme, and S. Plosker. *Quantum subsystems: Exploring the complementarity of quantum privacy and error correction.* Physical Review A, **90**, 032305, 2014.

6. D. W. Kribs and S. Plosker. *Private quantum codes: introduction and connection with higher rank numerical ranges*. Linear and Multilinear Algebra, **62**, pp. 639-647, 2014.

7. T. Jochym-O'Connor, D. W. Kribs, R. Laflamme, and S. Plosker. *Private quantum subsystems*. Physical Review Letters, **111**, 030502, 2013.

8. R. Pereira and S. Plosker. *Dirichlet polynomials, majorization, and trumping*. Journal of Physics A: Mathematical and Theoretical, **46**, 225302, 2013.

9. D. Farenick, R. Floricel, and S. Plosker. *Approximately clean quantum probability measures*. Journal of Mathematical Physics, **54**, Issue 5, 052201, 2013.

10. D. W. Kribs, R. Pereira, and S. Plosker. *Trumping and power majorization*. Linear and Multilinear Algebra, **61**, pp. 1455-1463, 2013.

11. D. Farenick, S. Plosker, and J. Smith. *Classical and nonclassical randomness in quantum measurements*. Journal of Mathematical Physics, **52**, Issue 12, 122204, 2011.

Invited Lectures

12. *Spectra and variance of quantum random variables*, Workshop on Quantum Marginals and Numerical Ranges, Guelph, Ontario Aug. 17–21, 2015

13. *Spectra and variance of quantum random variables*, Workshop on Matrices and Operators (MAO), Shaanxi Normal University, Xian, China Jul. 19–21, 2015

14. *Some geometric interpretations of quantum fidelity*, Summer Research Workshop on Quantum Information Science, Sanya, Hainan, China Jul. 13–17, 2015

15. *Quantum fidelity*, three part lecture series, University of Regina, June 29–Jul. 3, 2015

16. *Private quantum subsystems and error correction*, Operator Algebra Seminar Series, University of Regina, Sept. 26, 2014

17. *The majorization and trumping orders in quantum information*, Math Colloquium, University of Regina, Sept. 26, 2014

18. *On the problem of entanglement transformations: characterizing trumping*, Minisymposium on Quantum Information and Computing, 19th Conference of the International Linear Algebra Society (ILAS), Seoul, South Korea, Aug. 6–9, 2014

19. *Quantum expectations: a matricial range perspective*, The Twelveth Workshop on Numerical Ranges and Numerical Radii, Sanya, Hainan, China, Jul. 28 – Aug. 1, 2014

20. *Using vector spaces of matrices to study quantum measurements*, Workshop on Matrices and Operators, Haikou, Hainan, China, Jul. 24–27, 2014

21. *The majorization and trumping orders in quantum information* (co-presenter Rajesh Pereira, three lectures), 14th Canadian Summer School on Quantum Information, Guelph, ON, Jun. 16–20, 2014

22. *On majorization and trumping*, Winnipeg Institute for Theoretical Physics (WITP), University of Manitoba, Mar. 20, 2014

23. *Trumping and power majorization*, Minisymposium on Linear Algebra Problems in Quantum Computation, 18th Conference of the International Linear Algebra Society (ILAS), Providence, Rhode Island, USA, Jun. 3, 2013.

24. *Private quantum codes*, Operator Theory and Operator Algebras Session, CMS Winter Meeting, Montreal, PQ, Dec. 8, 2012.

25. *On complementarity in quantum error correction and quantum cryptography*, Operator Algebra Seminar Series, University of Regina, Regina, SK, Apr. 18, 2012.

A. Prymak

1. K. A. Kopotun, D. Leviatan, A. Prymak, I. A. Shevchuk, *Yet another look at positive linear operators, q-monotonicity and applications*, *Journal of Approximation Theory*, **210** (2016), 1–22.
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2. Z. Ditzian, A. Prymak, *On Nikol'skii inequalities for domains in R^d*, *Constructive Approximation*, **44** (2016), 23–51.
`http://arxiv.org/abs/1409.5397`

3. O. Maizlish, A. Prymak, *Convex polynomial approximation in R^d with Freud weights*, *Journal of Approximation Theory*, **192** (2015), 60–68.

4. Z. Ditzian, A. Prymak, *Discrete d-dimensional moduli of smoothness*, *Proc. Amer. Math. Soc.*, **142** (2014), no. 10, 3553–3559.
`http://arxiv.org/abs/1404.0063`

5. A. Bondarenko, A. Prymak, D. Radchenko, *On concentrators and related approximation constants*, *J. Math. Anal. Appl.*, **402** (2013), 234–241.
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S. Safi-Harb

Refereed Journal Articles

1. Rogers, A. & Safi-Harb, S. 2017, Monthly Notices of the Royal Astronomical Society (MNRAS), vol. 465, issue 1, pp. 383-393 (arXiv:1610.04685)

2. West, J. L., Safi-Harb, S. & Ferrand, G. 2017, accepted for publication in Astronomy&Astrophysics (arXiv:1609.02887)

3. Rogers, A. 2017, Monthly Notices of the Royal Astronomical Society, vol. 465, issue 2, pp. 2151-2159 (arXiv:1611.01269)

4. Miceli, M., Bamba, A., Orlando, S., Zhou, P., Safi-Harb, S., Chen, Y. & Bocchino, F. 2017, Accepted for publication in Astronomy&Astrophysics (arXiv:1612.01923)

5. Zhou, Ping, Chen, Yang, Safi-Harb, Samar, Zhou, Xin, Sun, Ming, Zhang, Zhi-Yu & Zhang, Gao-Yuan 2016, The Astrophysical Journal, Volume 831, Issue 2, article id. 192, 17 pp. (2016).

6. The Hitomi Collaboration, including Safi-Harb, S. 2016, Nature, Volume 535, Issue 7610, pp. 117-121 (2016).

7. The Hitomi Collaboration, including Safi-Harb, S. 2016, Submitted to the Astrophysical Journal Letters (arXiv:1607.07420)

8. Zhou, Ping, Chen, Yang, Zhang, Zhi-Yu, Li, Xiang-Dong, Safi-Harb, Samar, Zhou, Xin & Zhang, Xiao 2016, The Astrophysical Journal, Volume 826, Issue 1, article id. 34, 7 pp. (2016).

9. Matheson, H., Safi-Harb, S. & Kothes, R. 2016, The Astrophysical Journal, Volume 825, Issue 2, article id. 134, 10 pp. (2016).

10. Rogers, A. & Safi-Harb, S. 2016, Monthly Notices of the Royal Astronomical Society, Volume 457, Issue 2, p.1180-1189 (arXiv:1601.00949).

11. West, J. L., Safi-Harb, S., Jaffe, T., Kothes, R., Landecker, T. L., Foster, T. 2015, Astronomy & Astrophysics, Volume 587, id.A148, 20 pp. (arXiv:1510.08536).

12. Coti Zelati, F., Rea, N., Campana, S., De Martino, D., Papitto, A., Safi-Harb, S., Torres, D. F. 2015, Monthly Notices of the Royal Astronomical Society, Volume 456, Issue 2, p.1913-1923 (arXiv:1510.04431).

13. Bamba, Aya, Terada, Yukikatsu, Hewitt, John, Petre, Robert, Angelini, Lorella, Safi-Harb, Samar, Zhou, Ping, Bocchino, Fabrizio & Sawada, Makoto 2016, The Astrophysical Journal, Volume 818, Issue 1, article id. 63, 11 pp. (arXiv:1601.02715).

14. Rogers, A. 2015, Monthly Notices of the Royal Astronomical Society, Volume 451, Issue 1, p.17-25.

15. Yamaguchi, H., Badenes, C., Petre, R., Nakano, T., Castro, D., Enoto, T., Hiraga, J. S., Hughes, J. P., Maeda, Y., Nobukawa, M., Safi-Harb, S., Slane, P. O., Smith, R. K., Uchida, H. 2014, The Astrophysical Journal (ApJ) Letters, 785, L27.

16. Zhou, P., Chen, Y., Li, X.-D., Safi-Harb, S., Mendez, M., Terada, Y., Sun, W., Ge, M.-Y. 2014, ApJ (Letters), 781, L16.

17. Jackson, M., Safi-Harb, S., & Kothes, R. 2014, MNRAS, 444, 2228.

18. Ferrand, G., Danos, R., Shalchi, A., Safi-Harb, S., Edmon, P. & Mendygral, P. 2014, ApJ, 792, 133.

19. Kosenko, D., Ferrand, G., Decourchelle, A. 2014, MNRAS, 443, 1390.

20. Ferrand, G., Decourchelle, A., Safi-Harb, S. 2014, ApJ, 789, 49.

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22. Kumar, H. S., Safi-Harb, S., Slane, P., & Gothelf, E. V. 2014, ApJ, 781, 41.

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24. Ferrand, G., Decourchelle, A., & Safi-Harb, S. 2012, ApJ, 760, 34.

25. Kumar, H. S., Safi-Harb, S., & Gonzalez, M. E. 2012, ApJ, 754, 96.

26. Ferrand, G., & Safi-Harb, S. 2012, Advances in Space Research, 49, 1313.

Proceedings

27. Safi-Harb, S. 2017; Gamma2016: Highlights and Summary of Galactic Science (invited rapporteur talk), 6th International Symposium on High-Energy Gamma-Ray Astronomy (Gamma 2016), Heidelberg (Germany), 11–15 July (2016). To be published by AIP in 2017.

28. Cherenkov Telescope Array (CTA) consortium, in: 6th International Symposium on High-Energy Gamma-Ray Astronomy (Gamma 2016), Heidelberg (Germany), 11–15 July (2016) (arXiv:1610.05151).

29. Takahashi (Hitomi collaboration) et al., including Safi-Harb, S. 2016, Proceedings of the SPIE, Volume 9905, id. 99050U 17 pp. (2016).

30. Safi-Harb, S. 2016 (invited review) in: Supernova Remnants: An Odyssey in Space after Stellar Death, Proceedings of the Conference held 6-11 June 2016, in Chania, Greece; 2016sros.confE..49S.

31. Ferrand, G. & Safi-Harb, S. 2016; in Supernova Remnants: An Odyssey in Space after Stellar Death, Proceedings of the Conference held 6-11 June 2016, in Chania, Greece; arXiv:1609.03264 (2016)

32. West, J., Safi-Harb, S., Jaffe, T., Ferrand, G., Kothes, R., Landecker, T., Foster, T. 2016, in: Supernova Remnants: An Odyssey in Space after Stellar Death, Proceedings of the Conference held 6-11 June 2016, in Chania, Greece; 2016sros.confE..83W (2016)

33. Safi-Harb, S. & Rogers, A. 2016, in: Supernova Remnants: An Odyssey in Space after Stellar Death, Proceedings of the Conference held 6-11 June 2016, in Chania, Greece; 2016sros.confE..66S

34. Guest, B. & Safi-Harb, S. 2016 in: Supernova Remnants: An Odyssey in Space after Stellar Death, Proceedings of the Conference held 6-11 June 2016, in Chania, Greece; 2016sros.confE..52G

35. Zhou, Ping, Chen, Yang, Zhang, Zhi-Yu, Li, Xiang-Dong, Safi-Harb, Samar, Zhou, Xin & Zhang, Xiao 2016 in: Supernova Remnants: An Odyssey in Space after Stellar Death, Proceedings of the Conference held 6-11 June 2016, in Chania, Greece; 2016sros.confE.130Z.

36. Safi-Harb, S. 2015, International Astronomical Union Assembly, 2015IAUGA..2251633S (invited), submitted to the American Astronomical Society, 01 Nov. (2015).

37. Reichardt, I., Terrier, R., West, J., Safi-Harb, S., de Ona-Wilhelmi, E., Rico, J. 2014, Fermi Symposium proceedings - eConf C14102.1; arXiv:1502.03053 (2015).

38. Takahashi, T. et al. (for the ASTRO-H team) 2014, Proceedings of the SPIE, Volume 9144, id. 914425 24 pp; arXiv:1412.1356 (2014).

39. Ferrand, G. & Safi-Harb, S., Cosmic Rays and the Interstellar Medium (CRISM 2014), Proceedings of Science, paper I on the simulations (3D simulations of the multi-wavelength emission from young SNRs including efficient particle acceleration), CRISM 2014, 24-27 June, Montpellier, France (2014).

40. Ferrand, G. & Safi-Harb, S., Cosmic Rays and the Interstellar Medium (CRISM 2014), Proceedings of Science, paper II on the SNR catalogue (An updated Catalogue of High-Energy Observations of Galactic Supernova Remnants), CRISM 2014, 24-27 June, Montpellier, France (2014).

41. Zhou, P., Safi-Harb, S. et al., Proceedings of the IAU Symposium, Cambridge U. Press, Volume 296, 360 (2014).

42. Kumar, H. S., Safi-Harb, S., Slane, P., & Gotthelf, E. V., Proceeding of the IAU Symposium, Cambridge U. Press, Volume 296, 235 (2014).

43. Safi-Harb, S., Ferrand, G., & Matheson, H. 2013, Proceedings of the IAU Symposium, 291, 483, Cambridge U. Press; arXiv:1210.5264 (2013).

44. Safi-Harb, S., & Kumar, H. S. 2013, Proceedings of the IAU Symposium, 291, 480, Cambridge U. Press; arXiv:1210.5261 (2013).

45. Safi-Harb, S. 2013, Proceedings of the IAU Symposium, 291, 251, Cambridge U. Press; arXiv:1211.0852 (invited review. 2013).

46. Takahashi, T., Mitsuda, K., Kelley, R.,... Safi-Harb et al. 2012, Proceedings of the SPIE, Proc. SPIE, 8443, 22pp.; arXiv:1210.4378 (2012).

47. Safi-Harb, S. 2012, American Institute of Physics Conference Series, 1505, 13; arXiv:1210.5406 (invited review, 2012).

Theses

48. Jennifer West, PhD thesis: The connection between supernova remnants and the Galactic magnetic field; completed 24 Aug. (2016).

49. Chelsea Braun, MSc thesis: Study of the Supernova Remnant RCW 103 (G332.4-0.4) with the Chandra X-ray Observatory; completed 31 March (2016).

50. Heather Matheson, PhD thesis: X-ray observations of the young pulsar wind nebula G21.5–0.9 and the evolved pulsar wind nebulae CTB 87 (G74.9+1.2) and G63.7+1.1, completed 21 Dec. (2014).

51. Harsha S. Kumar, PhD thesis: X-ray studies of highly magnetized neutron stars and their environs, defended May (2013); recipient of the 2014 UofM's Governor General's Gold Medal.

52. Recent Honours undergraduate theses: Benson Guest and Chelsea Braun (2013), Kelvin Au (2015), and Yichen Zhan (2016).

White Papers

- Young Supernova Remnants by Hughes, Safi-Harb et al., ASTRO-H White Paper, arXiv:1412.1169 (2014).

- Older Supernova Remnants and Pulsar Wind Nebulae by Long et al., ASTRO-H White Paper, arXiv:1412.1166 (2014).

- Accreting Pulsars, Magnetars, and Related Sources by Kitamoto, Enoto, Safi-Harb et al., ASTRO-H White Paper, arXiv:1412.1165 (2014).

- *plus* 13 other white papers for the ASTRO-H team members (all posted on the arXiv on 03 Dec 2014): arXiv:14121190, 1412.1179, 1412:1177, 1412:1176, 1412:1175, 1412:1174, 1412:1173, 1412:1172, 1412:1171, 1412:1170, 1412:1164, 1412:1163, 1412:1162 (2014).

Conference Presentations

- X-ray Observations of the Supernova Remnant G21.5–0.9 by Guest, B. & Safi-Harb, S., Hitomi Collaboration meeting at NASA's Goddard Space Flight Centre, Greenbelt, MD, Sep. (2016).
- Rapporteur Summary at the 6th International Symposium of Gamma-Ray Astronomy , Heidelberg, Germany, 11-15 July (2016).
- **Six** Presentations given by Safi-Harb and group members at the Supernova Remnants Conference entitled: Supernova Remnants: An Odyssey in Space after Stellar Death, Conference held 6-11 June 2016, in Chania, Greece (2016).
- **Six** Presentations given by Safi-Harb's group at the annual CASCA meeting held in Winnipeg, May 30-June 2 (2016).
- Peering deeper into the Plerionic Supernova Remnant G21.5–0.9, Guest, B. & Safi-Harb, S., WITP Symposium, 25 Aug. (2016).
- Spin-Down Mechanisms in Neutron Stars with Anomalous Magnetic Fields, Rogers, A., Safi-Harb, S., International Astronomical Union (IAU) General Assembly, Meeting #29, id.#2257636, Aug. (2015).
- Autonomous Modelling of X-ray Spectra Using Robust Global Optimization Methods, Rogers, A., Safi-Harb, S. & Fiege, J., International Astronomical Union (IAU) General Assembly, Meeting #29, id.#2257588, Aug. (2015).
- 3D Simulations of the Emission from Young Supernova Remnants Including Efficient Particle Acceleration, Ferrand, G., Safi-Harb, S., Decourchelle, A. IAU General Assembly, Meeting #29, id.#2257717, Aug. (2015).
- Bilateral symmetry in supernova remnants and the connection to the Galactic magnetic field, West, J. L., Safi-Harb, S.,Jaffe, T., Kothes, R., Foster, T., Landecker, T., IAU General Assembly, Meeting #29, id.#2257592, Aug. (2015).
- Molecular environment and X-ray study of the metal-rich thermal composite supernova remnant Kes 79, Zhou, P., Chen, Y., Safi-Harb, S., Sun, IAU General Assembly, Meeting #29, id.#2255046, Aug. (2015).
- Multi-D SNR Simulations with Particle Acceleration, Ferrand. G. in collaboration with Safi-Harb and Decourchelle, 2015, Particle Astrophysics and Cosmology Including Fundamental InteraCtions (PACIFIC) workshop, Sep. (2015).
- Modelling Supernova Remnants with Bilateral Morphology, Jennifer West's PhD project presentation at the WITP symposium, UofM, Aug. (2015).
- A Chandra X-ray Study of a Supernova Remnant Hosting a Peculiar Compact Object, Kelvin Au, undergraduate thesis project presentation at WITP, UofM, Aug. (2015).
- Study of the Very High Energy Emission from the Galactic Supernova Remnant Population with H.E.S.S., Hahn, J., Fernandez, D., Casanova, S., Chaves, R., Marandon, V., Renaud, M., Safi-Harb, S., Vink, J., International Cosmic Ray Conference, ICRC 2015-I/686, The Hague, The Netherlands, 30 July–06 Aug. (2015).

- Autonomous Modelling of X-ray Spectra Using Robust Global Optimization Methods, Rogers, A., Safi-Harb, S. & Fiege, CASCA 2015, Hamilton, ON, May (2015).
- High-Energy Studies of the Supernova Remnant CTB 37B, Kumar, H. S. & Safi-Harb, S., Fermi Summer School, Delaware, 26 May – 05 June (2015).
- Studying Young and Old Supernova Remnants with the Upcoming X-ray Mission, Safi-Harb, S., for the ASTRO-H team, American Astronomical Society Meeting #225, id.#338.33, Seattle, 4–8 Jan. (2015).
- Prospects with ASTRO-H on New Sciences of Accreting Pulsars, Magnetars, & Related Sources by Kitamoto, Enoto, Safi-Harb et al. for the ASTRO-H team, American Astronomical Society Meeting #225, id.#345.22, Seattle, 4-8 Jan. (2015).
- Fermi/LAT Study of the Cygnus Loop Supernova Remnant: Discovery of a Point-like Source and of Spectral Differences in its gamma-ray emission, 2014 Fifth International Fermi Symposium, Nagoya U, Japan, 20–24 Oct. (2014).
- Hughes, J. P., Safi-Harb, S. et al. (for the ASTRO-H team), 40th COSPAR Scientific Assembly; Moscow, Russia, E1.4-20-14., Aug. (2014).
- Zhou, P., Chen, Y., Safi-Harb, S. & Ming, S., 40th COSPAR Scientific Assembly; Moscow, Russia, Abstract E1.16-41-14, Aug. (2014).
- Zhou, P. et al., 40th COSPAR Scientific Assembly; Moscow, Russia, Abstract E1.12-20-14., Aug. (2014).
- 3D simulations (poster) and SNRcat (talk), Ferrand, G. with Safi-Harb at CTA workshop in Paris, 30 June (2014).
- 3D simulations, Ferrand, G. at the RAMSES Users meeting, Saclay, 26 June (2014).
- A talk on SNRcat and a poster the 3D simulations, Ferrand, G. with Safi-Harb at the CRISM conference in Montpellier, 24–27 June (2014).
- Three Presentations on PV phase targets for ASTRO-H; Young and Old SNRs, and Compact Objects, in collaboration with the ASTRO-H team, ASTRO-H SM13 meeting, Metropolitan U., Japan, March (2014)
- Pulsar Wind Nebulae with ASTRO-H, Guest, B. & Safi-Harb, S., ASTRO-H Summer School, Paris, July (2014). (one of the winners for a poster presentation)
- Three presentations on white papers for Young and Old SNRs, Pulsar Wind Nebulae and Compact Objects, in collaboration with the ASTRO-H team, ASTRO-H's SM12, Matsuyama, Japan, Feb. (2014)
- Using Supernova Remnants to Probe Magnetars, Safi-Harb, Suzaku/Maxi 2014 conference, Matsuyama, Japan, Feb (2014).
- Supernova remnants as astrophysical laboratories for the formation of the elements, Braun, C. & Safi-Harb, S., WITP, Winnipeg, Aug. (2013)

- A new galactic pulsar candidate revealed by the Chandra X-ray Observatory, Guest, B. & Safi-Harb, S., WITP, Winnipeg, Aug. (2013)
- Young Supernova Remnants with Astro-H, Safi-Harb for the ASTRO-H Science Working Group on Young SNRs, Yale U. (2013)
- Magnetars and High-Mass X-ray Binaries with Astro-H, Kitamoto et al., ASTRO-H Science Working Group on compact objects, Yale U., Jul (2013)
- Old Supernova Remnants and Pulsar Wind Nebulae with Astro-H, Long et al., ASTRO-H Science Working Group on Old SNRs and PWNe, Yale U., Jul (2013)
- Bilateral Symmetry in Supernova Remnants and the Connection to the Galactic Magnetic Field, West, J., Safi-Harb, S. Jaffe, T., Kothes, R., Landecker, T., & Foster, T., Seventh NAIC/NRAO Single-Dish Summer School, Puerto Rico, July (2013).
- The Astro-H X-ray Mission, Safi-Harb, S., Gallo, L., McNamara, B. et al., CASCA, U. of British Columbia, May (2013).
- Applications of Global Optimization Methods in High-Energy Astrophysics, Rogers, A., Safi-Harb, S., & Fiege, J., CASCA, U. of British Columbia, May (2013).
- Modelling polarized radio emission from supernova remnants, West, J., Safi-Harb, S. Jaffe, T., Kothes, R., Landecker, T., & Foster, T., CASCA, U. of British Columbia, May (2013).
- Modelling polarized radio emission from supernova remnants, West, J., Safi-Harb, S. Jaffe, T., Kothes, R., Landecker, T., Foster, T., S, & Landecker, T. 2010, International EMU/POSSUM/GALFACTS Meeting, British Columbia, May (2013).
- Prospects for Astro-H studies of Young SNRs, Old SNRs and PWNe, and High-Mass X-ray Binaries+Magnetars; a total of 9 posters total for the ASTRO-H Science Working Group Meeting, Tsukuba, Japan, Feb. (2013).
- An XMM-Newton study of the mixed?-morphology supernova remnant W28, Zhou, P., Safi-Harb, S. et al., Supernova Environmental Impacts, IAU Symposium No. 296, Calcutta, India, Jan. (2013).
- X-ray imaging and spectroscopic study of the SNR Kes 73 hosting the magnetar 1E 1841–045, Kumar, H. S., Safi-Harb, S., Slane, P., & Gotthelf, E. V., Supernova Environmental Impacts, IAU Symposium No. 296, Calcutta, India, Jan. (2013).
- Pulsar Wind Nebulae, Kumar delivered on behalf of Safi-Harb, Supernova Environmental Impacts, IAU Symposium No. 296, Calcutta, India, Jan. (2013).
- Pulsar Wind Nebulae: On their growing diversity and association with highly magnetized neutron stars, Safi-Harb, S., IAU Symposium 291: Neutron Stars and Pulsars: Challenges and Opportunities after 80 years, Beijing, China, 20–31 Aug. (2012).
- A high-energy catalogue of galactic SNRs and PWNe, Safi-Harb, S., Ferrand, G., & Matheson, H. 2013, IAU Symposium 291: Neutron Stars and Pulsars: Challenges and Opportunities after 80 years, Beijing, China, 20–31 Aug. (2012).

- On the environments and progenitors of supernova remnants associated with highly magnetized neutron stars, Safi-Harb, S. & Kumar, H. S., IAU Symposium 291: Neutron Stars and Pulsars: Challenges and Opportunities after 80 years, Beijing, China, 20–31 Aug. (2012).

- 3D simulations of the emission from young supernova remnants including particle acceleration, Ferrand, G., Safi-Harb, S., The Cosmic Kaleidoscope, Pulsars and their Nebulae, Supernova Remnants and More, Kruger Park, S. Africa, 13–17 Aug. (2012).

- An X-ray study of the pulsar wind nebula G63.7+1.1 with Chandra and XMM-Newton, Matheson, S., Safi-Harb, S., & Kothes, R., The Cosmic Kaleidoscope, Pulsars and their Nebulae, Supernova Remnants and More, Kruger Park, S. Africa, 13–17 Aug. (2012).

- A Census of High-Energy Observations of Galactic Supernova Remnants and Pulsar Wind Nebulae, Ferrand, G., Safi-Harb, S., & Matheson, H., The Cosmic Kaleidoscope, Pulsars and their Nebulae, Supernova Remnants and More, Kruger Park, S. Africa, 13–17 Aug. (2012).

- An XMM-Newton Study of the Mixed-?Morphology Supernova Remnant W28, Zhou, P., Safi-Harb, S. et al.. The Cosmic Kaleidoscope, Pulsars and their Nebulae, Supernova Remnants and More, Kruger Park, S. Africa, 13–17 Aug. (2012).

- Plerionic Supernova Remnants, Safi-Harb, S., the 5th Symposium on Gamma-Ray Astronomy, Heidelberg, Germany, 9–13 Jul. (2012).

- SNR Plasmas White Paper Task Force, Hughes, J., Safi-Harb, S. et al., Astro-H Science Working Group (SWG) meeting, Cambridge, U.K., 9–11 Jul. (2012).

- Magnetars/High-Mass-X-ray Binaries White Paper Task Force, Enoto, Kitamoto, Safi-Harb, S. et al., Astro-H SWG meeting, Cambridge, U.K., 9–11 Jul. (2012).

- SNR Dynamics White Paper Task Force, Long, K. et al. including Safi-Harb, S., Astro-H SWG meeting, Cambridge, U.K., 9–11 Jul. (2012).

- The Astro-H X-ray Observatory: The mission, science, and Canadian participation, Gallo, L., Safi-Harb, S. (presenter), McNamara, B., on behalf of the Astro-H team, Canadian Astronomical Society Meeting (CASCA), U. of Calgary, 4–7 June (2012).

- 3D simulations of the emission from young supernova remnants including particle acceleration, Ferrand, G., Safi-Harb, S., Decourchelle, A., Pomarede, D., Canadian Astronomical Society Meeting (CASCA), U. of Calgary, 4–7 June (2012).

Invited Talks

- Presentation at the UofM Faculty of Science Homecoming event, 19 Sep. (2016)

- Keynote Lecture on 'High-Energy Astrophysics: A Window into a Violent and Extreme Universe; Women in Physics Conference, U. of Saskatchewan, 27 July (2016)

- Review on 'Future X-ray Studies of Pulsar Wind Nebulae' at the 'Modelling Nebulae' workshop, 5th session of the Sant Cugat Forum in Astrophysics, Barcelona, Spain, June 14-17 (2016)

- Review on 'High-Energy Observations of Pulsar Wind Nebulae' at the Supernova Remnants Conference 'An Odyssey in Space After Stellar Death', Crete Island, Greece, June 6-11 (2016)

- Rapporteur talk on Galactic Science, Gamma2016, Heidelberg, Germany, 11–15 July (2016)
- An X-ray View of the Zoo of Compact Objects and Associated Supernova Remnants, International Astronomical Union (IAU) General Assembly, Meeting #29, id.#2251633 Honolulu, Hawaii, 10 Aug. (2015)
- The Different Faces of Neutron Stars, U. of Tokyo in celebration of Prof. Makishima's Japan Academy Prize Award and his retirement from the U. of Tokyo, 01 Aug. (2015)
- The Beauty in the Extreme: Supernova Remnants and Associated Compact Objects, Max Planck Institute for Nuclear Physics (MPIK), Heidelberg, Germany, 08 June (2015)
- The Beauty in the Extreme: Supernova Remnants and Associated Compact Objects, National Research Council of Canada, Dominion Radio Astrophysical Observatory, Penticton, B.C., 20 May (2015)
- Supernova Remnants and Associated Beasts: A violent, hot and dynamic Universe: A Public Lecture at the U. of Toronto's Astronomy and Space Exploration (ASX) Society's Symposium, 23 Jan. (2015)
- Supernova Remnants: An Astrophysical Factory for High-Energy and Exotic Phenomena, Colloquium at the U. of Alberta, 13 Nov. (2014)
- Supernova Remnants, ASTRO-H 5th Summer School, Paris (France), July (2014)
- Pulsar Wind Nebulae and Neutron Stars, ASTRO-H 5th Summer School, Paris (France), July (2014)
- Neutron Stars, CCGRA15, U. of Winnipeg, 21-23 May (2014)
- Pulsar Wind Nebulae and Magnetars, ASTRO-H HXI/SGD Workshop at Hiroshima U. (Japan), 24-25 Feb. (2014)
- Pulsar Wind Nebula – Supernova Remnant Interaction, International Astronomical Union Symposium entitled 'Supernova Environmental Impacts', Calcutta, India, 6–11 Jan. (2013).
- Neutron Stars and Supernova Remnants, International Astronomical Union Symposium 291 entitled 'Neutron Stars and Pulsars: Challenges and Opportunities after 80 years', Beijing, China, 20–31 Aug. (2012).
- Supernova Remnants as Cosmic Laboratories for Studying the Physics of the Extreme and our Origins, Women in Physics Conference, University of British Columbia, Vancouver, Canada, 2–4 Aug. (2012).
- Plerionic Supernova Remnants, 5th International Symposium on High-Energy Gamma-Ray Astronomy dedicated to a centenary of cosmic ray research, Heidelberg, Germany, 9–13 July (2012).
- Supernova Remnants and Neutron Stars in X-rays, Colloquium at St. Mary's University, Halifax, Canada, 30 March. (2012).

Media and Press Releases

- Expanding molecular bubble unveils the mysterious origin of Tycho?s supernova; UofM press release (and others including ESA), 19 July (2016).

- Hitomi press releases: **several** press releases and interviews highlighting the pre- and post-launch of the X-ray mission, ASTRO-H (renamed to Hitomi), including interviews with Safi-Harb on Discovery Channel, CBC, Manitoba news and others; Feb.–Mar. (2016).
- PhD student Jennifer West's 1-min NSERC, Science Action video, runner-up, Featured in UofM Today: http://news.umanitoba.ca/winners-in-science-action/ (Apr. 2015).
- CSA Ottawa based Neptec Design Group built precision optics technology for Japan's Next Generation Space Observatory, Canadian Space Agency's press release, Longueuil, Quebec 19 Mar. (2015)
- 'Future of Canadian astronomy research is looking up', UofM Press release, 19 Mar. (2015).
- NASA/Chandra image release on the SNR Kes 73, 21 Oct. (2014).
- Iron 'Fingerprints' Point Astronomers to Supernova Suspects, NASA press release, NASA press release, 02 Jul. (2014).
- Government of Canada Awards Contract for Canada's Contribution to Japan's Next Generation Space Observatory, 24 Apr. (2014).
- 'Canada Partners on Upcoming Japanese X-ray Space Observatory', Canadian Space Agency Press Release, 28 Jan. (2014).
- Serendipitous discovery of star playing 'Now you see me?', U. of Manitoba press release on the XMM-Newton discovery of a transient magnetar (Dec. 2013). Led also to COSPAR and XMM-Newton press releases during 2013–2014.
- NASA/Chandra image release on the SNR 3C 397, 28 Oct. (2013)
- 'Travels Through Space': Interview and article featuring Safi-Harb's group's research in the International Innovation magazine published by ResearchMedia, July (2013).
- '3D Simulations of Supernova Remnants', U. of Manitoba and CEA/Saclay Press Release, Nov. (2012).
- UofM's Research Life interview and feature article, Jan. (2012).
- 'Canadian stellar sleuth seeks to unravel mysteries of exploding stars', Radio Canada International (RCI) interview, The Link. Broadcast replayed as one of their 'Best of 2011' shows during the holiday period (Dec. 2011).

Recent Conference Organization

- Scientific Organizing Committee member for the International Astronomical Union (IAU) Symposium 331 on 'SN1987A, 30 years later', to take place in Reunion Island, France, Feb. (2017).
- Scientific Organizing Committee member for Gamma2016, Heidelberg, Germany (2016).
- Organizing Committee member for CASCA 2016, Winnipeg (May 30-June 2, 2016).
- ASTRO-H SNR Workshop co-organizer, Tokyo Metropolitan U., July (2015).

High-energy missions membership and other activities

- Science working group member for the proposed ESA's Athena X-ray mission (since Apr. 2015)
- Full Member of the Cherenkov Telescope Array (CTA) future gamma-ray mission; co-applicant with Andreas Shalchi (since Dec. 2014)
- Associate member of the H.E.S.S. gamma-ray collaboration (since Oct. 2011)
- Science working group member and SNR team co-leader for the ASTRO-H X-ray mission launched in Feb. 2016 (since Aug. 2011), renamed to Hitomi. The mission was lost in Mar. (2016) but scientific activities continue with the data taken during the early phase of the mission.
- Chair of the CSA high-energy astrophysics Diffuse Emission Subcommittee
- Member of NASA's Chandra Users Committee
- Member of the Canadian Time Allocation Committee
- Member of the ACURA Advisory Committee for the Square Kilometre Array (AACS)
- Referee for astronomy and astrophysics journals, NASA and NSERC

E. Schippers

Publications

1. Schippers, E.; Staubach, W. "Harmonic reflection in quasicircles and well-posedness of a Riemann-Hilbert problem on quasidisks.", to appear in Journal of Mathematical Analysis and Applications.
2. Schippers, E.; Staubach, W. "Well-posedness of a Riemann-Hilbert problem on d-regular quasidisks.", to appear in Annales Academiae Scientiarum Fennicae.
3. Schippers, E.; Staubach, W. "Riemann boundary value problem on quasidisks, Faber isomorphism and Grunsky operator.", Complex Analysis and Operator Theory. 9 (2015) no. 8, 1663 – 1679.
4. Radnell, D.; Schippers, E.; Staubach, W. "Dirichlet problem and Sokhotski-Plemelj jump formula on Weil-Petersson class quasidisks." Annales Academiae Scientiarum Fennicae. 41 (2016), 1–9.
5. Radnell, D.; Schippers, E.; and Staubach, W. "Convergence of the Weil-Petersson metric on the Teichmueller space of bordered Riemann surfaces", Communications in Contemporary Mathematics 19, No. 01, 1650025 (2017).
6. Radnell, D.; Schippers, E.; and Staubach, W. "Quasiconformal maps of bordered Riemann surfaces with L^2 Beltrami differentials." to appear in Journal d'Analyse Mathématique.
7. Radnell, D.; Schippers, E.; and Staubach, W. "Weil-Petersson class non-overlapping mappings into a Riemann surface." Commun. Contemp. Math. 18, 1550060 (2016).
8. Schippers, E.; and Staubach, W. "A symplectic functional analytic proof of the conformal welding theorem." Proceedings of the American Mathematical Society **143** (2015), 265 – 278.
9. Radnell, D.; Schippers, E.; and Staubach, W. "A Hilbert manifold structure on the Weil-Petersson class Teichmueller space of bordered Riemann surfaces. Communications in Contemporary Mathematics **17** no 4, 1550016 (2015).

10. Reimer, K.; and Schippers, E. "Grunsky inequalities for mappings into a compact Riemann surface" Complex Analysis and Operator Theory **9**, Issue 8 (2014), 1663 –1826

11. Penfound, B.; Schippers, E. "Power matrices for Faber polynomials and conformal welding." Complex Variables and Elliptic Equations. **58** no 9 (2013), 1247–1259.

12. Radnell, D.; and Schippers, E. "The semigroup of rigged annuli and the Teichmueller space of the annulus." Journal of the London Mathematical Society **86** no 2 (2012), 321–342.

Refereed Conference Proceedings

13. Schippers, E. "Quadratic differentials and conformal invariants". To appear in the Journal of Analysis.

14. Radnell, D.; Schippers, E; Staubach, W. "Quasiconformal Teichmuller theory as an analytic foundation for two-dimensional conformal field theory." to appear in Contemporary Mathematics.

Research Presentations

15. CMS Winter Meeting, Special Session on Complex Analysis and Applications, Niagara Falls ON, December 2016.

16. Workshop on Probabilistic Methods in Spectral Geometry and Partial Differential Equations, Centre de Récherche Mathématique, Montréal, QC. August 2016.

17. Analysis Seminar, University of Bergen, Bergen, Norway, April 2016.

18. Analysis and Geometry Seminar, Aalto University, Helsinki, Finland, April 2016.

19. CMS winter meeting, Special Session on Complex Analysis and Operator Theory, Montréal QC, December 2015.

20. Conference on Trends in Contemporary Complex Analysis, University of Cincinnati, Cincinnati, OH, May 2015.

21. Rutgers University Lie Groups/Quantum Mathematics seminar, April 2014.

22. American Mathematical Society Sectional Meeting, special session on Complex Function Theory and Special Functions, Texas Tech University, Lubbock, TX, April 2014.

23. Workshop on infinite-dimensional geometry, MSRI (Mathematical Sciences Research Institute), Berkeley, December 2013.

24. McGill University analysis seminar, February 2013.

25. CMS winter meeting, special session on complex analysis and operator theory, Montreal, QC. December 2012.

26. University of Western Ontario, Colloquium. London, ON. November 2012.

27. CMS summer meeting, special session on complex geometry and related fields, Regina SK. June 2012.

28. Uppsala Universitet analysis seminar, Uppsala, Sweden. April 2012.

29. HCAA 2012, (Harmonic and Complex Analysis and its Applications), Tenerife, Spain, March 2012.

A. Shalchi

1. Lasuik, J., Fiege, J. D., & Shalchi, A., Numerical Analysis of the Fokker-Planck Equation with Adiabatic Focusing: Realistic Pitch-Angle Scattering, 2016, Advances in Space Research, in press

2. Shalchi, A., The implicit contribution of slab modes to the perpendicular diffusion coefficient of particles interacting with two-component turbulence, The Astrophysical Journal **830**, 2 (2016)

3. Shalchi, A., The influence of the Kubo number on the transport of energetic particles, New Journal of Physics **18**, 085010 (2016)

4. Heusen, M. & Shalchi, A., Simulations of energetic particles interacting with nonlinear anisotropic dynamical turbulence, Astrophysics and Space Science **361**, 308 (2016)

5. Shalchi, A., Negrea, M., & Petrisor, I., Stochastic field-line wandering in magnetic turbulence with shear, 1. Quasi-linear theory, Physics of Plasmas **23**, 072306 (2016)

6. Qin G. & Shalchi, A., Numerical test of different approximations used in the transport theory of energetic particles, The Astrophysical Journal **823**, 23 (2016)

7. Tautz, R. C., Bolte, J. & Shalchi, A., Monte Carlo simulations of intensity profiles for energetic particle propagation, Astronomy & Astrophysics **586**, A118 (2016)

8. Hussein, M. & Shalchi, A., Simulating parallel and perpendicular diffusion of energetic particles in dynamical turbulence, The Astrophysical Journal **817**, 136 (2016)

9. Reimer A. & Shalchi, A., Parallel Diffusion of Energetic Particles Interacting with Noisy Reduced MHD Turbulence, Monthly Notices of the Royal Astronomical Society **456**, 3803 (2016)

10. Shalchi, A., Finite Gyroradius corrections in the theory of perpendicular diffusion, 2. Strong velocity diffusion, Advances in Space Research **57**, 431 (2016).

11. Shalchi, A., Finite Gyroradius corrections in the theory of perpendicular diffusion, 1. Suppressed velocity diffusion, Advances in Space Research **56**, 1264 (2015).

12. Hussein, M., Tautz, R., and Shalchi, A., The Influence of Different Turbulence Models on the Diffusion Coefficients of Energetic Particles, Journal of Geophysical Research **120**, 4095 (2015).

13. Shalchi, A., Analytic Forms of the Perpendicular Diffusion Coefficient in NRMHD Turbulence, The Astrophysical Journal **799**, 232 (2015).

14. Shalchi, A., Perpendicular Diffusion of Energetic Particles in Collisionless Plasmas, Physics of Plasmas Letters **22**, 010704 (2015).

15. Qin, G. and Shalchi, A., Perpendicular Diffusion of Energetic Particles: Numerical Test of the Theorem on Reduced Dimensionality, Physics of Plasmas **22**, 012905 (2015).

16. Shalchi, A. and Hussein, M., Erratum: "Benchmarking the unified nonlinear transport theory for Goldreich-Sridhar turbulence" [Astrophys Space Sci (2013) 344:187-191], Astrophysics and Space Science **355**, 234 (2015).

17. Tautz, R. C., Shalchi, A., and Dosch, A., Pitch-angle scattering of energetic particles with adiabatic focusing, The Astrophysical Journal **794**S, 138 (2014).

18. Shalchi, A. and Hussein, M., Perpendicular Diffusion of Energetic Particles in Noisy Reduced Magnetohydrodynamic Turbulence, The Astrophysical Journal **794**, 56 (2014).

19. Hussein, M. and Shalchi, A., Parallel and perpendicular diffusion coefficients of energetic particles interacting with Shear Alfvén waves, Monthly Notices of the Royal Astronomical Society **444**, 2676 (2014).

20. Ferrand, G., Danos, R., Shalchi, A., Safi-Harb, S., Edmon, P., and Mendygral, P., Cosmic Ray Acceleration at Perpendicular Shocks in Supernova Remnants, The Astrophysical Journal **792**, 133 (2014).

21. Qin, G. and Shalchi, A., Detailed numerical investigation of 90° scattering of energetic particles interacting with magnetic turbulence, Physics of Plasmas **21**, 042906 (2014).

22. Hussein, M. and Shalchi, A., Detailed numerical investigation of the Bohm limit in cosmic ray diffusion theory, The Astrophysical Journal **785**, 31 (2014).

23. Srinivasan, S. and Shalchi, A., The different transport regimes of pitch-angle scattering of energetic particles, Astrophysics and Space Science **350**, 197 (2014).

24. Shalchi, A., On the Universality of Asymptotic Limits in the Theory of Field Line Diffusion and Perpendicular Transport of Energetic Particles, Advances in Space Research **53**, 1024 (2014).

25. Qin, G. and Shalchi, A., Pitch-Angle Dependent Perpendicular Diffusion of Energetic Particles Interacting with Magnetic Turbulence, Applied Physics Research **6**, 1 (2014).

26. Shalchi, A., Simple Analytical Forms of the Perpendicular Diffusion Coefficient for Two-Component Turbulence, II. Dynamical Turbulence with Constant Correlation Time, The Astrophysical Journal **780**, 138 (2014).

27. Qin, G. and Shalchi, A., The Role of the Kubo Number in Two-Component Turbulence, Physics of Plasmas **20**, 092302 (2013).

28. Shalchi, A., Simple Analytical Forms of the Perpendicular Diffusion Coefficient for Two-Component Turbulence, I. Magnetotstatic Turbulence, The Astrophysical Journal **774**, 7 (2013).

29. Dosch, A., Shalchi, A., and Zank, G. P., Perpendicular Transport of Charged Particles: Results for the Unified Nonlinear Transport theory derived from the Newton-Lorentz equation, Advances in Space Research **52**, 936 (2013).

30. Danos, R. J., Fiege, J. D., and Shalchi, A., Numerical Analysis of the Fokker-Planck Equation with Adiabatic Focusing: Isotropic Pitch-Angle Scattering, The Astrophysical Journal **772**, 35 (2013).

31. Tautz, R. C. and Shalchi, A., Simulated Energetic Particle Transport in the Interplanetary Space: The Palmer Consensus Revisited, Journal of Geophysical Research **118**, 642 (2013).

32. Shalchi, A. and Kolly, A., Analytical description of field line random walk in Goldreich-Sridhar Turbulence, Monthly Notices of the Royal Astronomical Society **431**, 1923 (2013).

33. Shalchi, A., Perpendicular Diffusion in Magnetostatic Slab Turbulence: The Theorem on Reduced Dimensionality and Microscopic Diffusion, Journal of Atmospheric and Solar-Terrestrial Physics **97**, 37 (2013).

34. Shalchi, A. and Danos, R. J., On the different results for the parallel diffusion coefficient of cosmic particles with adiabatic focusing, The Astrophysical Journal **765**, 153 (2013).

35. Shalchi, A., Benchmarking the unified nonlinear transport theory for Goldreich-Sridhar turbulence, Astrophysics and Space Science **344**, 187 (2013).

36. Buffie, K., Heesen, V., and Shalchi, A., Theoretical Explanation of the Cosmic Ray Perpendicular Diffusion Coefficient in the Nearby Starbust Galaxy NGC 253, The Astrophysical Journal **764**, 37 (2013).

37. Shalchi, A., Analytical description of nonlinear particle transport in slab turbulence: High particle energies and stochastic acceleration, Physics of Plasmas **19**, 102901 (2012).

38. Shalchi, A., Fitting Analytical Forms of Spatial and Temporal Correlation Functions to Spacecraft Data, Astrophys. Space Sci. Trans. **8**, 35 (2012).

39. Shalchi, A., Gyrophase Diffusion of Charged Particles in Random Magnetic Fields, Monthly Notices of the Royal Astronomical Society **426**, 880 (2012).

40. Buffie, K. and Shalchi, A., Compound Diffusion of Energetic Particles: A Kappa Model for the Parallel Distribution Function, Astrophysics and Space Science **340**, 351 (2012).

41. Shalchi, A., Webb, G. M., and le Roux, J. A., Parallel transport of cosmic rays for non-diffusive pitch-angle scattering. I. Using the standard Fokker-Planck equation, Physica Scripta **85**, 065901 (2012).

42. Qin, G. and Shalchi, A., Numerical investigation of the influence of large turbulence scales on the parallel and perpendicular transport of Cosmic Rays, Advances in Space Research **49**, 1643 (2012).

43. Guest, B. and Shalchi, A., Random Walk of Magnetic Field Lines in Dynamical Turbulence: A Field Line Tracing Method, II. Two Dimensional Turbulence, Physics of Plasmas **19**, 032902 (2012).

44. Li, G., Shalchi, A., Ao, X., Zank, G. P., and Verkhoglyadova, O. P., Particle acceleration and transport at an oblique CME-driven shock, Advances in Space Research **49**, 1067 (2012).

45. Shalchi, A., Dosch, A., le Roux, J. A., Webb, G. M., and Zank, G. P., Magnetic Field Line Random Walk in Turbulence: A Two-point Correlation Function Description, Physical Review E **85**, 026411 (2012).

46. Tautz, R. C. and Shalchi, A., Drift coefficients of charged particles in turbulent magnetic fields, The Astrophysical Journal **744**, 125 (2012).

Khodr M. Shamseddine

Refereed Journal Publications

1. A local mean value theorem for functions on non-Archimedean field extensions of the real numbers, *Khodr Shamseddine and Gidon Bookatz*, ***p*-Adic Numbers, Ultrametric Analysis, and Applications**, Volume 8 # 2, 2016, pp. 160-175.

2. On the solutions of linear ordinary differential equations and Bessel-type special functions on the Levi-Civita field, *Alpár Mészáros and Khodr Shamseddine*, **Journal of Contemporary Mathematical Analysis**, Volume 50 # 2, 2015, pp. 53-62.

3. Inner product on B*-algebras of operators on a Free Banach space over the Levi-Civita field, *José Aguayo, Miguel Nova and Khodr Shamseddine*, **Indagationes Mathematicae**, in press (to appear in Volume 26 # 1, January 2015, Pages 191–205.)

4. Characterization of compact and self-adjoint operators on Free Banach spaces of countable type over the complex Levi-Civita field, *José Aguayo, Miguel Nova and Khodr Shamseddine*, **Journal of Mathematical Physics**, Volume 54 # 2, 2013.

5. New results on integration on the Levi-Civita field, *K. Shamseddine*, **Indagationes Mathematicae**, Volume 24 # 1, 2013, pp. 199-211.

6. One-variable and multi-variable calculus on a non-Archimedean field extension of the real numbers, *Khodr Shamseddine*, ***p*-Adic Numbers, Ultrametric Analysis, and Applications**, Volume 5 # 2, 2013, pp. 160-175.

7. On locally uniformly differentiable functions on a complete non-Archimedean ordered field extension of the real numbers, *Khodr Shamseddine and Todd Sierens*, **ISRN Mathematical Analysis**, Volume 2012, Article ID 387053, 20 pages.

8. Preliminary notes on Fourier Series for functions on the Levi-Civita field, *Khodr Shamseddine and William Grafton*, **International Journal of Mathematical Analysis**, Volume 6, 2012, # 19, pp. 941-950.

Edited Proceedings

9. Advances in Ultrametric Analysis, Proceedings of the Fourteenth International Conference on *p*-Adic Functional Analysis, *Alain Escassut, Cristina Perez-Garcia and Khodr Shamseddine, editors*, **Contemporary Mathematics, American Mathematical Society**, in preparation.

10. Advances in Non-Archimedean Analysis, Proceedings of the Thirteenth International Conference on p-Adic Functional Analysis, *Helge Glockner, Alain Escassut and Khodr Shamseddine, editors*, **Contemporary Mathematics, American Mathematical Society**, Volume 665, 2016, ISBN 978-1-4704-1988-2.

11. Advances in Ultrametric Analysis, Proceedings of the Twelfth International Conference on *p*-Adic Functional Analysis, *Khodr Shamseddine, editor*, **Contemporary Mathematics, American Mathematical Society**, Volume 596, 2013, ISBN-13: 978-0-8218-9142-1.

Refereed Conference Proceedings

12. Calculus on a non-Archimedean field extension of the real numbers: inverse function theorem, intermediate value theorem and mean value theorem, *Gidon Bookatz and Khodr Shamseddine*, **Contemporary Mathematics, American Mathematical Society**, accepted.

13. Measure theory and Lebesgue-like integration in two and three dimensions over the Levi-Civita field, *Khodr Shamseddine and Darren Flynn*, **Contemporary Mathematics, American Mathematical Society**, Volume 665 (Advances in Non-Archimedean Analysis), 2016, pp. 289- 325.

14. Analysis on the Levi-Civita field and computational applications, *Khodr Shamseddine*, **Applied Mathematics and Computation**, Volume # 255, 2015, pp. 44-57.

15. A brief survey of the study of power series and analytic functions on the Levi-Civita fields, *Khodr Shamseddine*, **Contemporary Mathematics, American Mathematical Society**, Volume 596 (Advances in Ultrametric Analysis), 2013, pp. 269-280.

Invited Talks at Conferences

16. Calculus on a non-Archimedean field extension of the real numbers: The intermediate value theorem, mean value theorem, inverse function theorem and implicit function theorem. 14th International Conference on p-adic Functional Analysis, Aurillac, France, June 30-July 5, 2016.

17. On the Levi-Civita fields: introduction and survey of recent research. 14th International Conference on p-adic Functional Analysis, Aurillac, France, June 30-July 5, 2016.

18. One-variable and multi-variable integral calculus over the Levi-Civita field and applications. NUMTA2016 (Numerical Computations: Theory and Applications) International Conference and Summer School, Pizzo Calabro, Italy, June 19-25, 2016.

19. Characterization of compact and self-adjoint operators, and study of positive operators on a Banach space over a non-Archimedean field, International Conference on p-Adic Mathematical Physics and its Aplications, Belgrade, Serbia, September 7-12, 2015.

20. New results on the Lebesgue-like measure and integration theory on the Levi-Civita field and applications, 13th International Conference on p-Adic Functional Analysis, Paderborn, Germany, August 12-16, 2014.

21. On positive operators on a Banach space over the complex Levi-Civita field, The Seventh Conference on Function Spaces, Southern Illinois University- Edwardsville, Illinois, USA, May 20-24, 2014.

22. Preliminaries in non-Archimedean Functional Analysis, The Seventh Conference on Function Spaces, Southern Illinois University- Edwardsville, Illinois, USA, May 20-24, 2014.

23. Analysis on non-Archimedean ordered field extensions of the real numbers and applications, NUMTA2013 (Numerical Computations: Theory and Applications) International Conference and Summer School, Falerna, Italy, June 16-23, 2013

24. B*-algebras of operators and study of positive operators on a free Banach space of countable type over the complex Levi-Civita field, 12th International Conference on p-Adic Functional Analysis, University of Manitoba, Winnipeg, Canada, July 2-6, 2012.

25. (Co-author, talk given by Jose Aguayo) Characterization of Compact and self-adjoint operators on free Banach spaces of countable type over the complex Levi-Civita field, 12th International Conference on p-Adic Functional Analysis, University of Manitoba, Winnipeg, Canada, July 2-6, 2012.

26. (Co-author, talk given by Todd Sierens) On locally uniformly differentiable functions: the Inverse Function Theorem and the Implicit Function Theorem in a non-Archimedean setting, 12th International Conference on p-Adic Functional Analysis, University of Manitoba, Winnipeg, Canada, July 2-6, 2012.

Seminars and Colloquia at Universities

27. Numerical Calculus Laboratory, University of Calabria, Rende, Italy, June 28, 2016.

28. Department of Mathematics, American University of Beirut, Beirut, Lebanon, July 22, 2015.

29. Department of Mathematics (Functional Analysis seminar, part II), University of Manitoba, March 17, 2015.

30. Department of Mathematics (Functional Analysis seminar, part I), University of Manitoba, March 10, 2015.

31. Department of Mathematics, University of Manitoba, March 21, 2014.

32. Department of Physics, University of Regina, March 7, 2014.

33. Department of Physics and Engineering Physics, University of Saskatchewan, March 6, 2014.

34. Department of Mathematics & Statistics (Algebra seminar), University of Saskatchewan, March 6, 2014.

35. Department of Physics and Astronomy and Winnipeg Institute for Theoretical Physics (joint colloquium), University of Manitoba, April 10, 2013.

36. Science Department, Texas A & M University in Qatar, October 23, 2012.

37. Department of Mathematics, Western Illinois University, August 31, 2012.

38. Departments of Mathematics (Joint Mathematics Colloquium), Universidad del Bio-Bio and Universidad de Concepcion, Concepcion, Chile, December 5, 2011.

Conference Organization

- Member of the International Scientific Committee, 15th International Conference on p- Adic Functional Analysis, Poland (July 2018)
- Member of the International Scientific Committee, 14th International Conference on p- Adic Functional Analysis, France (July 2016)
- Member of the International Scientific Committee, NUMTA2016: Numerical Computations: Theory and Algorithms, Italy (June 2016)
- Organizer, Winnipeg Institute of Theoretical Physics Summer Symposium, U of Manitoba (August 2015)
- Member of the Scientific Advisory Board, 13th International Conference on p-Adic Functional Analysis, Germany (August 2014)
- Organizer of a special session on Non-Archimedean Functional Analysis, The Seventh Conference on Function Spaces, USA (May 2014)
- Co-organizer, Winnipeg Institute of Theoretical Physics Summer Symposium, U. of Manitoba (August 2013)
- Member of the International Scientific Committee, NUMTA2013: Numerical Computations: Theory and Algorithms, Italy (June 2013)
- Organizer and Chair of the International Scientific Committee, 12th Internaional Conference on p-Adic Functional Analysis, U. of Manitoba (July 2012).

J. Sirker

1. T. Enss, F. Andraschko, J. Sirker, "Many-body localization in infinite chains", arXiv: 1608.05733 (2016).

2. D. Morath, N. Sedlmayr, J. Sirker, S. Eggert, "Conductance in inhomogeneous quantum wires: Luttinger liquid predictions and quantum Monte Carlo results", Phys. Rev. B **94**, 115162 (2016).

3. Y. Zhao, F. Andraschko, J. Sirker, "Entanglement entropy of disordered quantum chains following a global quench", Phys. Rev. B **93**, 205146 (2016).

4. M. Harder, L. Bai, C. Match, J. Sirker, C.-M. Hu, "Study of the cavity-magnon-polariton transmission line shape", Sci. China Phys. Mech. Astron. **59**, 117511 (2016).

5. C. Karrasch, R. G. Pereira, J. Sirker, "Low temperature dynamics of nonlinear Luttinger liquids", New J. Phys. **17**, 103003 (2015).

6. F. Andraschko, J. Sirker, "Propagation of a single hole defect in the one-dimensional Bose-Hubbard model", Phys. Rev. B **91**, 235132 (2015).

7. F. Andraschko, T. Enss, J. Sirker, "Purification and many-body localization in cold atomic gases", Phys. Rev. Lett. **113**, 217201 (2014).

8. J. Sirker, M. Maiti, N.P. Konstantinidis, N. Sedlmayr, "Boundary Fidelity and Entanglement in the symmetry protected topological phase of the SSH model", J. Stat. Mech. P10032 (2014).

9. R. G. Pereira, V. Pasquier, J. Sirker, I. Affleck, "Exactly conserved quasilocal operators for the XXZ spin chain", J. Stat. Mech. P09037 (2014).

10. J. Sirker, N.P. Konstantinidis, F. Andraschko, N. Sedlmayr, "Locality and Thermalization in Closed Quantum Systems", Phys. Rev. A **89**, 042104 (2014).

11. F. Andraschko, J. Sirker, "Dynamical quantum phase transitions and the Loschmidt echo: A transfer matrix approach", Phys. Rev. B **89**, 125120 (2014).

12. N. Sedlmayr, D. Morath, J. Sirker, S. Eggert, I. Affleck, "Conducting fixed points for inhomogeneous quantum wires: a conformally invariant boundary theory", Phys. Rev. B **89**, 045133 (2014).

13. N. Sedlmayr, P. Korell, J. Sirker "Two-Band Luttinger Liquid with Spin-Orbit Coupling: Applications to Monatomic Chains on Surfaces", Phys. Rev. B **88**, 195113 (2013).

14. N. Sedlmayr, J. Ren, F. Gebhard, J. Sirker, "Closed and Open System Dynamics in a Fermionic Chain with a Microscopically Specified Bath: Relaxation and Thermalization", Phys. Rev. Lett. **110**, 100406 (2013).

15. N. Sedlmayr, P. Adam, J. Sirker, "Theory of the conductance of interacting quantum wires with good contacts and applications to carbon nanotubes", Phys. Rev. B **87**, 035439 (2013).

16. J. Sirker, "Entanglement measures and the quantum to classical mapping", J. Stat. Mech. P12012 (2012).

17. N. Sedlmayr, J. Ohst, I. Affleck, J. Sirker, S. Eggert, "Transport and scattering in inhomogeneous quantum wires", Phys. Rev. B **86**, 121302(R) (2012).

18. J. Ren and J. Sirker, "Spinons and helimagnons in the frustrated Heisenberg chain", Phys. Rev. B **85**, 140410(R) (2012).

19. F. Gebhard, K. zu Muenster, J. Ren, N. Sedlmayr, J. Sirker, B. Ziebarth, "Particle injection into a chain: decoherence versus relaxation for Hermitian and non-Hermitian dynamics", Ann. Phys. **524**, 286 (2012).

20. J. Sirker, "The Luttinger liquid and integrable models", Int. J. Mod. Phys. B. **26**, 1244009 (2012).

21. T. Enss and J. Sirker, "Lightcone renormalization and quantum quenches in one-dimensional Hubbard models", New J. Phys. **14**, 023008 (2012).

Talks

22. "Dynamical respomse in low-dimensional quantum models", Conference: Low-dimensional quantum systems: Models and Materials, Bad Honnef, Germany, November 2016.

23. "Low temperature dynamics of nonlinear Luttinger liquids", Conference: Boundary degrees of freedom and thermodynamics of integrable models, Natal, Brazil, August 2016.

24. "Dynamics in integrable quantum systems", CAP congress, Ottawa, Canada, June 2016.

25. "Entanglement entropy in quantum critical glasses and MBL phases" Conference: Quantum non-equilibrium phenomena, Natal, Brazil, June 2016.

26. "Low temperature dynamics of nonlinear Luttinger liquids", Conference: Correlation days, Dresden, September 2015.

27. "Many-body localization", Theory colloquium, TU Kaiserslautern, July 2015.

28. "Low temperature dynamics of nonlinear Luttinger liquids", International Workshop, 'Beyond Integrability', CRM, Montréal, July 2015.

29. "Many-Body Localization and possible realizations in cold atomic gases", CAP Congress, Edmonton, June 2015.

30. "Many-Body Localization", Theory seminar, University of British Columbia, April 2015.

31. "Purification and Many-Body Localization in cold atomic gases", Conference, Rotorua (New Zealand), February 2015 .

32. "Correlated quantum systems out of equilibrium", Colloquium, U of Alberta and U of Saskatchewan, January 2015.

33. "Magnetic frustration and spin liquids: From one to two dimensions", Condensed Matter Seminar, U of Manitoba, November 2014.

34. "Dynamical quantum phase transitions and the Loschmidt echo. Quantum Integrability", Conference: Conformal Field Theory and Topological Quantum Computation, Natal, Brazil, 2014.

35. "Thermalization in quantum systems: Conservation laws and effective baths", Colloquium, Bonn, Germany (2014).

36. "Transport in one-dimensional quantum systems and conservation laws", Conference: Correlation days 2013, Dresden, Germany (2013).

37. "When is a bath a bath? Hermitian and Non-Hermitian relaxation dynamics in a toy model", Conference: Quantum Many-body systems out of equilibrium, Dresden, Germany (2013).

38. "Thermalization in quantum systems: Conservation laws and effective baths. Amsterdam", Summer Workshop on Low-D Quantum Condensed Matter, Amsterdam, Netherlands (2013).

39. "Thermalization in quantum systems: Conservation laws and effective baths", Colloquium, Physics Department, Heidelberg, Heidelberg, Germany (2013).

40. "Some thoughts and numerical experiments on thermalization in quantum systems", Frontiers of quantum condensed matter physics: light, matter and unusual devices out of equilibrium, New York, United States (2013).

41. "Entanglement measures and the quantum-to-classical mapping", APS March Meeting 2013, Baltimore, United States (2013).

42. "Non-equilibrium dynamics in one-dimensional quantum models", Condensed Matter Seminar, University of British Columbia, Vancouver, Canada (2012).

43. "Non-equilibrium dynamics in one-dimensional quantum models" Condensed Matter Seminar, Simon Fraser University, Vancouver, Canada (2012).

44. "Dephasing, relaxation and thermalization in one-dimensional quantum systems", Colloquium, Physics Department, U Sao Paulo in Sao Carlos, Sao Carlos, Brazil (2012).

45. "Dephasing, relaxation and thermalization in one-dimensional quantum systems", Conference: The beauty of Integrability, Natal, Brazil (2012).

46. "Conservation laws: Consequences for thermalization and transport", Theory Colloquium, U Dortmund, Dortmund, Germany (2012).

47. "Transport in quantum wires and conservation laws", GGI Workshop: New quantum states of matter in and out of equilibrium, Florence, Italy (2012).

48. "New aspects of transport in spin chains", 504. WEH-Seminar: Quantum Magnetism in Low Spatial Dimensions, Bad Honnef, Germany (2012).

49. "Decoherence, relaxation and thermalization in one-dimensional quantum models", Theory colloquium U Hannover, Hannover, Germany (2012).

50. "Lightcone renormalization and quantum quenches in one-dimensional Hubbard models", APS March Meeting 2012, Boston, United States (2012).

51. "Decoherence, relaxation and thermalization in one-dimensional quantum models", Theory seminar Max-Planck Institute for Solid State Research, Stuttgart, Germany (2012).

B.W. Southern

Refereed Publications

1. Bassel Alkadour, J. I. Mercer, J. P. Whitehead, B. W. Southern, and J. van Lierop, "Dipolar ferromagnetism in three-dimensional superlattices of nanoparticles", Phys. Rev. B (revision requested) (2016)

2. Bassel Alkadour, J. I. Mercer, J. P. Whitehead, J. van Lierop and B. W. Southern, "Surface vacancy mediated pinning of the magnetization in $\gamma - Fe_2O_3$ nanoparticles: A micromagnetic simulation study", Phys. Rev. B **93**, 140411(R) (2016)

3. M. S. Holden, M. L. Plumer, I. Saika-Voivod and B. W. Southern, "Monte Carlo simulations of a kagome lattice with magnetic dipolar interactions", Phys. Rev. B **91**, 224425 (2015)

4. M.D. LeBlanc, B.W. Southern, M.L. Plumer and J.P. Whitehead, "Spin Waves in the Anisotropic FCC Kagome Antiferromagnet" Phys. Rev. B **90**, 144403 (2014)

5. P. Hyde, Lihui Bai, D.M.J. Kumar, B.W. Southern, C.-M. Hu, S.Y. Huang, B.F. Miao and C.L. Chien, "Electrical Detection of Direct and Alternating Spin Current Injected from a Ferromagnetic Insulator into a Ferromagnetic Metal" Phys. Rev. B **89**, 180404(R) (2014)

6. E. Skoropata, R.D. Desautels, B.W. Southern and J. van Lierop, Comment on "Colossal reduction in Curie temperature due to finite-size effects in CoFe2O4 nanoparticles", Chemistry of Materials **25**, 1898 (2013)

7. M. D. LeBlanc, M. L. Plumer, J. P. Whitehead, and B. W. Southern, "Monte Carlo simulations of the fcc kagome lattice: Competition between triangular frustration and cubic anisotropy", Phys. Rev. B**88**, 094406 (2013).

8. N. H. G. Grenda, P. A. Hyde, Y. S. Gui, M. P. Wismayer, J. D. A. Jung, C. M. Hu, B. W. Southern, and K. W. Lin, "Angular dependence of ferromagnetic resonance measurements in exchange coupled $NiFe_{20}$/NiO bilayers" , J. Phys. D: Applied Physics **46**, 205002 (2013)

9. V. Hemmati, M. L. Plumer, J. P. Whitehead, and B.W. Southern, "Monte Carlo simulations of magnetic ordering in the fcc kagome lattice" , Phys. Rev. B. **86**, 104419(1:8) (2012)

10. B.W. Southern, "Triangular Antiferromagnets and Universality", Invited review in "Frustrated Magnetism", Physics in Canada **68**, no 2, 83 87 (2012)

11. M.P. Wismayer, B.W. Southern, X. L. Fan, Y.S. Gui, C. M. Hu and R. E. Camley , "Nonlinear Behavior for the Uniform Mode and Horizontal Standing Spin Wave Modes in Metallic Ferromagnetic Microstrips: Experiment and Theory", Phys. Rev. B **85**, 064411(1:7) (2012)

Conference Contributions

12. B. Alkadour, J. P. Whitehead, J. I. Mercer, J. van Lierop, B. W. Southern, "Surface vacancy mediated pinning of the magnetization in $\gamma - Fe_2O_3$ nanoparticles: A micromagnetic simulation study", CAP Congress, Ottawa, Canada (2016)

13. John Whitehead, Bassel Alkadour, J. van Lierop, B. W. Southern, "Micromagnetic simulations of maghemite nanoparticles in FCC arrays", Magnetic North V, Colorado Springs, United States (2016)

14. Martin Plumer, Mark Holden, Andrew Way, Ivan Saika-Voivod, B. W. Southern, "Monte Carlo simulations of kagome lattices with magnetic dipolar interactions", APS March meeting, Baltimore, United States (2016)

15. Can-Ming Hu, Lihui Bai, P. Hyde, B.W. Southern, C.L. Chien, "Electrical detection of dynamically generated DC and AC currents", Canadian Association of Physicists Congress Sudbury (2014)

16. B. Alkadour, J. P. Whitehead, and B. W. Southern. "Simulation of the Magnetic Properties of Close Packed Arrays of Maghemite Nanospheres", Canadian Association of Physicists Congress Montreal (2013)

17. B. Alkadour, J.P. Whitehead, J.I. Mercer, B.W. Southern, "Simulation of Maghemite Nanospheres on a triangular lattice", Canadian Association of Physicists (CAP) Congress Calgary (2012)

18. B. Alkadour, J.P. Whitehead, J.I. Mercer, B.W. Southern, "Simulation of Maghemite Nanospheres on a triangular lattice", Magnetic North III, Banff (2012)

19. B.W. Southern, "Angular dependence of FMR measurements in exchange coupled NiFe/NiO bilayers: Experiment and Theory", invited talk, Magnetic North III, Banff (2012)

20. M.P. Wismayer, B.W. Southern, X. L. Fan, Y.S. Gui, C. M. Hu and R. E. Camley, "Nonlinear Behavior for the Uniform Mode and Horizontal Standing Spin Wave Modes in Metallic Ferromagnetic Microstrips: Experiment and Theory", APS March Meeting (2012)

21. V. Hemmati, M. L. Plumer, J. P. Whitehead, and B.W. Southern, "Monte Carlo simulations of the fcc Kagome lattice", APS March Meeting (2012)

Seminars and Colloquia

22. B. W. Southern, "Monte Carlo Studies of the FCC Kagome Lattice", Department of Physics and Astronomy, University of Manitoba, March 8, (2013).

J.P. Svenne

No update provided for this report

1. A multichannel model for clusters of an α and select N = Z nuclei, K. Amos, L. Canton, P. R. Fraser, S. Karataglidis, J. P. Svenne, and D. van der Knijff. Submitted to Physical Review C, October 27, 2014; **Reviewed; in revision.**

2. Conditional charge symmetry for nuclear mirror systems n+^{14}C and p+^{14}O, P. R. Fraser, K. Amos, L. Canton, S. Karataglidis, D. van der Knijff, J. P. Svenne. Submitted to Physics Letters B, September, 2014; **Reviewed; in revision.**

3. Comparing coupled-channel spectra with no-core multi-$\hbar\omega$ shell-model results for carbon isotopes and mirror nuclei, S. Karataglidis, K. Amos, L. Canton, P.R. Fraser, J.P. Svenne and D. van der Knijff, Revised version submitted to European Physical Journal A, November, 2013, 22 pp. **In revision**

4. Reactivity Impact of ^{2}H and ^{16}O Elastic Scattering Nuclear Data for Critical System with Heavy Water, D. Roubtsov, K.S. Kozier, J.C.Chow, A.J.M. Plompen, S. Kopecky, J.P. Svenne, and L. Canton, Nuclear Data Sheets **118**, 414-417 (2014).

5. The angular distribution of neutrons scattered from deuterium below 2 MeV, N. Nankov, A.J.M. Plompen, S. Kopecky, K.S. Kozier, D. Roubtsov, R. Rao, R. Beyer, E. Grosse R. Hannaske, A.R. Junghans, R. Massarczyk, R. Schwenger, D. Yakorev, A. Wagner, M. Stanoiu, L. Canton, R. Nolte, S. Rötger, J. Beyer, and J.P. Svenne, Nuclear Data Sheets **119**, 98-103 (2014).

6. Coupling to two target-state bands in the study of the n+^{22}Ne system at low energy, P. R. Fraser, L. Canton, K. Amos, S. Karataglidis, J. P. Svenne, and D. van der Knijff, Phys. Rev. **90**, 024616[1-13 pp.] (2014)

7. Modelling scattering and resonances of weakly-bound radioactive nuclei, P. R. Fraser, L. Canton, R. Fossion, K. Amos, S. Karataglidis, J. P. Svenne, and D. van der Knijff, Heavy Ion Accelerator Symposium on Fundamental and Applied Science, Canberra, Australia, 8-12 April 2013. EPJ Web of conferences, published online: 19 December 2013. DOI: http://dx.doi.org/10.1051/epjconf/20136302010

8. Analysis of a coupled-channel continuum approach for spectra of mass-17 compound systems, K. Amos, L. Canton, P.R. Fraser, S. Karataglidis, J. P. Svenne, and D. van der Knijff. Nuclear Physics, **A912**, 7-17 (2013).

9. Linking the exotic structure of ^{17}C to its unbound mirror ^{17}Na, K. Amos, L. Canton, P.R. Fraser, S. Karataglidis, J. P. Svenne, and D. van der Knijff, Nuclear Physics **A879**, 132-145 (2012).

10. Linking nuclear masses with nucleon-removal thresholds and the mass of the proton-emitter ^{17}Na, K. Amos, D. van der Knijff, L. Canton, P.R. Fraser, S. Karataglidis, and J. P. Svenne. European Physics Letters, **99**, 12001 (2012).

11. The case for a return to nuclear power, J.P. Svenne, The Environmentalist, **32**, 346-352 (2012). DOI 10.1007/s10669-011-9358-1

Refereed Conference Proceedings

12. Comparison of multi-$\hbar\omega$ shell-model results with MCAS, J.P. Svenne, S. Karataglidis, K. Amos, L. Canton, P.R. Fraser, Dirk van der Knijff, INPC 2013, International Nuclear Physics Conference, Florence, Italy, June 2-7, 2013. Accepted for publication on-line by EPJ Web of Conferences.

13. Investigating the astrophysical ^{22}Ne$(p,\gamma)^{23}$Na and ^{22}Mg$(p,\gamma)^{23}$Al reactions with a multi-channel scattering formalism. International Nuclear Physics Conference, Florence, Italy, June 2-7, 2013. Submitted for publication on-line by EPJ Web of Conferences, in review.

14. Exploring exotic nuclei with MCAS, S. Karataglidis [*et al*], invited talk presented at the first International African Symposium on Exotic Nuclei, Somerset West, South Africa, December 2013.

15. Aspects of the structure of heavy carbon isotopes, S. Karataglidis, K. Amos, J. P. Svenne, L. Canton, P. R. Fraser, and D. van der Knijff, talk presented at the 58th Annual Conference of the South African Institute of Physics, SAIP2013, Richards Bay, South Africa, July 2013, Proceedings to be published.

16. Recent developments in Multi-Channel Algebraic Scattering calculations, L. Canton, K. Amos, S. Karataglidis, P.R. Fraser, J.P. Svenne, and D. van der Knijff, invited parallel talk at the 10th Latin American Symposium on Nuclear Physics and Applications held on December 1-6, 2013 in Montevideo, Uruguay. Proceedings of Science 047.

17. Medium-light nuclei beyond the drip line: the proton-emitter ^{17}Na, P.R. Fraser, L. Canton, K. Amos, S. Karataglidis, J.P. Svenne and D. van der Knijff; Villa Monastero, Varenna, Italy June 11-17, 2012. CERN Proceedings 2012, 243-249 (2012)

18. Neutron scattering from deuterium and oxygen: New theoretical results, J.P. Svenne and L. Canton, WINS 2012, Workshop on (In) elastic Neutron Scattering, Boston, Ma, U.S.A., September 17-19, 2012. Invited paper, published on-line.

19. Structure of medium-light nuclei near the proton drip line, J.P. Svenne, K. Amos, D. van der Knijff, L. Canton, P.R. Fraser, S. Karataglidis; contributed paper (poster) at NS2012, Nuclear Structure 2012 Conference August 13-17, 2012, Argonne National Laboratory, Illinois, U.S.A. Papers published on-line.

20. Systematics of nuclear masses and nucleon-removal thresholds, J.P. Svenne, K. Amos, D. van der Knijff, L. Canton, G. Pisent, P.R. Fraser, S. Karataglidis; contributed paper at the Canadian Association of Physicists Annual Congress, June 11-15, 2012, Calgary, AB, Canada. Abstract on-line.

G.C. Tabisz

No update provided for this report

Last Refereed Publications

1. A. Senchuk and G. C. Tabisz, "General expression for the depolarization ratio for first order collision induced light scattering", Journal of Raman Spectroscopy, 42, 1046 1048 (2011).

2. A. Senchuk and G. C. Tabisz, "Second order collision induced light scattering: a spherical tensor approach", Journal of Raman Spectroscopy, 42, 1049 1054 (2011).

J.M. Vail

No update provided for this report

Last Refereed Publication

1. Vail, J. M., Haroon, T., Hernandez-Melgar, J., Chevrier., D. K, and Pandey, R., "Nitrogen Vacancy and Oxygen Impurity in AlN: Spintronic Quantum Dots", Radiation Effects and Defects in Solids, 164, 585-591 (2009).

M. Whitmore

Refereed Publications

1. Mark D. Whitmore, Gary S. Grest, Jack F. Douglas, M. S. Kent and Tongchuan Suo, *End–Anchored Polymers in Good Solvents from the Single Chain Limit to High Anchoring Densities*, J. Chem. Phys.**145**, 174904-1 to 11 (2016); doi: 10.1063/1.4966576

2. Tongchuan Suo and Mark D. Whitmore, *Self-consistent Field Theory of Tethered Polymers: One Dimensional, Three Dimensional, and High Stretching Theories*, J. Chem. Phys. **140**, 114901-1 to 14 (2014)

3. Tongchuan Suo and Mark D. Whitmore, *Controlling Microtube Permeability via Grafted Polymers and Solvent Quality*, J. Chem. Phys. **140**, 114902-1 to 7 (2014)

4. Tongchuan Suo and Mark D. Whitmore, *Doubly Self-Consistent Field Theory of Grafted Polymers Under Simple Shear in Steady State*, J. Chem. Phys. **140**, 114901-1 to 14 (2014)

5. Mark D. Whitmore, Jeffrey D. Vavasour, John G. Spiro and Mitchell A. Winnik, *On Cylindrical PS-b-PMMA in Moderate and Weak Segregation,* Macromolecules **46**, 9045–9054 (2013)

6. Tongchuan Suo and Mark D. Whitmore, *Grafted Polymers inside Cylindrical Tubes: Chain Stretching vs Layer Thickness,* J. Chem. Phys. **138**, 164907: 1–11 (2013)

7. Tongchuan Suo, Tyler N. Shendruk, Owen A. Hickey, Gary W. Slater and Mark D. Whitmore, *Controlling Grafted Polymers Inside Cylindrical Tubes,* Macromolecules **46**, 1221–1230 (2013)

8. John G. Spiro, Nicolas Illy, Mitchell A. Winnik, Jeffrey D. Vavasour and Mark D. Whitmore, *Theory of Lamellar Superstructure from a Mixture of Two Cylindrical PS-PMMA Block Copolymers,* Macromolecules **45**, 4289 – 4294 (2012)

Invited Talk

1. M. D. Whitmore and Tongchuan Suo, *Self-consistent Theory of Liquids Flowing Through Capillaries with End-anchored Polymers,* II International Symposium on Profiling, Lisbon, Portugal (2015)

J.G. Williams

No update provided for this report

1. T.A. Harriott and J.G. Williams, "Solutions for the null-surface formulation of general relativity," in Proceedings of the 14th Marcel Grossmann Meeting on General Relativity, edited by M. Bianchi, R.T. Jantzen and R. Ruffini (World Scientific, Singapore), to appear 2016.

2. T.A. Harriott and J.G. Williams, "Solutions in the 2+1 null-surface formulation," in Relativity and Gravitation, Springer Proceedings in Physics 157, edited by J. Bicak and T. Ledvinka, (Springer, New york), pp. 283–286 (2014).

3. T.A. Harriott and J.G. Williams, "Solution for the null-surface formulation of general relativity in 2+1 dimensions," in General Relativity and Gravitation, **46**, 1666 (2014).

4. T.A. Harriott and J.G. Williams, "Exact positive curvature solution for the null surface formulation in 2+1 dimensions," in Essays on Mathematics and Statistics: Volume 4, edited by V. Akis (Atiner, Athens), pp. 3–10 (2013).

5. T.A. Harriott and J.G. Williams, "Light cone cut solution in the 2+1 null surface formulation," in Proceedings of the 12th Marcel Grossmann Meeting on General Relativity, edited by T. Damour, R.T. Jantzen and R. Ruffini (World Scientific, Singapore), pp. 1896–1898 (2012).

I.2 Seminars: 2013-2017

Date	Speaker	Title
July 20, 2017	G. Ferrand	"From the supernova to the supernova remnant"
May 25, 2017	T. Tanaka	"Shaping our Understanding of Supernova Remnants with the Fermi Large Area Telescope"
Feb. 16, 2017	D. Page	"Anthropic Estimates for ManyParameters of Physics and Astronomy"
Jan. 17, 2017	A. Nielson	"Binary Black Hole Mergers in the First Advanced LIGO Observing Run"
Jan. 13, 2107	J. Ziprick	"Quantum gravitational collapse of a thin shell"
Dec. 2, 2016	A. Rogers	"Gravitational Lensing by Compact Objects in Plasma Environments"
Nov. 25, 2016	N. Sedlmayr	"The Superconductivity of Topologically Protected Surface States"
Oct. 21, 2016	H. Maeda	"Exact Solutions with a Scalar Field in General Relativity"
June 29, 2016	J. Louko	"Low Energy Lorentz Violation from High Energy Modified Dispersion"
April 1, 2016	A. Frey	"Black Hole Formation in Anti-de Sitter Spacetime (and What it Means)"
March 10, 2016	A. Prymak	"Compressed Sensing and Quantum State Tomography"
Jan. 28, 2016	S. Wykes	"HD simulations of internal jet-stellar wind interactions: the case of Centaurus A"
Nov. 26, 2015	E. Schippers	"Quasiconformal Teichmuller Theory and Conformal Field Theory"
Nov. 12, 2015	G. Ferrand	"Simulating particle acceleration in supernova remnants"
Nov. 6, 2015	G. Sawatzky	"Electronic structure of the doped Cuprates, Nickelates and superconducting Bismuthates"
Oct. 23, 2015	C. Fryer	"Chasing the Supernova Engine"
Oct. 1, 2015	S. Das	"Quantum Raychaudhuri equation and its applications to gravity and cosmology"
Aug. 13, 2015	S. Bacca	"From Neutron-Rich Nuclei to Stars"
July 17, 2015	H. Maeda	"Unitary Evolution of the Quantum Universe with a Brown-Kuchar Dust"
April 1, 2015	D. Krepski	"Group-valued moment maps and quantization"
Dec. 3, 2014	H. Fertig	"Topological Edges and Defects of Quantized Hall States in Graphene"
Oct. 22, 2014	Z. Papic	"Entanglement and dynamics in topological phases and interacting disordered systems"
Oct. 10, 2014	S. Kirkland	"Sensitivity Analysis for Perfect State Transfer in Quantum Spin Networks"
Oct. 3, 2014	V. Dwarkadas	"CSI Supernova: Hydrodynamic and X-ray Modeling of the Circumstellar Medium as Clues to Supernova Progenitors"
Sep. 18, 2014	W. Töws	"Many-body theory of laser-induced ultrafast demagnetization and angular momentum transfer in ferromagnetic transition metals"
Sep. 15, 2014	V. Freilikher	"Charge transport in graphen and light propagation in dielectric structures with metamaterials: A comparative study"
July 2, 2014	T. Taves	"Modelling the Evaporation of Non-singular Black Holes"
May 26, 2014	B. Underwood	"Non-Canonical Scalar Fields in Inflation and Reheating"
March 20, 2014	S. Plosker	"On Majorization and Trumping"
Sep. 27, 2013	T. Jones	"The Interplay of Shocks, Turbulence and Magnetic Fields in the Formation of Galaxy Clusters"
Aug. 9, 2013	D. Garfinkle	"Collapse of a Massive Scalar field in AdS"
Apr. 10, 2013	K. Shamseddine	"Characterization of compact and self-adjoint operators, and study of positive operators on a Banach space over a non-Archimedean field"
Feb. 1, 2013	S. Bacca	"From Nuclear Forces to Nuclei"

I.3 Visitors: 2013-2017

Date	Visitor	Institution	Host
Oct. 30-Nov. 3, 2017	Shirin Moein	Isfahan University of Technology	S. Plosker
July 17-21, 2017	Gilles Ferrand	RIKEN, Japan	S. Safi-Harb
May 23-26, 2017	Takaaki Tanaka	Kyoto, Japan	S. Safi-Harb
May 15-19, 2017	Rajesh Pereira	Universty of Guelph	S. Plosker
Apr 20-24, 2017	Shigehiro Nagataki	Riken, Japan	Safi-Harb
Feb. 13-17, 2017	Don Page	University of Alberta	G. Kunstatter
Nov. 21-25, 2016	Nicholas Sedlmayr	Michigan State University (USA)	J. Sirker
Oct. 18-27, 2016	Hideki Maeda	Hokkai-Gakuen University (Japan)	G. Kunstatter
June 27-July 1, 2016	Jorma Louko	University of Nottingham (UK)	G. Kunstatter
May 16-20, 2016	Nathaniel Johnston	Mount Allison University	S. Plosker
Nov. 5-7, 2015	George Sawatzky	UBC	J. Sirker
Oct. 21-24, 2015	Christopher Fryer	Los Alamos National Laboratory	S. Safi-Harb
Sep. 30-Oct. 2, 2015	Saurya Das	University of Lethbridge	G. Kunstatter
Aug. 12-14, 2015	Sonia Bacca	TRIUMF	J. Svenne
July 16-25, 2015	Hideki Maeda	Hokkai-Gakuen University (Japan)	G. Kunstatter
May 11-20, 2015	Chi-Kwong Li	College of William and Mary (USA)	S. Plosker
Dec. 2-5, 2014	Herb Fertig	Indiana University	T. Chakraborty
Oct. 22-23, 2014	Zlatko Papic	Perimeter Institute	J. Sirker
Oct. 3, 2014	Vikram Dwarkadas	University of Chicago	S. Safi-Harb
Aug. 11 - Sep. 16, 2014	Valentin Freilikher	Bar-Ilan University	J. Page (Manitoba)
May 22-27, 2014	Bret Underwood	Pacific Lutheran University	A. Frey
Jan. 3- July 7, 2014	Tim Taves	C.E.C.s., Chile	G. Kunstatter
Sept. 26-27, 2013	Tom Jones	University of Minnesota	S. Safi-Harb
Aug. 7-10, 2013	David Garfinkle	Oakland University	G. Kunstatter
Jan. 31- Feb. 2, 2013	Sonia Bacca	TRIUMF	J. Svenne

I.4 Student Research Symposia

Since 2013, the WITP organizes each year a symposium where WITP students can present their research. The program of the symposia from 2013-2016 is shown in the following figures.

WITP Summer Symposium 2013

29 Aug 2013, Allen Building Room 519, University of Manitoba

Research talks will be 20 minutes, including time for questions.

9:15 Welcome by Mark Whitmore, Dean of Science, University of Manitoba

9:30 *Brad Cownden* "Modern models of extra dimensions in string theory"

9:50 *Nick Reid* "A dark theory for a light problem"

10:10 Break

10:30 *Joe Smith* "The 4-vertex in scalar-Ψ^4 theory using the 2PI effective action"

10:50 *Gabriel Chernitsky* "Searching for gamma radiation in dwarf galaxies"

11:10 Break

11:20 *Morgan Mercredi* "Cell migration in competing chemotactic environments"

11:40 *Jared Enns* "Dark light: Exploring dark radiation Models"

12:00 Lunch & Discussion

13:30 *Nils Deppe* "Adaptive mesh refinement for constrained 1D hyperbolic systems"

13:50 *Allison Kolly* "Gravitational collapse in anti-de Sitter space"

14:10 Break

14:30 *Ben Guest* "A new galactic pulsar candidate revealed by the Chandra X-ray Observatory"

14:50 *Chelsea Braun* "Supernova remnants as astrophysical laboratories for the formation of the elements"

15:10 Break

15:20 *Angel Barria* "On the algebraic and topological structures of the Levi-Civita field"

15:40 *Darren Flynn* "On delta functions on the Levi-Civita field"

16:00 Break

16:10 *Gidon Bookatz* "On locally uniformly differentiable functions on the Levi-Civita field: the inverse function theorem and the intermediate function theorem"

16:30 *William Grafton* "Fourier analysis on the Levi-Civita field"

Figure 2: Program of the 2013 WITP summer symposium at UM.

9:00-10:00	coffee (for those arriving early)
10:00-10:25	Gabriel Chernitsky (UW)
10:30-10:55	Gidon Bookatz (UM)
11:00-11:25	L.J. Zhou (UW)
11:30-11:55	Jarrad Perron (BU)
12:00-1:00	lunch
1:00-1:25	Ryan Bergen (BU)
1:30-1:55	Brett Meggison (BU)
2:00-2:25	Brad Cownden (UW)
2:30-2:55	Paul Mikula (UW)

Figure 3: Program of the 2014 WITP summer symposium at BU.

WITP Summer Student Symposium 2015
28 Aug 2015, Allen Building Rm 326, University of Manitoba

Time	Speaker	Title
9:15-9:30	Opening remarks	
9:30-10:00	Jennifer West	Bilateral symmetry in supernova remnants and the connection to the Galactic magnetic field
10:00-10:30	Kelvin Au	A Unique X-ray Emitting Compact Object in a Young Supernova Remnant
10:30-10:50	Coffee break	
10:50-11:20	Brad Cownden	A Derivation of the Equation of Motion for a Magnetic Monopole
11:20-11:50	Paul Mikula	Yang-Mills Flow in the Abelian Higgs Model
11:50-13:00	Lunch	
13:00-13:30	Ryan Sherbo	On the Algebraic and Topological Structures of the Levi-Civita Field
13:30-14:00	Will Grafton	On the Convergence and Analytical Properties of Power Series over the Levi-Civita Field
14:00-14:20	Coffee Break	
14:20-14:50	Darren Flynn	Measure Theory and Integration over the Levi-Civita Field
14:50-15:20	Gidon Bookatz	On Locally Uniformly Differentiable Functions in the Levi-Civita Field

Figure 4: Program of the 2015 WITP summer symposium at UM.

WITP Summer Student Symposium 2016
August 25, 2016, Room 3M69, University of Winnipeg

9:00 - 9:15	*Coffee/Refreshments*	
9:15 - 9:30	Dr. Danny Blair	Welcome Address
9:30 - 9:55	Philipp Jaeger	*Measuring Topological Invariants: Lohschmidt Echo in the SSH-Model*
9:55 - 10:20	Ben Guest	*Peering Deeper into the Plerionic Supernova Remnant G21.5-0.9*
10:20 - 10:40	*Coffee Break*	
10:40 - 11:05	L.J. Zhou	*Firewall Creation in Curved Space-Time under Spherical Symmetry*
11:05 - 11:30	Paul Mikula	*Gradient Flow in the Ginzburg-Landau model for Superconductivity*
11:30 – 11:55	Donovan Allum	*Modeling the Formation of non-Singular Black Holes in Spherical Symmetry*
11:55 – 13:00	*Lunch*	
13:00 - 13:25	Darren Flynn	*Non-Archimedean Fields: A Laboratory for the Infinite and the Infinitesimal*
13:25 - 13:50	Will Grafton	*On the Convergence and Analytical Properties of Power Series on non-Archimedean Field Extensions of the Real Numbers*
13:50 – 14:15	Brett Meggison	*Renormalization of Scalar nPI Effective Theories in 4 Dimensions*
14:15 – 14:45	*Snack Break*	
14:45 – 15:10	Brad Cownden	*Modelling Gravitational Collapse in Anti-de Sitter Space*
15:10 – 15:35	Raphael Hoult	*Black Hole Formation in AdS_4 with Varying Boundary Conditions*

Figure 5: Program of the 2016 WITP summer symposium at UW.

Figure 6: Participants of the 2017 WITP workshop at UM.

On July 31 - August 1, 2017 the WITP held its so far largest summer school at the University of Manitoba with was a great success with more than 40 participants and 5 internationally well-known lecturers in mathematical physics (Aguyao, Concepcion), condensed matter physics (Affleck, UBC), quantum optics (Grusdt, Harvard), cosmology (Watson, Syracuse), and string theory (Dasgupta, McGill).

In addition to the lectures, all WITP-affiliated graduate students and summer research students were invited to give a short oral presentation or to present a poster. Overall, we had 10 contributed talks and 3 posters by our students. The schedule of the summer school is attached below.

WITP workshop 2017 (July 31 – August 1)

Trace: • invited_speakers • program

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registration
talks_posters
topics

Scientific Program

Time	Sunday, 7/30	Monday, 7/31	Tuesday, 8/1
8:45 – 9:00		Opening	—
9:00 – 10:00		Ian Affleck (I)	Ian Affleck (II)
10:00 – 10:40		Naseri, Phillips	Mikula, Frey
10:40 – 11:10		Coffee	
11:10 – 12:10		Dasgupta (I)	Dasgupta (II)
12:10 – 14:00		Lunch	
14:00 – 14:40	Arrival	Zhou, Ziprick	Hoult, Cownden
14:40 – 15:40		Watson (I)	Watson (II)
15:40 – 16:10		Coffee	
16:10 – 17:10		Aguayo	Grusdt
17:10 – 17:30		Barria Comicheo	Mclaren
17:30 – 18:30		Poster & Discussions	Poster & Discussions
18:30		Dinner	

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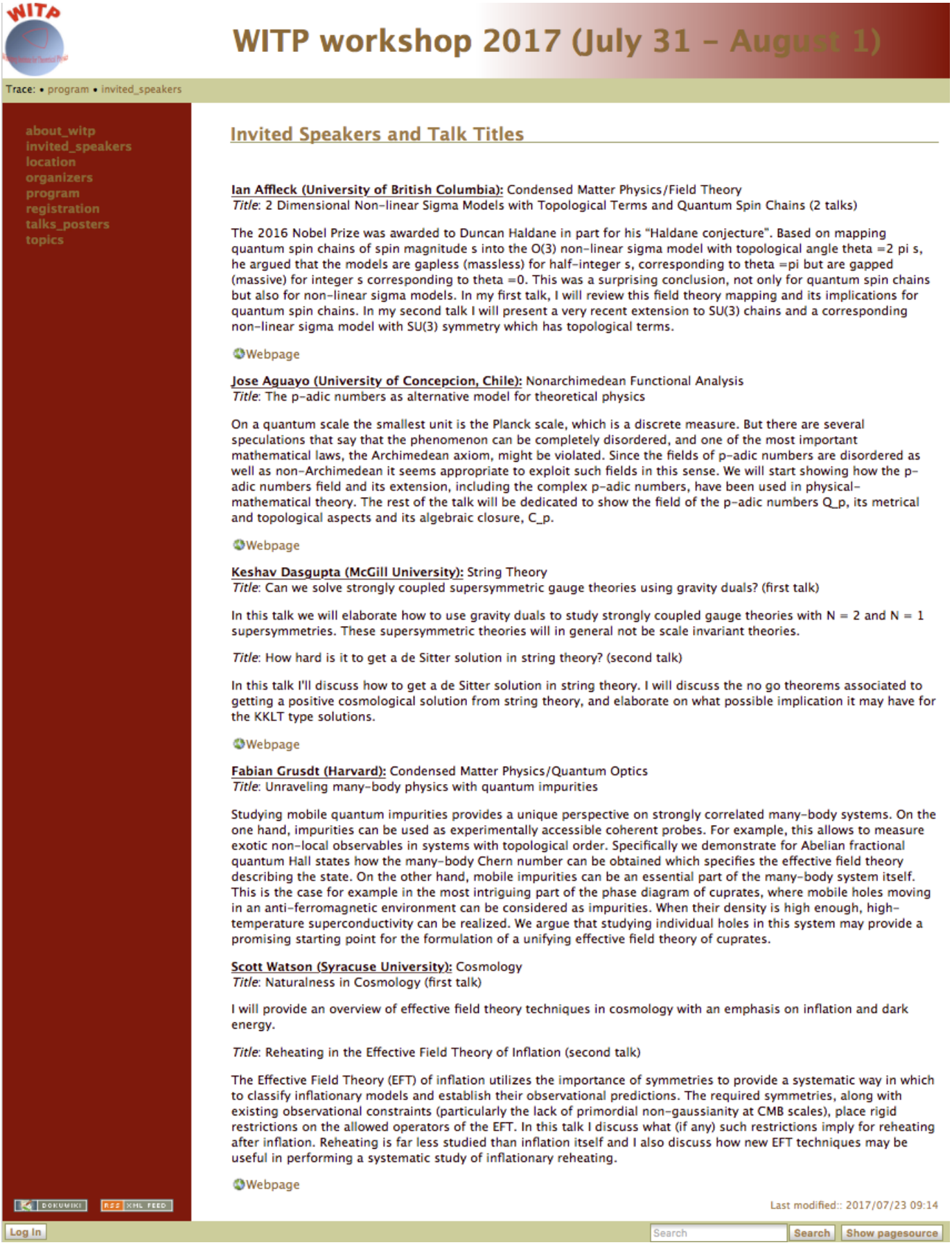
Figure 7: Program of the workshop including lectures as well as talks by graduate students.



WITP workshop 2017 (July 31 – August 1)

Trace: • program • invited_speakers

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Invited Speakers and Talk Titles

Ian Affleck (University of British Columbia): Condensed Matter Physics/Field Theory
Title: 2 Dimensional Non-linear Sigma Models with Topological Terms and Quantum Spin Chains (2 talks)

The 2016 Nobel Prize was awarded to Duncan Haldane in part for his "Haldane conjecture". Based on mapping quantum spin chains of spin magnitude s into the O(3) non-linear sigma model with topological angle theta =2 pi s, he argued that the models are gapless (massless) for half-integer s, corresponding to theta =pi but are gapped (massive) for integer s corresponding to theta =0. This was a surprising conclusion, not only for quantum spin chains but also for non-linear sigma models. In my first talk, I will review this field theory mapping and its implications for quantum spin chains. In my second talk I will present a very recent extension to SU(3) chains and a corresponding non-linear sigma model with SU(3) symmetry which has topological terms.

Webpage

Jose Aguayo (University of Concepcion, Chile): Nonarchimedean Functional Analysis
Title: The p-adic numbers as alternative model for theoretical physics

On a quantum scale the smallest unit is the Planck scale, which is a discrete measure. But there are several speculations that say that the phenomenon can be completely disordered, and one of the most important mathematical laws, the Archimedean axiom, might be violated. Since the fields of p-adic numbers are disordered as well as non-Archimedean it seems appropriate to exploit such fields in this sense. We will start showing how the p-adic numbers field and its extension, including the complex p-adic numbers, have been used in physical-mathematical theory. The rest of the talk will be dedicated to show the field of the p-adic numbers Q_p, its metrical and topological aspects and its algebraic closure, C_p.

Webpage

Keshav Dasgupta (McGill University): String Theory
Title: Can we solve strongly coupled supersymmetric gauge theories using gravity duals? (first talk)

In this talk we will elaborate how to use gravity duals to study strongly coupled gauge theories with N = 2 and N = 1 supersymmetries. These supersymmetric theories will in general not be scale invariant theories.

Title: How hard is it to get a de Sitter solution in string theory? (second talk)

In this talk I'll discuss how to get a de Sitter solution in string theory. I will discuss the no go theorems associated to getting a positive cosmological solution from string theory, and elaborate on what possible implication it may have for the KKLT type solutions.

Webpage

Fabian Grusdt (Harvard): Condensed Matter Physics/Quantum Optics
Title: Unraveling many-body physics with quantum impurities

Studying mobile quantum impurities provides a unique perspective on strongly correlated many-body systems. On the one hand, impurities can be used as experimentally accessible coherent probes. For example, this allows to measure exotic non-local observables in systems with topological order. Specifically we demonstrate for Abelian fractional quantum Hall states how the many-body Chern number can be obtained which specifies the effective field theory describing the state. On the other hand, mobile impurities can be an essential part of the many-body system itself. This is the case for example in the most intriguing part of the phase diagram of cuprates, where mobile holes moving in an anti-ferromagnetic environment can be considered as impurities. When their density is high enough, high-temperature superconductivity can be realized. We argue that studying individual holes in this system may provide a promising starting point for the formulation of a unifying effective field theory of cuprates.

Scott Watson (Syracuse University): Cosmology
Title: Naturalness in Cosmology (first talk)

I will provide an overview of effective field theory techniques in cosmology with an emphasis on inflation and dark energy.

Title: Reheating in the Effective Field Theory of Inflation (second talk)

The Effective Field Theory (EFT) of inflation utilizes the importance of symmetries to provide a systematic way in which to classify inflationary models and establish their observational predictions. The required symmetries, along with existing observational constraints (particularly the lack of primordial non-gaussianity at CMB scales), place rigid restrictions on the allowed operators of the EFT. In this talk I discuss what (if any) such restrictions imply for reheating after inflation. Reheating is far less studied than inflation itself and I also discuss how new EFT techniques may be useful in performing a systematic study of inflationary reheating.

Webpage

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Figure 8: Lectures at the 2017 WITP workshop.

I.5 15th and 16th Canadian Conference on General Relativity and Relativistic Astrophysics

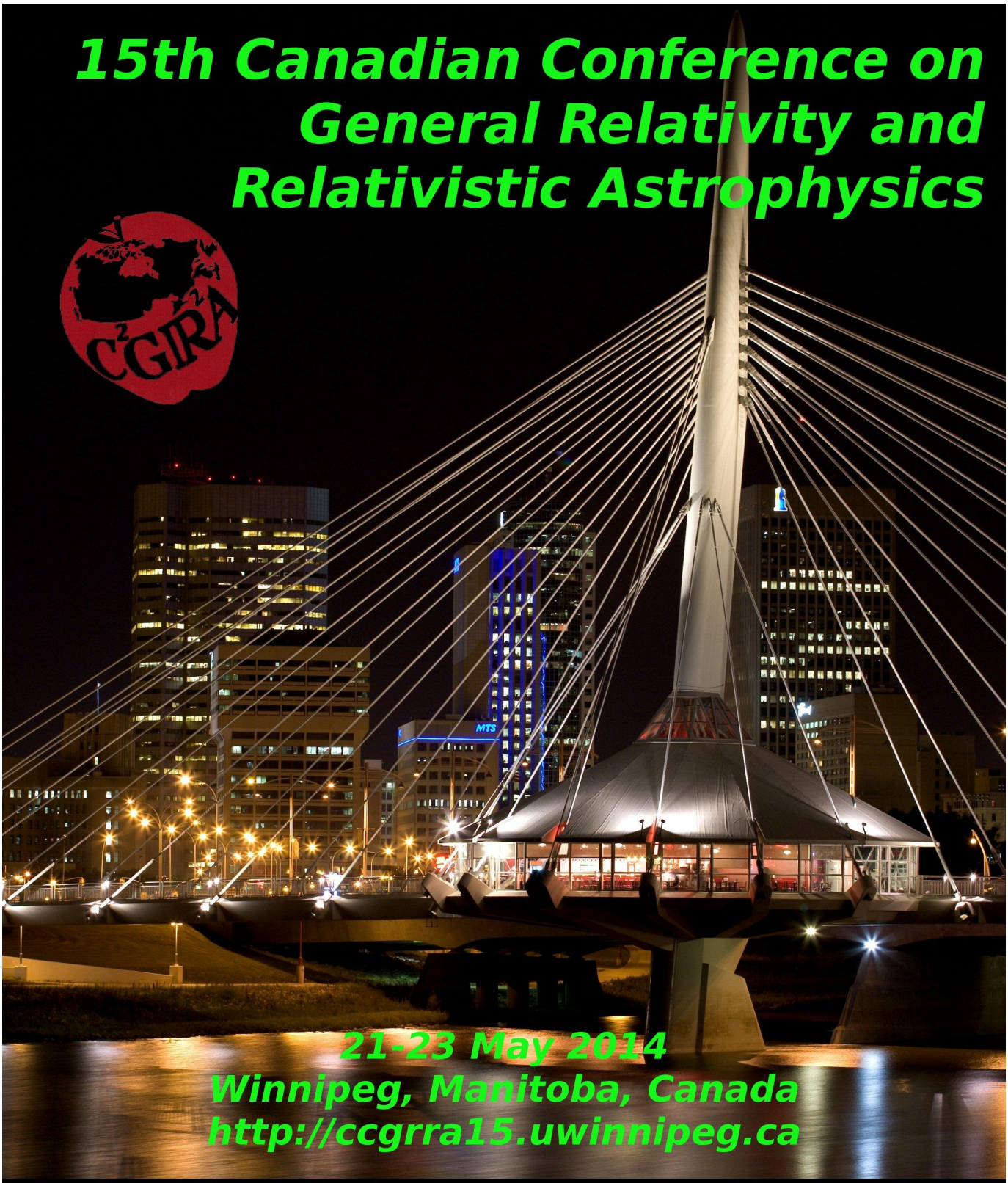
The WITP co-sponsored a public lecture in 2014 with the 15th Canadian Conference on General Relativity and Relativistic Astrophysics, which was held in Eckhardt-Gramatte Hall at the University of Winnipeg. The lecture, titled "Higgs Bang" was presented by Neil Turok, the Director and Niels Bohr Chair of the Perimeter Institute and the 2013 CBC Massey Lecturer. This was a rare event for Winnipegers to see one of the leading minds of cosmology, and close to 200 people attended.

The WITP also co-sponsored the 16th Canadian Conference on General Relativity and Relativistic Astrophysics, which was held at SFU.

I.6 CASCA 2016

The WITP co-sponsored the annual meeting of the Canadian Astronomical Society which was held in Winnipeg (May 30- June 2, 2016) and organized by WITP members from U of M and UW. As part of the CASCA 2016 conference, the winner of the 2015 Nobel Prize in Physics, Dr. Art McDonald gave a public lecture 'The Sudbury Neutrino Observatory: Observing the Sun from 2 km Underground', on June, 1, 2016.

15th Canadian Conference on General Relativity and Relativistic Astrophysics



21-23 May 2014
Winnipeg, Manitoba, Canada
http://ccgrra15.uwinnipeg.ca

Confirmed Plenary Speakers

A. Ashtekar (Penn State)
L. Boyle (Perimeter)
M. Johnson (York & Perimeter)
A. Maloney (McGill)
J. Moffat (Perimeter)
L. Pogosian (Simon Fraser)
J. Polchinski (KITP, UCSB)
F. Pretorius (Princeton)
S. Safi-Harb (Manitoba)
N. Turok (Perimeter)
J. Zanelli (CECs, Chile)

Organizing Committee

A. Frey
G. Kunstatter
D. Vincent
(Univ of Winnipeg)

Sponsors

WITP

Public Lecture

Higgs Bang

Recent measurements using the Large Hadron Collider (LHC) and the Planck Satellite have revealed the universe to us, from scales a billion times smaller than an atom to ten trillion times larger than the solar system. Amazingly, the universe turned out to be simpler than we expected, in both cases. This is profoundly encouraging to those of us seeking deep explanations for the origin and the future evolution of the universe. In the talk, I will review a very recent idea: that the Higgs field discovered by the LHC played a key role in initiating the big bang, and that it will initiate another big bang in the future.


Photo Credit: Gabriela Secara

Neil Turok

Director and Niels Bohr Chair, Perimeter Institute

World-renowned South African physicist **Neil Turok** is Director and Niels Bohr Chair of Canada's Perimeter Institute for Theoretical Physics. One of the world's leading minds in physics and cosmology, the former Princeton professor and Cambridge Chair in Mathematical physics is known for his innovative approach. Turok has received numerous awards, and in 2012 he was selected to deliver the prestigious CBC Massey Lectures. His resulting series "The Universe Within: From Quantum to Cosmos" sold-out in other cities across Canada. This is Winnipeg's chance to see Dr. Turok speak live!

7:30PM 21 May 2014
Eckhardt-Gramatté Hall, University of Winnipeg

Free Admission
Reserve tickets by calling 204-786-9852 or emailing CCGRRA@uwinnipeg.ca
Or first-come, first-served at the door starting 6:30PM
Refreshments will be served after the lecture

Proudly co-sponsored by the **15th Canadian Conference on General Relativity & Relativistic Astrophysics** and the **Winnipeg Institute for Theoretical Physics**

THE UNIVERSITY OF WINNIPEG

16th Canadian Conference on General Relativity and Relativistic Astrophysics

CASCA MANITOBA 2016

HOME | LOCATION | PROGRAM | REGISTRATION | ACCOMMODATIONS | CONTACT

Join us in Winnipeg, Manitoba, **May 30 – June 2, 2016** for the annual meeting of the Canadian Astronomical Society (CASCA).

We are excited to announce that the winner of the 2015 Nobel Prize in Physics, **Dr. Art McDonald** will be giving our public lecture: *The Sudbury Neutrino Observatory: Observing the Sun from 2 km Underground,* on the evening of June, 1, 2016.

See our **list of confirmed invited speakers** and the **conference schedule**.

Registration is now closed.

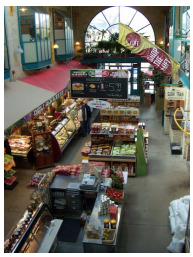
Conference program in now available!

Banquet Speaker: Wilfred Buck on First Nations Astronomy

The meeting will be held at the historic Fort Garry Hotel, located in the heart of Winnipeg, within easy walking distance of many attractions such as The Forks and the Canadian Museum for Human Rights.

Canadian Human Rights Museum (V.Pahkala)

The Fort Garry Hotel



Forks Market (Ccyyrree)

Languages

English
Français

Hosted by:

University of Manitoba

And our partners:

The University of Winnipeg

Brandon University

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University of Manitoba — faculty of SCIENCE

The University of Winnipeg

WITP

Royal Astronomical Society of Canada — Winnipeg Centre

Canadian Astronomical Society / Société canadienne d'astronomie

II Funds Received

In addition to funds committed to the WITP by the University of Manitoba, the University of Winnipeg, and Brandon University, it should be pointed out that the members of the Institute use their individual NSERC Discovery Grants to subsidize Institute activities. The members from the three universities received more than $700,000 of individual NSERC Research Grants in the 2016-17 fiscal year. These funds have a significant fortifying effect on the level of activities in which we are able to engage. The financial contribution of the members associated with the expenses of visiting guest theorists, supports the activities and goals of the Institute, but does not appear in the budget data shown above.

The funds received by non-retired individual members are summarized in the table below. NSERC is the National Science and Engineering Resource Council of Canada, DG represents the Discovery Grant program, and CRC is the Canada Research Chairs program. SAP indicates the subatomic physics envelope of NSERC. DFG indicates the German Research Council. MSI2 is the major science initiative of the Canadian Foundation for Inovation (CFI).

Member	**Source & Type**	**2016-17 Amount**
P.G. Blunden	NSERC DG (SAP)	$60,000
M.E. Carrington	NSERC DG (SAP)	$40,000
T. Chakraborty	NSERC CRC I	$200,000
J.D. Fiege	NSERC DG	$21,000
A.R. Frey	NSERC DG (SAP)	$40,000
D. Krepski	NSERC DG	$13,000
G. Kunstatter	NSERC DG	$33,000
C. O'Dea	NSERC DG	$28,000
S. Plosker	NSERC DG NSERC CRC II	$15,000 $ 100,000
A. Prymak	NSERC DG	$11,000
S. Safi-Harb	NSERC DG	$26,000
E. Schippers	NSERC DG	$11,000
A. Shalchi	NSERC DG	$28,000
K. Shamseddine	NSERC DG	$14,000
B.W. Southern	NSERC DG	$18,000
J. Sirker	NSERC DG DFG CFI (MSI2)	$31,000 $46,000 $380,000

Total funding in 2016-17 without CFI is $735,000. Including the CFI funding for MSI2 it is $1,115,000.

III Financial Statements

The WITP has three financial accounts, one maintained at the University of Winnipeg and two at the University of Manitoba. Currently, the account at UW has a balance of $ 1095.42, and the UW (through the offices of the Dean of Science and the Vice President (Research, Recruitment, and International)) has committed to credit that account with $ 2000 each year from 2013 to 2017. The WITP account used for the budget provided by the Faculty of Science at UM has currently a negative balance of -$1895.43. The second account at UM used for the budget provided by Brandon University, on the other hand, has a balance of $2065.87. The Faculty of Science at UM has committed to provide $3000 in funding annually while the University of Brandon will continue to provide $1000 annually from 2018 to 2022.

IV Letters of Support

Letters of support from the Deans of Science from UM and UW, of which the WITP is a formal institute, are attached on the following pages. A letter of support from the Vice-President (Academic & Provost) of Brandon University is attached following those pages.

THE UIVERSITY OF MANITOBA
Faculty of Science
Office of the Dean
247 Machray Hall
INTER-DEPARTMENTAL CORRESPONDENCE

DATE: February 26, 2018

TO: Digvir Jayas, Vice-President (Research & International)

FROM: Stefi Baum, Dean, Faculty of Science

SUBJECT: Support for the Winnipeg Institute for Theoretical Physics

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I am very pleased to support the renewal of the Winnipeg Institute for Theoretical Physics.

This Institute draws its membership from three universities in Manitoba, with 21 faculty members, eight senior scholars, approximately nine research associates and postdoctoral fellow, 36 graduate students, and 25 summer undergraduate research students. Its purpose is to support theoretical physics in Manitoba by encouraging collaboration between members and by financially supporting workshops and conferences, visiting speakers, and short and long term visitors.

Important outreach includes: a) support for the 15th and 16th Canadian Conference on General Relativity and Relativistic Astrophysics including a public lecture by Neil Turok (Director, Perimeter Institute, 2013 CBC Massey lecturer); and b) support for CASCA 2016 (Canadian Astronomical Society) with a public lecture by Art McDonald (2015 Nobel Prize winner). Recent events include a yearly workshop/summer school for graduate and undergrad students. The 2017 summer school was a 2-day event with approximately 40 participants and 5 international lecturers, including Ian Affleck (APS Onsage prize, FRS London). Support was provided for a number of visiting scientists who gave talks at the WITP seminars.

The membership's record of external funding fluctuates a bit from year to year, but is typically around $800K-$900K per year, which is a substantial increase compared to the $500K per year reported in the last review from 2013.

I am pleased to commit a total of $15,000 of funding from the Faculty of Science over a 5-year period, which includes contribution from the Department of Physics and Astronomy, to this valuable and very successful Institute.

THE UNIVERSITY OF WINNIPEG
OFFICE OF THE DEAN OF SCIENCE

March 2, 2018

Dr. Digvir Jayas
Vice-President (Research and International)
The University of Manitoba
Winnipeg, MB R3T 2N2

Dear Dr. Jaya

In February of 2018 I met with Dr. Andrew Frey (The University of Winnipeg) and Dr. Jesko Sirker, Director of the Winnipeg Institute of Theoretical Physics (WITP) to discuss the activities of this group. As per our discussion I am writing to confirm that The University of Winnipeg will commit $10000.00 to the WITP over the years (2018-2022). The WITP is an impressive group of Research Scientists who are committed to the promoting research and supporting undergraduate and graduate students through a number of activities including public lectures and workshops. This is certainly as excellent example of the benefit of smooth co-operation between our universities

Sincerely,

Douglas Goltz

Dean of Science (Acting)

cc : Jesko Sirker, WITP
Manish Pandey, Acting Vice President (Research and Innovation) The University of Winnipeg
James Currie, Vice President (Academic), The University of Winnipeg

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BRANDON UNIVERSITY

March 5, 2018

Dr. Jesko Sirker
Associate Professor
Department of Physics & Astronomy
University of Manitoba
Winnipeg MB R3T 2N2

Dear Dr. Sirker,

RE: Winnipeg Institute for Theoretical Physics (WITP)

I am pleased to share that Brandon University will continue its support toward the Winnipeg Institute for Theoretical Physics with an annual contribution of $1,000 beyond the 2017-2018 fiscal year. We look forward to reviewing the renewal agreement that outlines the specifics and expectations of Brandon University's commitment.

If you require additional information, please feel free to contact me at (204) 727-7455 or serfaty@brandonu.ca.

Sincerely,

Dr. Meir Serfaty
Acting Vice-President (Academic & Provost)
Brandon University

smd

C Ms. Kerry Murkin, Manager of Research Services, Brandon University