Dr. Gabriele Sala

Curriculum Vitae

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"Audentes Fortuna Iuvat." - Virgil

Education:

2019–Present **Leading Instrument Scientist for the CHESS direct geometry spectrometer**, *Second Target Station, Oak Ridge National Laboratory*, Oak Ridge, (TN) USA.

2016–2019 **Post Doc in the Neutron Scattering Division (Spectroscopy Group) and Local Contact at CNCS (BL-5), HYSPEC (BL-14b), SEQUOIA (BL-17), ARCS (BL-18)**, *Oak Ridge National Laboratory*, Oak Ridge, (TN) USA.

2015–2016 **Post Doc in the Department of Physics and Astronomy**, *McMaster University*, Hamilton, (ON) Canada.

2011–2014 **PhD in Condensed Matter Physics**, *Royal Holloway University of London*, Egham. Passed with minor corrections on 5^{th} June 2014.

2008–2010 **Master Degree in Condensed Matter Physics**, *University of Ferrara*, Ferrara, *Grade – 110/110 Magna cum Laude.*

2005–2008 **Bachelor Degree in Physics and Astrophysics**, *University of Ferrara*, Ferrara, *Grade – 110/110 Magna cum Laude.*

PhD Thesis:

Title *Spin Ice: a Wonderful World*

Supervisor Professor Jon P. Goff & Dr Claudio Castelnovo

Description This thesis characterised the spin ice crystals $Dy_2Ti_2O_7$, $Ho_2Ti_2O_7$ in presence of structural defects and disorder. It explored the new physics developed by these systems and it showed how to study, analyse and simulate their behaviour at low temperatures.

Master Thesis:

Title *Study and realisation of a crystal for volume reflection experiments at Tevatron*

Supervisors Professor Vincenzo Guidi & Associate Dr Andrea Mazzolari

Description This thesis explored the idea of the volume reflection for high energy experiments. In particular it showed how to build and align a silicon wafer using common photolithography techniques for Tevatron experiments at CERN.

Bachelor Thesis:

Title *Multilayer high transparency crystal lens for channeling experiments*

Supervisors Professor Vincenzo Guidi

Description This thesis explored the idea of the channeling in silicon crystals, providing informations on the trajectory of the particles due to the crystal electric field of the silicon along a particular direction.

— Personal Statement: —

ORCiD, *0000-0002-6654-0275*, Current h-index, 10.

I am a condensed matter physicist specialised in the study of frustrated magnetism in f-electron rare earth compounds. I completed my PhD on the characterisation of the geometrically frustrated spin ice materials $Dy_2Ti_2O_7$ and $Ho_2Ti_2O_7$ at Royal Holloway University of London in 2014 using neutron scattering and X-rays techniques at the ISIS facility. I examined these systems in both the stoichiometric form and with structural defects such as oxygen vacancies and doping with yttrium ions. Modelling the exotic behaviour of these samples allowed me to develop advanced theoretical and experimental skills. The theoretical study was conducted primarily under the supervision of Dr. Claudio Castelnovo (Cavendish Laboratory, Cambridge University) and Prof. Roederich Moëssner (Max Planck Institut, Dresden), while the experimental study was carried out under the supervision of Prof. Jon Goff (Royal Holloway University of London) and Dr. Matthias Gutmann (ISIS). Following my PhD, I worked as a Post Doc at McMaster University for 1 year under the supervision of Prof. Bruce Gaulin. In 2016 I moved to Oak Ridge National Laboratory for my second Post Doc, under the supervision of Dr. Mark Lumsden and Dr. Georg Ehlers. This Post Doc was articulated in 3 parts: developing Monte Carlo simulations to model the performance of CHESS, the flagship cold neutron spectrometer for the second target station at SNS; supporting the user program with local contact duties at CNCS (BL-5) and developing a scientific program examining frustrated rare earth quantum magnets. Simulations of CHESS were performed using a combination of McStas and MCViNE; I am proficient in ray tracing programs for instrument simulations, and I personally developed Monte Carlo algorithms in C/C++ and Python for data analysis. I have extensive experience in neutrons and neutron scattering techniques on ToF and triple axis spectrometers, having successfully obtained beam-time at many international facilities (e.g. SNS, HFIR, ISIS, DNS, DESY, DIAMOND and APS). I was also given the opportunity to collaborate on two experiments at large German user facilities (DNS in Munich and DESY in Hamburg), where I improved my knowledge on both polarised neutron scattering and high energy X-ray diffraction. I am very passionate about instrument development and try to improve the efficiency of data collection and analysis for the benefit of my experiments and that of other users. I have currently made 39 high impact publications on topics spanning crystal field analysis on frustrated f-electron materials, spin liquids, spin ice, 2D Shastry-Sutherland frustrated system, phonons in irradiated graphite, spin waves in 2D and 3D magnets and, more recently, I studied a Van Hove singularity in the DOS of a 2D honeycomb magnet. I love my work and I enjoy working both independently and in a team; I have excellent interpersonal and communication skills that allowed me to develop strong relationships with the other scientists.

— Current Science Projects: —

2016–Present **Analysis of quantum magnets and frustrated f-electron rare earth systems using neutron scattering techniques**, *Oak Ridge National Laboratory*.

My current studies examine a series of frustrated quantum magnets based upon the rare-earth Nd^{3+} ion. The novel physics in these materials is driven by frustrated quasi-2D lattices in conjunction with the significant spin orbit coupling and strong Coulomb repulsions inherent to rare earth ions. I found that, while a local moment picture is able to describe the crystal field level scheme, reduced dimensionality and competing low energy exchange paths suppress long-range magnetic order to temperatures well below the Curie-Weiss temperature. Furthermore, the neutron scattering data determined that the ordered spin configuration is driven by the combination of on-site and inter-site interactions. More recently, I have been studying potential 2D spin liquid systems for quantum computer applications, and a novel system, $YbCl_3$, that hosts a Van Hove singularity on its 2D honeycomb lattice.

Awards and Honors:

2019 October – ORNL Awards Night 2019, Prize for the Best Post Doc in the Neutron Scattering Division

2019 July 15^{th} – Highlights Rice University for the discovery of the first possible 3D Quantum Spin Liquid. "https://news.rice.edu/2019/07/15/physicists-find-first-possible-3d-quantum-spin-liquid-2/"

2019 January 22^{nd} – Highlights on the ORNL web-site for the discovery of a new Quantum Spin Liquid

2013 Top Achiever Award – First prize for the best poster at the ICNS conference in Edinburgh

Professional Membership:

2012–Present American Physical Society (APS)

2019–Present American Crystallographic Association (ACA)

2019–Present International Society of Neutron Instrument Engineers (ISNIE)

— Theoretical Experience: —

2017–2019 **Python Libraries for ToF Instruments and Triple Axis**, *Oak Ridge National Laboratory*, ORNL.
Creation of a standard python library to control ToF instruments at SNS and HFIR.

Detailed achievements:
- I personally developed Python libraries to control the 4 ToF instruments at SNS and WAND^2 at HFIR from a console. The feedbacks received from the user community were very positive, the python library was found to be very intuitive, easy and extremely flexible in accommodating many different user experiments. The techniques developed for this library are contributing to the developments of python based instrument control by the DAS group within the Neutron Scattering Directorate at ORNL.
- I supported and helped the DAS group in the organisation and maintenance of the CSS software at the 4 spectroscopy beam-lines at SNS and the WAND^2 diffractometer at HFIR.

2016–Present **McStas and MCViNE**, *Oak Ridge National Laboratory*, ORNL.
Modelling new direct geometry ToF Instruments for the Second Target Station (STS)

Detailed achievements:
- Learned how to set up Monte Carlo simulations to model ToF Instruments for ORNL, and to model real experiments and sample environments at the beam-line calculating $S(Q, \omega)$.
- Simulations of new ToF spectrometers for the second target station at SNS.
- Simulations of proposed radial collimators for current instruments at the SNS facility.
- Simulations of experiments for comparison to single crystal measurements of samples with significant absorption effects.

2016–2019 **DAS and Mantid support**, *Oak Ridge National Laboratory*, ORNL.
Creation of algorithms for Single Crystal Alignment using ToF Instruments.

Detailed achievements:
- I developed a streamlined algorithm built inside Mantid to calculate the UB matrix of a Single Crystal during experiments across the 4 ToF Instruments (CNCS, ARCS, SEQUOIA and HYSPEC) at SNS and WAND^2 at HFIR.
- I supported and helped the DAS group during the software upgrade at BL-5 and I provided user-friendly python scripts for UB matrix calculations, powder data reduction and single crystal data reduction.

2011–Present **Programming in C and C++**.
Developed detailed knowledge of the Monte Carlo simulations.

Detailed achievements:
- Learned how to create a Monte Carlo simulation for a system at the equilibrium.
- Learned how to implement a Marsaglia random generator code for statistical analysis.
- Learned how to implement a calculation for:
  - Heat Capacity,
  - Hysteresis Loop,
  - Calculation of the internal fields of the Crystal for both 3D and 2D systems using the Ewald Summation Technique,
  - Unpolarised neutron scattering cross section,
  - Polarised neutron scattering cross section (both Spin Flip and Non Spin Flip Channels).
- Learned how to export and import data from different formats in order to plot, refine and analyse it.
- Learned how to create programs to model the structural diffuse scattering of a sample in presence of defects.

2011–Present **Mathematica**.
Developed detailed knowledge of the Wolfram Mathematica software and related packages.

Detailed achievements:
- Learned how to create a code for Crystal Field Analysis of rare earth based materials.
- Learned how to create a code for Spin Wave Analysis.
- Learned how to create a code for Phonon DOS analysis
- Learned how to create a code for structural diffuse scattering analysis and simulations.
- Learned how to create programs to benchmark and support the Monte Carlo simulations.
- Learned how to plot and generate high quality figures for publication.

2011–2012 **Superconductivity and Magnetism**, *SEPnet Euromaster program*, ISIS.
Developed detailed knowledge about magnetic material (ferromagnets, paramagnets and anti ferromagnets) and about superconductivity .

Detailed achievements:
- Revision of the main properties of magnetic and superconducting systems.

— Experimental Experience: —

2015–Present **Characterisation using High Energy X-rays with Hi-Pulsed magnetic field**, at Argonne National Laboratory.
Developed the knowledge of the APS facility and the 6-ID-C beamline.

Detailed achievements:
- Study of the diffraction pattern in $SrCu(BO_3)_2$ Mg doped single crystal.
- Application of a high pulsed magnetic field $B \geq 28$ Tesla to induce magnetic order at low temperatures and study the magneto-elastic effect in the lattice.
- Data analysis using the software SPEC.

2015–Present **Characterisation using Neutrons at HB1a, HB2a and HB3**, at HFIR Oak Ridge National Laboratory.
Developed my background knowledge of Triple Axis Instruments.

Detailed achievements:
- Study of diffraction data sets and refinement of magnetic structures.
- Mapping phase diagrams using triple axis instruments.

2015–Present **Characterisation using Neutrons at CNCS, SEQUOIA, ARCS, HYSPEC, TOPAZ, POWGEN and CORELLI**, at SNS Oak Ridge National Laboratory.
Developed my background knowledge of ToF diffraction and spectroscopy instruments.

Detailed achievements:
- Study of both Elastic and Inelastic Neutron Scattering data using single crystals and powder samples.
- Learned how to calculate and simulate the spin wave dispersion using SpinW.
- Learned how to analyse and fit Crystal Field Parameters from the INS data.
- Learned how to perform a Hi-Pulse Magnetic Field Experiment.
- Learned how to use DAVE and Mantid for the analysis of the data.

2013–Present **Characterisation using High Energy X-rays at DESY**, Hamburg.
Developed detailed knowledge of the DESY facility in Hamburg, under the supervision of Dr. M. J. Gutmann.

Detailed achievements:
- Health and Safety training course on high energy X-rays radiation and risk assessment.
- Learned how to prepare single crystals for high energy X-rays analysis both at room temperatures and at low temperatures.
- Learned how to plot, analyse and refine high energy X-ray data.

2013–2014 **Characterisation using Polarised Neutrons at the DNS facility**, Munich.
Developed detailed knowledge of the DNS facility in Munich, under the supervision of Dr. Su Yixi.

Detailed achievements:
- Health and Safety training course on radiation and risk assessment.
- Learned how to prepare single crystals for polarised neutron scattering analysis.
- Learned how to align the sample with the beam to get the maximum coverage of the reciprocal space.
- Learned how to plot analyse and refine neutron scattering data with the DNS softwares.

2012–2014 **Characterisation using Neutrons at the SXD facility**, Rutherford Appleton Laboratory (ISIS).
Developed detailed knowledge of the SXD facility in ISIS, under the supervision of Dr. M. J. Gutmann.

Detailed achievements:
- Health and Safety training course on radiation and risk assessment.
- Learned how to prepare single crystals for unpolarised neutron scattering analysis (both structural and magnetic).
- Learned how to use the SXD facility to its maximum capability.
- Learned how to use the different types of cryostats according to the temperatures of the experiments.
- Learned how to plot, analyse and refine neutron scattering data with software SXD2001 and JANA2006.

2011–Present **Characterisation using X-rays**, Royal Holloway University of London.
Developed basics knowledge of the X-rays data analysis.

Detailed achievements:
- Learned how to prepare crystals for the X-rays analysis at room temperature.
- Learned how to analyse and refine X-rays data.
- Detailed characterisation of Spin Ice crystals Dy_2 Ti_2O_7, $Ho_2Ti_2O_7$ and relative pyrochlore compounds with structural defects.

2011–Present **Characterisation using SQUID**, Clarendon Laboratory, Oxford University.
Developed basic knowledge of the SQUID data analysis, under the supervision of Dr. D. Prabhakaran.

Detailed achievements:
- Learned how to prepare crystals for the SQUID analysis in a range of temperatures $2 \leq T \leq 300$ K.
- Learned how to analyse and refine SQUID data, in particular:
  - Hysteresis loop.
  - DC Susceptibility measurements.

2011–Present **Characterisation using PPMS**, Clarendon Laboratory, Oxford University.
Developed basic knowledge of the PPMS data analysis, under the supervision of Dr. D. Prabhakaran.

Detailed achievements:
- Learned how to prepare crystals for the PPMS analysis in a range of temperatures $2 \leq T \leq 300$ K.
- Learned how to analyse and refine PPMS data for heat capacity measurements.

— Local Contact Experience: —

2016–Present **Local Contact for CNCS BL-5, SEQUOIA BL-17, ARCS BL-18 and HYSPEC BL-14b**, at Oak Ridge National Laboratory.
User support as a beam-line local contact.

Detailed achievements:
- Expertise in local contact for the four direct geometry chopper spectrometers.
- Learn how to manage a beam-line, solve hardware and software problems related to the instrument.
- Involved in the development of software and hardware upgrades.
- Support the upgrade of the new radial collimator at CNCS (BL-5).
- Support the transition of CNCS (BL-5) to the new CSS software.
- Support the user program supervising users during their experiments and data analysis.
- Supervise that users respect the DOE code of conduct about health and safety at the beam-line.

List of Publications:

39) **G. Sala**, J. Y. Lin, T. J. Williams, M. B. Stone and A. D. May: *"Ferrimagnetic spin-waves in the honeycomb and triangular layer of $Mn_3Si_2Te_6$"* submitted to Phys. Rev X (2021).

38) Yongqiang Cheng, **G. Sala**, Anne Campbell, J. Y. Y. Lin, K. Ramic, F. Islam, A. Qteish, B. Marsden, D. Abernathy, M. B. Stone, Iyad Al-Qasir: *"Neutron Thermalization in Nuclear Graphite: A modern story of a Classic Moderator"* Accepted Journal of Nuclear Materials (2021).

37) M. G. Hermann, R. P. Stoffel, I. Sergueev, H. C. Wille, O. Leupold, M. Ait Haddouch, **G. Sala**, D. L. Abernathy, J. Voigt, R. P. Hermann, R. Dronskowski and K. Friese: *"Lattice dynamics of the $Sb_2Te_{3-x}Se_x$ solid solution from experiment and theory"* Submitted Phys. Rev. X (2021).

36) **G. Sala**, Yuto Ishii, M. B. Stone, V. O. Garlea, Hao Zhang, S. Calder, Jie Chen, Hiroyuki Yoshida, Shuhei Fukuoka, Kazunari Yamaura, C. Batista, and A. D. Christianson: *"Nontrivial topology in the Shastry-Sutherland lattice with ferromagnetic dimers"* Accepted Phys. Rev. B (2021).

35) Binod K. Rai, G. Pokharel, H. S. Arachchige, S-H Do, Q. Zhang, M. Matsuda, M. Frontzek, **G. Sala**, O. Garlea, A. D. Christianson, A. F. May: *"Complex magnetic phases in the polar tetragonal inter-metallic $NdCoGe_3$"* Phys. Rev. B **103**, 014426 **Editors' Suggestion** (2021).

34) **G. Sala**, M. B. Stone, Binod K. Rai, A. F. May, Pontus Laurell, V. O. Garlea, N. P. Butch, M. D. Lumsden, G. Ehlers, G. Pokharel, D. Mandrus, D. S. Parker, S. Okamoto, G. B. Halasz, A. D. Christianson: *"Van Hove singularity in the magnon spectrum of the antiferromagnetic quantum honeycomb lattice"* Nature Communications **12**, 171 (2021).

33) I. I. Al-Qasir, A. A. Campbell, **G. Sala**, J. Y. Y. Lin, Y. Cheng, F. F. Islam, D. l. Abernathy and M. B. Stone: *"Vacancy-driven variations in the phonon density of states of fast neutron irradiated nuclear graphite"* Carbon **168**, 42-54 (2020).

32) Vera Bocharova, Anne-Caroline Genix, Alexander Kisliuk, **G. Sala**, Naresh Osti, Eugene Mamontov, Alexei P. Sokolov: *Role of fast dynamics in conductivity of polymerised ionic liquids* J. Phys. Chem. B **124**, 46, 10539-10545 (2020).

31) X. Bai, R. S. Fishman, **G. Sala**, D. M. Pajerowski, V. O. Garlea, T. Hong, M. Lee, J. A. Fernandez-Baca, H. B. Cao, and W. Tian,: *"Magnetic Excitations of the Hybrid Multiferroic $(ND_4)_2FeCl_5D_2O$"* Nat. Phys. (in review) (2020).

30) Lise O. Sandberg, Richard Edberg, Kasper S Pedersen, Monica C. Hatnean, Geetha Balaskrishnan, Lucile Mangin-Thro, A. Wildes, B Fak, G. Ehlers, **G. Sala**, P. Henelius, K. Lefmann, P. P. Deen: *"Emergent Magnetic behaviour in the frustrated $Yb_3Ga_5O_{12}$ garnet"* Phys. Rev. Mat. (accepted in review) (2020).

29) A. Scheie, J. Kindervater, S. Zhang, H.J. Changlani, **G. Sala**, G. Ehlers, A. Heinemann, G. S. Tucker, S.M. Koohpayeh, C. Broholm: *"Multiphase Magnetism in $Yb_2Ti_2O_7$"* Proceedings of the National Academic of Science (2020).

28) G. Pokharel, H. S. Arachchige, T. J. Williams, A. F. May, R. S. Fishman, **G. Sala**, S. Calder, G. Ehlers, D. S. Parker, T. Hong, A. Wildes, D. Mandrus, J. A. M. Paddison, A. D. Christianson: *"Cluster Frustration in the Breathing Pyrochlore Magnet $LiGaCr_4S_8$"* Phys. Rev. Letter **125**, 167201 **Editors' Suggestion** (2020).

27) B. K. Rai, **G. Sala**, A. D. Christianson, M. B. Stone, Y. Liu and A. F. May: *"Magnetism of Nd_2O_3 single crystals near the Neel temperature"* Phys. Rev. B **102**, 054434 (2020).

26) Markus G. Herrmann, R. P. Stoffel, Ilya Sergueev, Hans-Christian Wille, Olaf Leupold, Mohammed Ait Haddouch, **G. Sala**, D. L. Abernathy, J. Voigt, R. P. Hermann, R. Dronskowski, K. Friese: *"Lattice Dynamics of Sb_2Se_3 from inelastic neutron and X-ray scattering"* Physica Status Solidi B **257**, 2000063 (2020).

25) D. D. Maharaj, **G. Sala**, M. B. Stone, E. Kermarrec, C. Ritter, F. Fauth, C. A. Marjerrison, A. Paramekanti, J. E. Greedan and B. D. Gaulin: *"Octupolar vs Neel order in cubic $5d^2$ double perovskite"* Phys. Rev. Lett. **124**, 087206 (2020).

24) **G. Sala**, M. B. Stone, Binod K. Rai, A. F. May, D. S. Parker, Gabor B. Halasz, Y. Q. Cheng, G. Ehlers, V. O. Garlea, Q. Zhang, M. D. Lumsden, and A. D. Christianson: *"Crystal field splitting, local anisotropy, and low energy excitations in quantum magnet $YbCl_3$"* Phys. Rev. B(R) **100**, 180406 (2019).

23) J. Y. Lin, F. Islam, **G. Sala**, I. Lumsden, H. Smith, M. Doucet, M. B. Stone, D. L. Abernathy, G.Ehlers, J. F. Ankner and G. E. Granroth: *"Recent developments on MCViNE and its applications at SNS"* Journal of Physics Communications **3**, 085005 (2019).

22) Y. Cai, M.N. Wilson, J. Beare, C. Lygouras, G. Thomas, D.R. Yahne, K. Ross, K.M. Taddei, **G. Sala**, H.A. Dabkowska, A.A. Aczel, and G.M. Luke: *"Crystal field and magnetic structure of the Ising anti-ferromagnet $Er_3Ga_5O_{12}$"* Phys. Rev. B **100**, 184415 **Editors' Suggestion** (2019).

21) M. B. Stone, **G. Sala**, J. Y. Lin: *"Design of a radial collimator for the SEQUOIA direct geometry chopper spectrometer"* Physica B: Cond. Matt. **564**, 17-21 (2019).

20) G. Ehlers, **G. Sala**, J. Y. Lin, V. B. Graves: *"Future directions for spectroscopy at the Spallation Neutron Source"* Physica B: Cond. Matt. **564**, 5-9 (2019).

19) L. S. Wu, S. E. Nikitin, M. Brando, L. Vasylechko, G. Ehlers, M. Frontzek, A. T. Savici, **G. Sala**, A. D. Christianson, M. D. Lumsden, and A. Podlesnyak: *"Antiferromagnetic ordering and dipolar interactions of $YbAlO_3$"* – Phys. Rev. B **99**, 195117 (2019).

18) L. Clark, **G. Sala**, D. D. Maharaj, M. B. Stone, K. S. Knight, M. T. F. Telling, X. Wang, Xianghan Xu, Jaewook Kim, Yanbin Li, Sang-Wook Cheong and B. D. Gaulin: *"Two-dimensional Magnetic Correlations in the Triangular-honeycomb Anti-ferromagnet $TbInO_3$"* – Nature Phys. **15**, 262-268 (2019).

17) Bin Gao, Tong Chen, David W. Tam, Chien-Lung Huang, Kalyan Sasmal, Devashibhai T. Adroja, Feng Ye, Huibo Cao, **G. Sala**, M. B. Stone, Christopher Baines, Joel A. T. Verezhak, Haoyu Hu, Jae-Ho Chung, Xianghan Xu, Sang-Wook Cheong, Manivannan Nallaiyan, Stefano Spagna, M. Brian Maple, Andriy H. Nevidomskyy, Emilia Morosan, Gang Chen and Pengcheng Dai: *"Experimental signatures of a quantum spin liquid in effective spin-1/2 Ce_2Zr_2O7 pyrochlore"* – Nature Phys. **15**, 1052-1057 (2019).

16) L. S. Wu, S. E. Nikitin, Z. Wang, W. Zhu, C. D. Batista, A. M. Tsvelik, A. M. Samarakoon, D. A. Tennant, M. Brando, L. Vasylechko, M. Frontzek, A. T. Savici, **G. Sala**, G. Ehlers, A. D. Christianson, M. D. Lumsden and A. Podlesnyak: *"Tomonaga-Luttinger Liquid behaviour and Spinon Confinement in $YbAlO_3$"* – Nature Communications **10**, 698 (2019).

15) Gavin Hester, H. S. Nair, T. Reeder, D. R. Yahne, T. N. DeLazzer, L. Berges, D. Ziat, J. R. Neilson, A. A. Aczel, **G. Sala**, J. A. Quilliam, and K. A. Ross: *"Novel strongly Spin-orbit coupled quantum dimer magnet: $Yb_2Si_2O_7$"* Phys. Rev. Lett. **123**, 027201 (2019).

14) G. Ehlers, **G. Sala**, F. Gallmeier and K. W. Herwig: *"Figure-of-merit for a Cold Coupled Moderator at the SNS Second Target Station suited for Direct Geometry Inelastic Spectrometers"* – Jour. of Physics: Conf. Series **1021**, 012031 (2018).

13) J. Gaudet, A. M. Hallas, C. R. C. Buhariwalla, **G. Sala**, M. B. Stone, M. Tachibana, K. Baroudi, R. J. Cava, and B. D. Gaulin: *"Magneto-elastic induced vibronic bound state in the spin ice pyrochlore Ho_2Ti_2O7"* – Phys. Rev. B **98**, 014419 (2018).

12) **G. Sala**, M. B. Stone, B. K. Rai, A. F. May, C. R. Dela Cruz, H. Suriya Arachchige, G. Ehlers, V. R. Fanelli, V. O. Garlea, M. D. Lumsden, D. Mandrus and A. D. Christianson: *"New unprecedented physical properties of the Trigonal binary compound Nd_2O_3"* – Phys. Rev. Mat. **2**, 114407 **Editors' Suggestion** (2018).

11) C. Mauws, A. M. Hallas, **G. Sala**, A. A. Aczel, P. M. Sarte, J. Gaudet, D. Ziat, J. A. Quilliam, J. A. Lussier, M. Bieringer, H. D. Zhou, A. Wildes, M. B. Stone, D. Abernathy, G. M. Luke, B. D. Gaulin, and C. R. Wiebe: *"The Ising Anti-ferromagnet $Sm_2Ti_2O_7$: A Magnetic-Moment Fragmentation Candidate"* – Phys. Rev. B **98**, 10401(R) (2018).

10) D. D. Maharaj, **G. Sala**, C. A. Marjerrison, M. B. Stone, J. E. Greedan, B. D. Gaulin: *"Spin gaps in the ordered states of $La_2LiXO_6(X = Ru, Os)$ and their relation to distortion of the cubic double perovskite structure in $4d^3$ and $5d^3$ magnets."* – Phys. Rev. B **98**, 104434 (2018).

9) **G. Sala**, D. D. Maharaj, M. B. Stone, H. A. Dabkowska, B. D. Gaulin: *"Crystal Field excitations from Yb3+ ions at defective sites in highly stuffed $Yb_2Ti_2O_7$"* – Phys. Rev. B **97**, 224409 (2018).

8) **G. Sala**, J. Y. Lin, V. B. Graves, G. Ehlers: *"Conceptual design of CHESS, a new direct geometry inelastic neutron spectrometer dedicated to studying small samples"* – Journal of Applied Crystallography **51**, 282-293 (2018).

7) **G. Sala**, S. Mašková, M. B. Stone: *"Frustrated Ground State in the metallic Ising anti-ferromagnet Nd_2Ni_2In"* – Phys. Rev. Mat. **1**, 054404 (2017).

6) C. M. Thompson, C. A. Marjerrison, A. Z. Sharma, C. R. Wiebe, D. Maharaj, **G. Sala**, R. Flacau, A. Hallas, Y. Cai, B.D. Gaulin, G.M. Luke and J.E. Greedan: "Frustrated Magnetism in the Double Perovskite La_2LiOsO_6. A Comparison with La_2LiRuO_6" – Phys. Rev. B **93**, 014431 (2016).

5) C. A. Marjerrison, C. M. Thompson, **G. Sala**, D. D. Maharaj, E. Kermarrec, Y. Cai ,A. Hallas, T.J.S. Munsie, G.E. Granroth, R. Flacau J.E. Greedan , B.D. Gaulin, G.M. Luke: "Cubic Re6+ (5d1) Double Perovskites, Ba_2MgReO_6, Ba_2ZnReO_6 and $Ba_2Y_{2/3}ReO_6$. Magnetism, Heat Capacity, μSR , Neutron Scattering Studies and Comparison with Theory." Inorganic Chemistry **55**(20), 10701-10713 (2016).

4) J. Gaudet, D. D. Maharaj, **G. Sala**, E. Kermarrec, K. A. Ross, H. A. Dabkowska, A. I. Kolesnikov, G. E. Granroth, B. D. Gaulin: *"Neutron Spectroscopic Study of Crystalline Electric Field Excitations in Stochiometric and Lightly Stuffed $Yb_2Ti_2O_7$"* – Phys. Rev. B **92**, 134420 (2015).

3) **G. Sala**, M. J. Gutmann, D. Prabhakaran, D. Pomaranski, C. Mitchelitis, J. B. Kycia, D. G. Porter, C. Castelnovo, and J. P. Goff: *"Vacancy defects and monopole dynamics in oxygen-deficient pyrochlores"* – Issue on Notiziario Neutroni e Luce di Sincrotrone (2014).

2) **G. Sala**, M. J. Gutmann, D. Prabhakaran, D. Pomaranski, C. Mitchelitis, J. B. Kycia, D. G. Porter, C. Castelnovo, and J. P. Goff: *"Vacancy defects and monopole dynamics in oxygen-deficient pyrochlores"* – Nature Materials **13**, 488–493 (2014).

1) **G. Sala**, C. Castelnovo, R. Moessner, S. L. Sondhi, K. Kitagawa, M. Takigawa, R. Higashinaka, and Y. Maeno: *"Magnetic Coulomb Fields of Monopoles in Spin Ice and Their Signatures in the Internal Field Distribution"* – Phys. Rev. Lett. **108**, 217203 (2012).

Articles in Preparation:

2) **G. Sala**, M. B. Stone, Binod K. Rai, A. F. May and A. D. Christianson: *"The "Dark" Crystal Field transitions in the Ising ferromagnet $NdCl_3$"* Phys. Rev. B (in preparation) (2021).

1) **G. Sala** and V. O. Garlea: *"Characterisation of the new quantum spin liquid candidate $K_3Yb(VO_4)_2$"* in preparation (2021).

Technical Reports:

3) **G. Sala**: *"Design Criteria Document of the Direct Geometry Chopper Spectrometer CHESS"* (2021).

2) **G. Sala** et al.: *"Spallation Neutron Source: Second Target Station Integrated System Update"* (2020).

1) **G. Sala** et al.: *"First Experiments Report at the Spallation Neutron Source"* (2019).

Reviewing Activities:

The following is a list of reviewing activities I am currently performing.

2) Reviewer for the User Proposals for the Japan Proton Accelerator Research Complex (JPARC) JAPAN

1) Reviewer for Physical Review Journals (Phys. Rev. B, X, Lett.)

Acknowledgements:

The following is a list of papers and/or thesis that acknowledged my contributions in their research.

5) M. Daum: *"Monte Carlo Neutron Scattering Techniques and their Applications to Triple Axis Spectrometers"* PhD Thesis in preparation (2021).

4) D. D. Maharaj: *"Neutron studies on magnets with frustrated architectures"* PhD Thesis (2020).

3) D. F. Bowman, E. Cemal, T. Lehner, A. R. Wildes, L. Mangin-Thro, G. J. Nilsen, M. J. Gutmann, D. J. Voneshen, D. Prabhakaran, A. T. Boothroyd, D. G. Porter, C. Castelnovo, K. Refson and J. P. Goff : *"Role of defects in determining the magnetic ground state of ytterbium titanate"* – Nature Communications **10**, 637 (2019).

2) Bruno Tomasello, Claudio Castelnovo, Roderich Moessner, and Jorge Quintanilla: *"Correlated Quantum Tunnelling of Monopoles in Spin Ice."* – Phys. Rev. B (2018).

1) Gang Chen and Leon Balents: *"Erratum: Spin-orbit coupling in d^2 ordered double perovskites"* – Phys. Rev. B **91**, 219903(E) (2015).

Referee Contacts and Collaborators:

The following is a list of potential referees and collaborators that can be contacted for recommendation letters.

Dr. Mark D. Lumsden	Neutron Scattering Division (Spectroscopy), Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA — lumsdenmd@ornl.gov
Dr. Georg Ehlers	Neutron Technologies Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA — ehlersg@ornl.gov
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Prof. Bruce Gaulin	Department of Physics and Astronomy, McMaster Univerisity, 1280 Main St West Hamilton, ON L8S 4L8, CANADA. — bruce.gaulin@gmail.com
Prof. Jon P. Goff	Department of Physics, Royal Holloway University of London, Egham TW20 0EX, UK. — Jon.Goff@rhul.ac.uk
Dr. Matthias J. Gutmann	ISIS Facility, Rutherford Appleton Laboratory, Chilton, Didcot OX11 0QX, UK. — matthias.gutmann@stfc.ac.uk
Dr. Claudio Castelnovo	Theory of Condensed Matter group, Cavendish Laboratory, University of Cambridge, Cambridge CB3 0HE, UK. — cc726@cam.ac.uk
Prof R. Moëssner	Max Planck Institute for the Physics of Complex Systems, Dresden. – moessner@pks.mpg.de
Dr. D. Prabhakaran	Department of Physics, University of Oxford, Oxford OX1 3PU, UK. — d.prabhakaran1@physics.ox.ac.uk

Computer skills:

Basic	JAVA, Adobe Reader, X-rays data analysis (both Gemini and Supernova), SQUID data analysis, PPMS data analysis
Intermediate	Jana2006, Fullprof, SXD2001, VESTA, LaTeX, OpenOffice, Linux, Microsoft Windows, Mac, CAD editors, GIMP, DAVE, Matlab, Spice, Python, CSS
Advanced	Mathematica, C and C++ programming, McStas and MCViNE ray tracing softwares, Mantid

Communication Skills:

March 2020	Oral presentation at the virtual APS March meeting. Title: "Van Hove singularity in the 2D system $YbCl_3$."
July 2019	Invited speaker at ACA in Kentucky. Title: "Frustrated Magnetism on Nd-based Shastry-Sutherland (SS) lattices."

April 2019	Invited speaker at Los Alamos National Laboratory. Title: "Comparison of the frustrated magnetism on Nd-based Shastry-Sutherland (SS) lattices."
March 2019	Oral presentation at APS March meeting in Boston. Title: "Physical properties of the trigonal binary compound Nd_2O_3."
March 2018	Oral presentation at APS March meeting in Los Angeles. Title: "Frustrated Ground State in the metallic Ising 2D anti-ferromagnet Nd_2Ni_2In."
July 2017	Poster Presentation at ORNL for ORPA. Title: "CHESS: a look into the next generation of neutron spectrometers."
May 2017	Oral Presentation at ORNL for the Neutron Day. Title: "CHESS: a look into the next generation of neutron spectrometers."
March 2016	Oral Presentation at the APS March meeting in Baltimore. Title: "A new novel quantum spin liquid $TbInO_3$."
October 2015	Seminar at Waterloo University. Title: "Defects in Pyrochlore materials and their relations with Spin Ice crystals."
Nov. 2014	Invited Speaker at the Physical Crystallography Group meeting 2014 in Abingdon. Title: "Monte Carlo modelling of structural diffuse scattering in Oxygen deficient pyrochlores."
July 2014	Poster at the International Conference on Highly Frustrated Magnetism 2014 in Cambridge. Title: "Role of Oxygen vacancy defects on the physics of classical spin ice $Dy_2Ti_2O_7$ and $Ho_2Ti_2O_7$."
July 2013	Poster at the ICNS 2013 Conference in Edinburgh. Title: "Role of Oxygen vacancy defects on the physics of classical spin ice $Dy_2Ti_2O_7$ and $Ho_2Ti_2O_7$."
March 2013	Oral Presentation at the APS March meeting in Baltimore. Title: "Role of Oxygen vacancy defects on the physics of classical spin ice $Dy_2Ti_2O_7$ and $Ho_2Ti_2O_7$."
Sept. 2012	Poster at the annual SEPnet conference in Southampton. Title: "Review of the physics in classical spin ice systems."
March 2012	Oral Presentation at the Open University of Milton Keynes. Title: "Direct simulations of the monopole magnetic field and its signature in classical spin ice."
Dec. 2011	Poster at the IOP conference in Manchester. Title: "Internal field distribution in classical spin ice compounds $Dy_2Ti_2O_7$ and $Ho_2Ti_2O_7$."
October 2011	Poster at the Kavili Royal Society International Centre for the Highly Frustrated Magnetism Conference. Title: "Internal field distribution in classical spin ice compounds $Dy_2Ti_2O_7$ and $Ho_2Ti_2O_7$."

Languages:

Italian	**Native**	
English	**Advanced**	*Conversationally fluent, excellent writing skills*