

1 Personal details

Name: Weir, David James
Researcher identifier (ORCID): orcid.org/0000-0001-6986-0517
Website: saoghal.net
Date of CV: 1.8.2022

2 Degrees

Academic degrees

1.12.2011: PhD in Theoretical Physics, Imperial College London, United Kingdom
Supervisor: Arttu Rajantie
Title: *Quantum mechanics of topological solitons*

1.8.2007: MSci Physics with Theoretical Physics, Imperial College London, United Kingdom
Dissertation Supervisor: Andrew Parry
Title: *Wetting transitions in two dimensions*
Abdus Salam Prize (best student in year); 1st Class Honours

Docentship

1.6.2018: Title of Docent in Theoretical Physics, University of Helsinki

3 Current employment

[career stage III; held simultaneously]

Since Sep. 2019: Associate Professor, University of Helsinki
Academy Research Fellow, Helsinki Institute of Physics

4 Previous work experience

Apr. - Aug. 2019: STFC Ernest Rutherford Fellow, University of Nottingham
(90% full time)

May 2018 - Aug. 2019: University Researcher, Helsinki Institute of Physics
(10% full time Apr. - Aug. 2019)

Sept. 2016 - Apr. 2018: Postdoctoral Researcher, Helsinki Institute of Physics

Sept. 2014 - Aug. 2016: Marie Curie fellow, University of Stavanger, Norway

Sept. 2011 - Aug. 2014: Postdoctoral Researcher, Helsinki Institute of Physics

July 2007 - Sept. 2007: OpenLab summer studentship, CERN

5 Career breaks - none to date

6 Research funding and grants

- Academy Project, Sept. 2022 - Aug. 2026
(value 496 000 euros)
Topic: ‘P4T: Precision Predictions for Primordial Phase Transitions’
- Academy Research Fellow, Sept. 2019 - Aug. 2024
(personal fellowship; value 439 000 euros, plus project funding 369 000 euros)
Topic: ‘LISA and the electroweak phase transition’
- Ernest Rutherford Fellowship, Apr. 2019 - Mar. 2024
(personal fellowship; approx. full value 500 000 euros; vacated end Aug. 2019)
Topic: ‘Gravitational wave cosmology for LISA’
- University of Helsinki Three-year Grant, Jan. 2018 - Dec. 2020
(group start-up grant; value 150 000 euros)
Topic: ‘Gravitational wave cosmology for LISA’
- European Commission Marie Curie intra-European Fellowship, Sept. 2014 - Aug. 2016
(personal fellowship; value 231 000 euros)
Topic: ‘Electroweak phase transition beyond the Standard Model’
- Academy Postdoctoral Researcher, Sept. 2014 - Aug. 2017
(declined in favour of Marie Curie fellowship; value 252 000 euros)
Topic: ‘Electroweak phase transition beyond the Standard Model’

7 Research output

I developed the online tool ptplot.org to allow researchers to explore the parameter space of first-order phase transitions detectable by LISA. The source code is public.

8 Research supervision and leadership experience

Current students [Masters and above]

[Completed prior to autumn 2020: three Masters and three Doctoral theses.]

- Anna Kormu, Doctoral thesis, Jan. 2021 - present: Main supervisor
- Jani Dahl, Doctoral thesis, Sept. 2018 - present: Co-supervisor
- Tiina Minkkinen, Masters thesis, Sept. 2021 - present: Main supervisor
- Riikka Seppä, Masters thesis, Sept. 2021 - present: Main supervisor
- Satumaaria Sukuvaara, Sept. 2021 - present: Main supervisor
- Essi Vilhonen, Sept. 2021 - present: Main supervisor

Supervision of postdoctoral researchers

- Deanna Hooper, Postdoctoral researcher, Sep. 2021 - present: Main supervisor
- Daniel Cutting, Postdoctoral researcher, Sep. 2020 - May 2022: Main supervisor
- Oliver Gould, Postdoctoral researcher, June 2018 - Aug. 2020: Main supervisor

Experience as leader of research work

Principal investigator roles on High Performance computing projects:

- CSC (Finnish high performance computing centre) Grand Challenge grants: 10M hours (2017-18); pilot project for ‘Puhti’ (2019)
- Partnership for Advanced Computing in Europe Tier-0 grants: 17.6M hours (2015-16); 46M hours (2020-21)

9 Teaching merits

I have completed 25 credits of pedagogical training with the highest possible grade in each case.

9.1 General teaching experience

- 2020- Board member:
Masters Programme in Theoretical and Computational Methods (Helsinki)
- 2020- Taught undergraduate course (5 credits):
Introduction to quantum physics (Helsinki)
- 2019 Taught Master’s course (5 credits):
Gravitational waves (Helsinki)
- 2017 Invited lecture course:
Gravitational waves and cosmology (KITP China Spring School, Beijing)
- 2017 Developed and taught short course (2 credits):
Gravitational waves and cosmology (Helsinki)
- 2014 Taught Master’s course (10 credits):
Quantum Mechanics II (Helsinki)
- 2010-13 Annual short Masters course in lattice field theory (Imperial)

9.2 Production of teaching materials

- Short animated video lectures for ‘Introduction to quantum physics’ course.
- Concept, syllabus and material for both gravitational waves courses above.
- Complete set of typeset lecture notes for ‘Quantum Mechanics II’ course.

10 Other academic merits

10.1 Other merits

- 2020- Finnish delegate on the LISA Consortium Executive Board
- 2020- Membership of thesis committees for three students
- 2019- Member, Nordita committee for gravitation and cosmology (chair 2020-)
- 2019- Peer review of funding applications for organisations in Netherlands, Poland and United Kingdom
- 2017-19 Member, Organising Committee, Departmental Colloquia, Helsinki
- 2015- Member, LISA Cosmology Working Group (LISA Consortium member since 2018)
- 2013- Referee for journals (including PRL, PRD, JHEP, JCAP), over 38 papers refereed in total

10.2 Organising scientific conferences

- 2021 Senior advisory board, EAS 2021 Special Session:
Early Career Astronomers & their supporters, Netherlands
- 2018 Main organiser, Fifth LISA Cosmology Working Group workshop, Helsinki
(66 participants)
- 2017 Co-organiser, ACFI workshop, UMass Amherst
(20 participants)
- 2016 Co-organiser, Strong and Electroweak Matter (SEWM) 2016, Stavanger
(91 participants)
- 2015 Main organiser, Second LISA Cosmology Working Group workshop, Stavanger
(30 participants)

11 Scientific and societal impact

- 2020-22 Chair, Diversity in Physics, Finland (working group of Finnish Physical Society)
- 2018- Member, Helsinki Institute of Physics Communications Group, Helsinki
- 2017- Co-organiser of events on wellbeing and diversity issues (LGBTQ+, Athena SWAN, etc.)
- 2018 Co-author, Kumpula Campus Code of Conduct
- 2017-19 Member, Departmental Colloquium Committee, Helsinki
- 2017-19 Member, Departmental Wellbeing and Diversity Committee, Helsinki
- 2017 Science communication: participation in Science Slam Helsinki and Worldcon, Helsinki
- 2016 Co-organisation of exhibition at science museum Vitenfabrikken, Sandnes, Norway
- 2015- Public talks and lectures on gravitational waves

12 Other activities

12.1 Invited talks

Invited international talks and lectures, *in addition to* invited seminars to research groups (four so far in 2022, one in 2021, three in 2020), contributed talks at international meetings (one in 2020, four in 2019), and colloquia within Finland (one in 2020):

- 2022 YETI summer school, Durham, United Kingdom
- 2022 EuCAPT virtual colloquium, CERN, Switzerland [online]
- 2021 Anomalies 2021, Indian Institute of Technology Hyderabad, India [online]
- 2021 Gravitational Wave Probes of Physics Beyond the Standard Model, Tallinn [online]
- 2019 Selected topics in high energy physics, astrophysics, and cosmology, Brda, Slovenia
- 2019 Opportunities at Future High Energy Colliders workshop, IFT Madrid
- 2019 Amsterdam Cosmology Meeting, Amsterdam
- 2018 ECT* composite dark matter workshop, Trento
- 2018 Prospects for charged Higgs discovery at colliders, Uppsala
- 2018 Aspen Center for Physics, Aspen, Colorado
- 2017 Chinese Spring School on Gravitational Waves, KITP China, Beijing
- 2017 Royal Society Theo Murphy meeting, Kavli Royal Society Centre, England
- 2016 CERN Theory Workshop ('The Big Bang and the little bangs'), CERN, Geneva
- 2016 MIAPP Topical Workshop ('Why is there more matter than antimatter?'), Munich
- 2015 SFB/Transregio 55 ('Hadron Physics from Lattice QCD') Workshop, Wuppertal

International event attendance:

- 2022 Invited attendee, Science Foo Camp 2022, Google X, Mountain View
- 2019 Invited attendee, Science Foo Camp 2019, Google X, Mountain View
- 2019 Invited attendee, Sixth LISA Cosmology Working Group workshop, Madrid
- 2018 Invited attendee, Science Foo Camp 2018, Google X, Mountain View
- 2017 Invited attendee, Fourth LISA Cosmology Working Group workshop, Mainz
- 2017 Invited attendee, Science Foo Camp 2017, Google, Mountain View
- 2016 Invited attendee, Third LISA Cosmology Working Group workshop, DESY

12.2 Language skills

- English – Native;
- Finnish – B1/B2;
- French – B1;
- Norwegian – A2.

David J. Weir – Publication List

List current as of 1.8.2022.

A: Peer-reviewed scientific articles

Journal articles

- [A1] Pau Amaro Seoane *et al.*, *The Effect of Mission Duration on LISA Science Objectives*, *Gen. Rel. Grav.* **54** 3 (2022) [arXiv:2107.09665].
- [A2] Oliver Gould, Satumaaria Sukuvaara and David J. Weir, *Vacuum bubble collisions: from microphysics to gravitational waves*, *Phys. Rev. D* **104** 075309 (2021) [arXiv:2107.05657].
- [A3] Lauri Niemi, Michael Ramsey-Musolf, Tuomas V.I. Tenkanen and David J. Weir, *Thermodynamics of a two-step electroweak phase transition*, *Phys. Rev. Lett.* **126** 171802 (2021) [arXiv:2005.11332].
- [A4] Daniel Cutting, Elba Granados Escartin, Mark Hindmarsh and David J. Weir, *Gravitational waves from vacuum first order phase transitions II: from thin to thick walls*, *Phys. Rev. D* **103** 023531 (2021) [arXiv:2005.13537].
- [A5] Daniel Cutting, Mark Hindmarsh and David J. Weir, *Vorticity, kinetic energy, and suppressed gravitational wave production in strong first order phase transitions*, *Phys. Rev. Lett.* **125** 021302 (2020) [arXiv:1906.00480].
- [A6] Chiara Caprini *et al.*, *Detecting gravitational waves from cosmological phase transitions with LISA: an update*, *JCAP* **2003** 024 (2020), [arXiv:1910.13125].
- [A7] Oliver Gould, Jonathan Kozaczuk, Lauri Niemi, Michael J. Ramsey-Musolf, Tuomas V. I. Tenkanen and David J. Weir, *Nonperturbative analysis of the gravitational waves from a first-order electroweak phase transition*, *Phys. Rev. D* **100** 115024 (2019) [arXiv:1903.11604].
- [A8] Lauri Niemi, Hiren H. Patel, Michael J. Ramsey-Musolf, Tuomas V. I. Tenkanen and David J. Weir, *Electroweak phase transition in the Σ SM - I: Dimensional reduction*, *Phys. Rev. D* **100** 035002 (2019) [arXiv:1802.10500].
- [A9] Tyler Gorda, Andreas Helset, Lauri Niemi, Tuomas V.I. Tenkanen and David J. Weir, *Three-dimensional effective theories for the two Higgs doublet model at high temperature*, *JHEP* **1902** 081 (2019), [arXiv:1802.05056].
- [A10] Mark Hindmarsh, Anna Kormu, Asier Lopez-Eiguren and David J. Weir, *Scaling in necklaces of monopoles and semipoles*, *Phys. Rev. D* **98** 103533 (2018), [arXiv:1809.03384].
- [A11] Jens O. Andersen, Tyler Gorda, Andreas Helset, Lauri Niemi, Tuomas V. I. Tenkanen, Anders Tranberg, Alekski Vuorinen and David J. Weir, *Nonperturbative analysis of the electroweak phase transition in the Two Higgs Doublet Model*, *Phys. Rev. Lett.* **121** 191802 (2018), [arXiv:1711.09849].

- [A12] Ray J. Rivers, Danièle A. Steer, Chi-Yong Lin, Da-Shin Lee and David J. Weir, *When are two fermions a simple boson? New Gross-Pitaevskii actions for cold Fermi condensates*, *Ann. Phys. (N.Y.)* **396** 495 (2018), [arXiv:1609.05435].
- [A13] Daniel Cutting, Mark Hindmarsh and David J. Weir, *Gravitational waves from vacuum first-order phase transitions: from the envelope to the lattice*, *Phys. Rev. D* **97** 123513 (2018), [arXiv:1802.05712].
- [A14] Anders Tranberg, Sara Tähtinen and David J. Weir, *Gravitational waves from non-abelian gauge fields at a tachyonic transition*, *JCAP* **1804** 012 (2018), [arXiv:1706.02365].
- [A15] David J. Weir, *Gravitational waves from a first order electroweak phase transition: a brief review*, *Phil. Trans. Roy. Soc. A* **376** 0126 (2018), [arXiv:1705.01783].
- [A16] Mark Hindmarsh, Stephan J. Huber, Kari Rummukainen and David J. Weir, *Shape of the acoustic gravitational wave power spectrum from a first order phase transition*, *Phys. Rev. D* **96** 103520 (2017), [arXiv:1704.05871].
- [A17] Mark Hindmarsh, Kari Rummukainen and David J. Weir, *Numerical simulations of necklaces in SU(2) gauge-Higgs field theory*, *Phys. Rev. D* **95** 063520 (2017), [arXiv:1611.08456].
- [A18] Tomáš Brauner, Tuomas V. I. Tenkanen, Anders Tranberg, Aleksi Vuorinen and David J. Weir, *Dimensional reduction of the Standard Model coupled to a new singlet scalar field*, *JHEP* **1703** 007 (2017), [arXiv:1609.06230].
- [A19] Mark Hindmarsh, Kari Rummukainen and David J. Weir, *New solutions for non-Abelian cosmic strings*, *Phys. Rev. Lett.* **117** 251601 (2016), [arXiv:1607.00764].
- [A20] David J. Weir, *Revisiting the envelope approximation: gravitational waves from bubble collisions*, *Phys. Rev. D* **93** 124037 (2016), [arXiv:1604.08429].
- [A21] Chiara Caprini *et al.*, *Science with the space-based interferometer eLISA. II: Gravitational waves from cosmological phase transitions*, *JCAP* **1604** 001 (2016), [arXiv:1512.06239].
- [A22] Kari Enqvist, Sami Nurmi, Stanislav Rusak and David J. Weir, *Lattice calculation of the decay of the primordial Higgs condensate*, *JCAP* **1602** 057 (2016), [arXiv:1506.06895].
- [A23] Mark Hindmarsh, Stephan J. Huber, Kari Rummukainen and David J. Weir, *Numerical simulations of acoustically generated gravitational waves at a first order phase transition*, *Phys. Rev. D*, **92** 123009 (2015), [arXiv:1504.03291].
- [A24] Mark Hindmarsh, Kari Rummukainen, Tuomas V.I. Tenkanen and David J. Weir, *Improving cosmic string network simulations*, *Phys. Rev. D* **90** 043539 (2014), [arXiv:1406.1688].
- [A25] Anders Tranberg and David J. Weir, *On the quantum stability of Q-balls*, *JHEP* **1404** 184 (2014), [arXiv:1310.7487].
- [A26] Mark Hindmarsh, Stephan J. Huber, Kari Rummukainen and David J. Weir, *Gravitational waves from the sound of a first order phase transition*, *Phys. Rev. Lett.* **114** 041301 (2014), [arXiv:1304.2433].

- [A27] David J. Weir *et al.*, *Gaussianity revisited: Exploring the Kibble-Zurek mechanism with superconducting rings*, published in a special section (‘Condensed matter applications of cosmology’) of *J. Phys.: Cond. Matter* **25** 404207 (2013), [arXiv:1302.7296].
- [A28] David J. Weir, Roberto Monaco and Ray J. Rivers, *Defect formation in superconducting rings: external fields and finite-size effects*, *J. Low Temp. Phys.* **171** 788 (2013), [arXiv:1208.3426].
- [A29] Arttu Rajantie, Kari Rummukainen and David J. Weir, *Form factor and width of a quantum string*, *Phys. Rev. D* **86** 125040 (2012), [arXiv:1210.1106].
- [A30] Carl M. Bender and David J. Weir, *PT phase transition in multidimensional quantum systems*, *J. Phys. A* **45** 425303 (2012), [arXiv:1206.5100].
- [A31] Jutho Haegeman *et al.*, *Variational matrix product ansatz for dispersion relations*, *Phys. Rev. B* **85** 100408 (2012) [arXiv:1103.2286].
- [A32] Arttu Rajantie and David J. Weir, *Nonperturbative study of the 't Hooft-Polyakov monopole form factors*, *Phys. Rev. D* **85** 025003 (2012), [arXiv:1109.0299].
- [A33] Arttu Rajantie and David J. Weir, *Soliton form factors from lattice simulations*, *Phys. Rev. D* **82** 111502 (2010), [arXiv:1006.2410].
- [A34] David J. Weir, *Studying a relativistic field theory at finite density using the density matrix renormalization group*, *Phys. Rev. D* **82** 025003 (2010), [arXiv:1003.0698].
- [A35] Arttu Rajantie and David J. Weir, *Quantum kink and its excitations*, *JHEP* **0904** 068 (2009), [arXiv:0902.0367].

Conference proceedings

- [A36] Lauri Niemi, Kari Rummukainen, Riikka Seppä and David J. Weir, *Infrared physics of the SU(2) Georgi-Glashow crossover transition*, *PoS LATTICE2021* (2022) 041, [arXiv:2111.09097].
- [A37] David J. Weir, *Acoustic waves and the detectability of first-order phase transitions by eLISA*, *J. Phys.: Conf. Ser.* **840** 012031 (2017).
- [A38] Joni M. Suorsa *et al.*, *Mass anomalous dimension of SU(2) with $N_f = 8$ using the spectral density method*, *PoS LATTICE2015* (2015) 247, [arXiv:1511.03468].
- [A39] Teemu Rantalaiho *et al.*, *Investigating the Sharpe-Singleton scenario on the lattice by direct eigenvalue computation*, *PoS LATTICE2013* (2014) 118, [arXiv:1311.1680].
- [A40] Simon Catterall, Dhagash Mehta and David J. Weir, *Eigenvalue spectrum of lattice $\mathcal{N} = 4$ super Yang-Mills*, *PoS LATTICE2013* (2014) 093, [arXiv:1311.3676].
- [A41] Carlos Aguado Sanchez *et al.*, *Volunteer Clouds and citizen cyberscience for LHC physics*, *J. Phys.: Conf. Ser.* **331** 062022 (2011).

- [A42] David J. Weir and Ray J. Rivers, *Fluxoid formation: size effects and non-equilibrium universality*, *J. Phys.: Conf. Ser.* **286** 012056 (2011), [arXiv:1105.2349].
- [A43] Ben Segal *et al.*, *LHC cloud computing with CernVM*, *PoS ACAT2010* (2010) 004.
- [A44] Ben Segal *et al.*, *Building a volunteer cloud*, Conferencia Latinoamericana de Computación de Alto Rendimiento (2009).
- [A45] Carl M. Bender, Joshua Feinberg, Daniel Hook and David J. Weir, Proceedings of PHHQP VIII, *Complex systems in chaotic phase space*, *Pramana* **73** (2009) 453-470, [arXiv:0809.1975].

B: Non-refereed scientific articles

- [B1] Jean-Baptiste Bayle *et al.* *Workshop on Gravitational-Wave Astrophysics for Early Career Scientists*, *Nature Astron.* **6** 304 (2022), [arXiv:2111.15596].

Preprints available on arXiv, submitted to journals:

- [B2] Lauri Niemi, Kari Rummukainen, Riikka Seppä and David J. Weir, *Infrared physics of the 3D SU(2) adjoint Higgs model at the crossover transition*, arXiv:2206.14487.
- [B3] Pierre Auclair *et al.* *Generation of gravitational waves from freely decaying turbulence*, arXiv:2205.02588.
- [B4] Pierre Auclair *et al.* [LISA Cosmology Working Group] *Cosmology with the Laser Interferometer Space Antenna*, 2204.05434 [endorsing author only].
- [B5] Daniel Cutting, Essi Vilhonen and David J. Weir, *Droplet collapse during strongly supercooled transitions*, arXiv:2204.03396.
- [B6] Robert Caldwell *et al.*, *Detection of Early-Universe Gravitational Wave Signatures and Fundamental Physics*, arXiv:2203.07972.
- [B7] Jani Dahl, Mark Hindmarsh, Kari Rummukainen and David J. Weir, *Decay of acoustic turbulence in two dimensions and implications for cosmological gravitational waves*, arXiv:2112.12013.

G: Theses

- [G1] David J. Weir, *Quantum mechanics of topological solitons*, Imperial College London, 2011. PhD. thesis.