Paul BARRÈRE

Curriculum Vitae

Chemin Pegasi 51
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Switzerland
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ORCID-ID: 0000-0002-4441-5625

Research interests

Objects — Magnetar formation, core-collapse supernovae, stellar physics

Physics — Magnetohydrodynamics (MHD), dynamo theory, turbulence, instabilities

Methods — Numerical simulations, high performance computing (HPC), computational fluid dynamics (CFD)

Postdoctoral research

Since 10/2024 **Postdoctoral researcher**, *Observatory of Geneva, Switzerland.*

Education

2024 **PhD in Astronomy and Astrophysics**, *CEA Saclay/AIM – Paris-Saclay University*, Paris, France.
Thesis: *Modelling magnetar formation*
Supervisors: Jérôme Guilet & Raphaël Raynaud

2021 **Master's degree of Science in astronomy and astrophysics (Magistère)**, *Paris-Cité University*, Paris, France.
With honours

2019 **Bachelor's degree of Science in physics (Magistère)**, *Paris Diderot University - P7*, Paris, France.
With honours

2016 **Baccalauréat Série S**, *Lycée Pardailhan*, Auch, France.
With honours

Predoctoral research

08/03/2021 – 06/08/2021 **End-of-year research internship**, Magnetar formation in a protoneutron star spun up by fallback, supervised by Jérôme Guilet, *Laboratoire de Modélisation des Plasmas Astrophysiques (LMPA)*, Astrophysique Instrumentation Modélisation (CEA/AIM), Saclay, France.

01/03/2021 – 05/03/2021 **Observational internship in millimetric radioastronomy**, Caracterisation of protostellar outflows and turbulence in the L1251-A region, supervised by Pierre Guillard, *Institut de radioastronomie millimétrique (IRAM)*, Institut d'astrophysique de Paris, Paris, France.

16/05/2020 – 10/07/2020 **End-of-year research internship**, Accretion history of the Milky Way as revealed by N-body simulations, supervised by Paola Di Matteo, *Galaxies, Etoiles, Physique et Instrumentation (GEPI)*, Paris Observatory, Meudon, France.

20/05/2019 – 05/07/2019 **End-of-year research internship**, Characterisation of the magnetic field's turbulent diffusivity on the solar surface, supervised by François Rincon, *Institut de Recherche en Astrophysique et Planétologie (IRAP)*, CNRS/Paul Sabatier University, Toulouse, France.

10/10/2018 – 17/12/2018 **Work-study research internship as part of the EU *Discovery of research***, Optical resonances simulations inside microlasers with a pyramidal cavity, supervised by Giuseppe Leo and Mélanie Lebental, *Laboratoire Matériaux et Phénomènes Quantiques (LMPQ)*, University of Paris, Paris, France.

2018 – 2019 **French Physicists' Tournament**, *Took part in the preparation of one of the topics of the FPT/IPT*, Paris Diderot University, Paris, France.

Given talks and poster presentations

4 invited seminars/interviews

11/12/2023 **Interview for Postdoc Fellowship at MPA**, Stellar magnetism: from magnetars to massive stars, *Max Planck Institute for Astrophysics*, Garching, Germany.

07/12/2023 **Stellar Group Seminar**, Tayler-Spruit dynamo in a proto-neutron star: a new magnetar formation scenario, *Observatory of Geneva*, Geneva, Switzerland.

29/11/2023 **Albert Einstein Institute seminar**, Tayler-Spruit dynamo in a proto-neutron star: a new magnetar formation scenario, *Max Planck Institute for Gravitational Physics (AEI)*, Potsdam, Germany.

25/07/2023 **Zoom seminar, Department of Astronomy and Astrophysics at the University of Valencia**, Numerical simulations of the Tayler-Spruit dynamo in proto-magnetars, *Universidad de Valencia*, Valencia, Spain.

6 conferences

04/11/2024 – 07/11/2024 **Journées Programme National des Hautes Énergies 2024**, Magnetar formation through numerical simulations of the Tayler-Spruit dynamo, *APC laboratory*, Paris, France.

16/10/2023 – 27/10/2023 **MIAPbP program: stellar magnetic fields from protostars to supernovae**, Tayler-Spruit dynamo in a proto-neutron star: a new magnetar formation scenario, *MIAPbP*, Garching, Germany.

20/06/2023 – 23/06/2023 **Journées de la SF2A 2023**, Tayler-Spruit dynamo in a proto-neuton star spun up by fallback, *Université de Strasbourg*, Strasbourg, France.

27/06/2022 – 01/07/2022 **Workshop on Codes in Stellar Physics**, Presentation of the MagIC and PaRoDy codes, *Centre de Conférence Jules Janssen*, Observatoire de Paris, Meudon, France.

16/05/2022 – 19/05/2022 **PHAROS conference 2022**, A new magnetar formation scenario: Tayler-Spruit dynamo in a proto-neuton star spun up by fallback, *Sapienza Università di Roma*, Rome, Italy.

28/03/2022 – 29/03/2022 **Workshop ANR BEAMING**, Modelisation and simulations of the Tayler-Spruit dynamo in proto-neutron stars, *Institut de Recherche en Astrophysique et Planétologie (IRAP)*, Observatoire Midi-Pyrénées, Toulouse, France.

3 posters

01/07/2024 – 05/07/2024 **Annual meeting of European Astronomical Society 2024**, New magnetar formation scenario: Tayler-Spruit dynamo in a proto-neutron star spun up by fallback, *Padova Congress*, Padova, Italy.

04/06/2023 – 09/06/2023 **Thematic school GWsNS-2023: Gravitational waves from neutron stars**, Numerical simulations of the Tayler-Spruit dynamo in proto-magnetars, *Centre Paul Langevin*, Aussois, France.

28/11/2022 – 02/12/2022 **Workshop Modeling, observing and understanding flows and magnetic fields in the Earth's core and in the Sun**, Numerical simulations of the Tayler-Spruit dynamo in proto-magnetars, *Isaac Newton Institute*, University of Cambridge, Cambridge, UK.

Teaching

2022 – 2024 **Numerical methods**, *Lectures and practical works given to first-year undergraduate students (190 hours)*, Paris-Saclay University, Orsay, France.

Outreach

2022 – 2024 **Conférence Elbereth**, *Member of the organisation committee*, Paris, France.

03/11/2023 – 05/11/2023 **Scientific animation at the Explor'Espace 2023 festival**, Beffroi de Montrouge, Montrouge, France.

05/11/2021 – 07/11/2021 **Scientific animation at the Explor'Espace 2021 festival**, Beffroi de Montrouge, Montrouge, France.

Languages

French Native speaker

English C1 level

Spanish B2 level

Computing skills

Programming languages:
- Fortran 90, Python (advanced)
- MATLAB (basics+)
- SQL, Caml Light (basics)

Numerical codes
- MagIC (spectral method)
- Code to simulate light diffusion (Monte-Carlo method, development)
- Code to solve hyperbolic PDEs (Godunov scheme, develpoment)

Parallel computing
- MPI
- OpenMP

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Publication list

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Refereed/submitted publications

5. **P. Barrère**, J. Guilet, R. Raynaud, A. Reboul-Salze, *Tayler-Spruit dynamo in stably stratified rotating fluids: Application to proto-magnetars*, submitted to A&A, July 2024.
   DOI: 2407.01775
4. A. Igoshev**, P. Barrère**, R. Raynaud, J. Guilet, T. Wood, R. Hollerbach, *From proto-neutron star dynamo to low-field magnetars*, submitted to Nature Astronomy, May 2024.
3. F. Rincon**, P. Barrère**, T. Roudier, *Observational characterisation of large-scale transport and horizontal turbulent diffusivity in the quiet Sun*, submitted to A&A, April 2024.
   DOI: 2404.14383
2. **P. Barrère**, J. Guilet, R. Raynaud, A. Reboul-Salze, *Numerical simulations of the Tayler-Spruit dynamo in protomagnetars*, MNRAS Letters 526, L88-L93, August 2023.
   DOI: 10.1093/mnrasl/slad120
1. **P. Barrère** , J. Guilet, A. Reboul-Salze, R. Raynaud, & H.-T. Janka, *A new scenario for magnetar formation: Tayler-Spruit dynamo in a proto-neutron star spun up by fallback*, A&A 668, A79, December 2022.
   DOI: 10.1051/0004-6361/202244172

Conference proceedings

2. **P. Barrère**, J. Guilet, R. Raynaud, A. Reboul-Salze, *A new scenario for magnetar formation in a proto-neutron star spun up by fallback*, SF2A proceedings, 2023.
1. M. Bendahman**, P. Barrère** , A.-C. Buellet, M. Bugli, et al., *Core-collapse supernovae: from ν physics to new physics*, 38th International Cosmic Ray Conference, 2023.