Dr. Tim D. Pearce

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Research: Debris discs • Exoplanets • Planet-disc interactions • Hot exozodis • Dynamics & simulations

Employment

2024–present **Stephen Hawking Fellow**, University of Warwick, UK
Independent research fellowship funded by UKRI, worth £0.5 million over 3 years. Includes a significant outreach component.

2023–2024 **Prize Fellow**, University of Warwick, UK
3+2 year independent research fellowship, worth roughly £300-400k. Paused in May 2024 to start Hawking fellowship.

2019–2023 **Postdoctoral Researcher**, Friedrich-Schiller-Universität, Jena, Germany
Full-time research, supervision and teaching in the Theory Group.

2018–2019 **Lead Mathematical Developer**, JCT Consultancy Ltd., Lincoln, UK
Responsible for all maths and research in an industry-leading traffic-modelling company.

2016–2018 **Weapon Engineer Officer (Submariner)**, Royal Navy
Underwent extensive management, leadership, communication, administration and engineering training before joining a *Vanguard*-class submarine as an engineering officer.

2011 **Visiting Researcher**, Institute of Astronomy, University of Cambridge, UK
Summer job in the X-ray astrophysics group, characterising gas structures in galaxies.

Education

2012–2016 **PhD in Theoretical Astrophysics (awarded with no corrections)**
Institute of Astronomy, University of Cambridge, UK
Title: *Planetary Orbits and Interactions with Debris*
Supervisors: Mark Wyatt & Grant Kennedy

2008–2012 **MPhys in Physics and Astronomy (1st class Hons., 4th highest mark of 107 students)**
Durham University, UK
Masters thesis: *Modelling Hypervelocity Stars*

2006–2008 **A levels: Physics (A), Maths (A), Biology (A). AS levels: Further Maths (A)**
King Edward VII School, Melton Mowbray, UK (state school, now closed)

Observations

James Webb Space Telescope (JWST)

Cycle 4 *JEDIS: The JWST Eccentric debris DIsk Survey* (6 hrs, PI: Lovell)

Cycle 3 *Finding the great sculptors: a renaissance in planet disk dynamics* (48hrs, PI: Millar-Blanchaer)

Cycle 2 *Using planets to dynamically weigh a debris disc for the first time* (8hrs, PI: **Pearce**)

Cycle 2 DDT: *Establishing the Formation of AF Lep b with NIRCam: The Lowest-Mass Imaged Exoplanet with a Dynamical Mass* (5hrs, PI: Franson)

Cycle 1 *Using JWST to search for Planetary Sculptors in an ALMA-Selected Sample of Debris Disks* (24hrs, PI: Hinkley)

Cycle 1 *Searching for low mass planets in debris disk gaps* (11hrs, PI: Marino)

VLTI-MATISSE

2023 *Investigating the variability and morphology of hot exozodiacal dust around κ Tuc* (6hrs, PI: Stuber)

2022 *Disc or spherical shell? The architecture of hot exozodiacal dust systems observed with MATISSE* (9hrs, PI: Kirchschlager)

2021 *Mid-infrared emission of six hot exozodis* (9hrs, PI: Kirchschlager)

ALMA

2023 *Vertical structure and planetary system dynamics* (52 hrs, PI: Hughes)

2016 *Double-ring debris disks at 10s of au: probing how far out planets can form* (10 hrs, PI: Marino)

2016 *What lies beyond Exo-Jupiter planets?* (2 hrs, PI: Wyatt)

VLT-SPHERE

2023 *DDT: Enabling breakthrough science with the JWST* (3 hrs, PI: Ginski)

Student Supervision

Masters projects

2024-2025 (ongoing) **Campbell Ludlow & Alastar Knight**, primary supervisor
Title: *How thick would belts of asteroids or comets be?*

2021–2022 **Tyson Costa**, primary supervisor
Title: *Projectile stirring of a debris disc by planetesimals scattered by a planet*
Publication: Costa, Pearce & Krivov (2024)

2020–2021 **Robert Ostermann**, primary supervisor
Title: *Constraints on unseen planets in ISPY debris-disk systems*
Publication: Pearce, Launhardt, Ostermann et al. (2022)

Masters mini-projects

2022 **Marc Friebe & Richard Bernecker**, primary supervisor
Title: *Constraining planets around ϵ Eri from clumps in the debris disc*

Bachelors projects

2022 **Laura Schulze**, primary supervisor
Title: *Constraining the orbit of Fomalhaut b through mean-motion resonances*

2021 **Marc Friebe**, primary supervisor
Title: *Gaps in debris discs - the importance of planet migration*
Publication: Friebe, Pearce & Löhne (2022)

Summer projects

2024 **Noah Sims**, primary supervisor (Warwick URSS-funded project)
Title: *Explaining the intermediate debris ring around Fomalhaut*

Teaching

University of Warwick

2024-2025 **Guest lecture**, 4th-year *Planets, Exoplanets and Life* course
Wrote and delivered a new lecture on debris discs, and wrote and marked exam questions.

Pre-conference workshop: *Dust Devils - Debris Disks in the Sonoran Desert*, Tucson

2024 **Introductory lecture**, *Debris-disc dynamics*
Invited pre-conference workshop lecture, to bring undergraduates and PhD students up to speed before the conference started. Recording available here.

Friedrich-Schiller-Universität, Jena

2020-2021 **Example classes**, 4th-year *Celestial Mechanics* course
Group of 10 students. Official student feedback very positive, placing my teaching quality and engagement well above Physics-department averages in all assessment criteria.

Institute of Astronomy, University of Cambridge

2014-2016 **Example classes**, 4th-year *Planetary System Dynamics* course
Groups of 6-12 students. Taught for 2 years.

2014-2016 **Tutorials**, 3rd-year *Problems in Astrophysics* course
Supervised 3 pairs of students.

Scientific services

Membership of shortlisting & interview panels

2025 Warwick PhD positions
Assessed and shortlisted 51 applicants, conducted 17 interviews

2024 Warwick Prize Fellowships (3-year independent research positions)

Expert reviewer

2016 - present Referee for AJ, A&A, MNRAS, P&SS and the Open Journal of Astrophysics

2023 - present Reviewer for several major fellowship and grant schemes

2023 - present Reviewer of observing proposals for *JWST* and ALMA

Author of public science codes

Six programs and numerical tools available on my website and GitHub, including:

- `SculptingPlanet` - Constrain the mass and orbit of an unseen planet sculpting a debris disc.
- `GetDebrisStirringLevelInReboundSim` - Measure the level of debris-disc stirring in a Rebound simulation.
- `MinSelfStirringDiscMass` - Calculate the absolute minimum mass a debris disc requires to self-stir.
- `PlanetMassToCarveDebrisGap` - Calculate the gap carved by a planet embedded in a massive debris disc.

Conference Organisation

Session convener & chair

2025 (upcoming) *European Astronomical Society (EAS)*, Cork, Ireland
Session: *Dust, Gas and Planets in Debris Disk Systems* (SOC co-chair)

2024 *Europlanet Science Congress (EPSC)*, Berlin, Germany
Session: *The impact of planets and flybys on debris disks*

Invited Scientific Organising Committee (SOC) member

2025 (upcoming) *UK & Ireland Discs Meeting* (2nd instance), Hertfordshire, UK

2024 *Dust Devils - Debris Disks in the Sonoran Desert*, Tucson, USA

2023 *ExoPAG SAG 23 symposium*, Baltimore, USA

Organisation Panel member & session chair

2018, 2019 *JCT Traffic Signal Symposium and Exhibition*, Nottingham, UK
The primary UK conference on traffic modelling and junction design (2 instances)

Invited discussion-session chair

2024 *UK & Ireland Discs Meeting* (1st instance), Warwick, UK

2022 *Debris Discs at Home and Abroad*, Jena, Germany
Session: *Hot exozodis*

Invited session chair

2025 *UK Exoplanet Community Meeting (UKEXOM)*, Leeds, UK

2024 *Dust Devils - Debris Disks in the Sonoran Desert*, Tucson, USA
Session: *Exozodis*

Local Organising Committee (LOC) member

2024 *UK & Ireland Discs Meeting* (1st instance), Warwick, UK

2022 *Debris discs: At Home and Abroad*, Jena, Germany

2014 *Characterizing Planetary Systems Across the HR Diagram*, Cambridge, UK

Formal Collaborations

2022-present **VLTI-NOTT** Exozodi Science-Team member (exozodi science-verification for NOTT)

2022-present **ALMA-ARKS** Science-Team member (large-programme legacy survey of debris discs)

2022-present **ExoPAG SAG 23** Science-Team member (impact of exozodis on exoplanet imaging)

2020-present **NaCo-ISPY** Science-Team member (direct-imaging survey for planets)

2019-2023 **FOR 2285** Research-Unit member (DFG-funded, multi-institution collaboration)

Outreach & EDI

Maths is everywhere programme

2024-2027 Devised and leading a primary school programme to demonstrate the relevance of maths

- Aims:
  - foster an early understanding that maths has enormous applications beyond everyday life
  - counter a common view that maths is dull, difficult and irrelevant
- Provides supplementary software, showing examples of how maths lets us do amazing things
- Started development May 2024 in collaboration with schools, expecting first rollout May 2025
- Funded by UKRI/EPSRC Stephen Hawking Fellowship

Outreach qualifications

2024-present STEM outreach ambassador with DBS clearance

Invited EDI talks

2024-present Subject: *Leaving and re-entering academia - my weird career path*

- 2025: UK Exoplanet Community Meeting (UKEXOM)
- 2024: Dublin astrophysics colloquium
- 2024: Warwick *Equitea* series

Public-outreach talks

2025 Nottingham Astronomical Society (invited)
2025 Leicester Astronomical Society
2025 (upcoming) Coventry and Warwickshire Astronomical Society

School visits

2024 Visited local primary schools to teach coding and mathematics (2 instances)
2024 Hosted school visit to Warwick

Expert comment in press releases

2024 *Sky and Telescope* magazine
Article: New Views of Vega's Dusty Disk

Public open evenings

2012-2016 Regularly participated in open evenings at the Institute of Astronomy in Cambridge
- Helped run events and supervised public-observing sessions
- Gave a public talk about space elevators

Other Skills and Experience

Computing: *Python*, *C#*, *C++*, *LaTeX*, *Linux*, *Windows*. Highly experienced with n-body integrator *Rebound*.
Management: Level 5 Diploma in Management and Leadership, Chartered Management Institute, 2016.
German language: Intermediate 1 (CEFR level B1), Jena Sprachenzentrum, 2020 (awarded grade 1.7).
English language: Fluent (native speaker).

Academic Talks and Posters

Invited review talks

2022 *(Exo)Planet Diversity, Formation and Evolution*, Berlin, Germany
Title: *Debris Discs as Probes of Planetary Systems*

Contributed talks

2025 *UK Exoplanet Community Meeting (UKEXOM)*, Leeds, UK
2024 *Europlanet Science Congress (EPSC)*, Berlin, Germany
2024 *Dust Devils - Debris Disks in the Sonoran Desert*, Tucson, USA
2023 *STScI: Planetary Systems and the Origins of Life in the Era of JWST*, Baltimore, USA
2023 *PERC International Symposium on Dust & Parent Bodies 2023*, Tokyo, Japan
2022 *Debris Discs at Home and Abroad*, Jena, Germany
2022 *In the Spirit of Lyot*, Leiden, Netherlands
2022 *PERC International Symposium on Dust & Parent Bodies 2022*, Japan (Virtual)
2021 *European Astronomical Society Annual Meeting*, Leiden, Netherlands (Virtual)
2020 *Five years after HL Tau: a new era in planet formation*, Chile (Virtual)

(Outside academia April 2016 - December 2019)

2015 *Exoplanet Community Meeting*, Warwick, UK

Seminars

2025 (upcoming) *Institute for Astronomy Colloquium Series*, Edinburgh, UK
2025 (upcoming) *Midlands Discs Meeting*, Warwick, UK
2025 *Planet- & Star-Formation Seminar Series*, Heidelberg, Germany
2025 *Exoplanets Seminar Series*, Warwick, UK
2024 *Astrophysics Seminar Series*, Leeds, UK
2023 *Astrophysical Colloquium*, Jena, Germany
2023 *NOTT exozodi workshop*, Leuven, Belgium
2023 *STScI High-Contrast Imaging Seminar Series*, Baltimore, USA
2023 *Planet- & Star-Formation Seminar Series*, Heidelberg, Germany
2022 *Cambridge Exoplanet Seminar Series*, Cambridge, UK
2022 *Astrophysics Seminar Series*, Warwick, UK
2021 *TLS Institute's Colloquium*, Tautenburg, Germany (Virtual)
2021 *Mark Wyatt's Group Seminar Series*, Cambridge, UK (Virtual)
2020 - 2023 *FOR 2285 Research Unit Seminar Series*, various locations, Germany (7 talks over 3.5 years)
2020 - 2023 *AIU Seminar Series*, Jena, Germany (4 talks over 3.5 years)

(Outside academia April 2016 - December 2019)

2016 *Astrophysics Seminar Series*, Exeter, UK
2014 *Institute of Astronomy Seminar Series*, Cambridge, UK

Posters

2022 *Debris Discs at Home and Abroad*, Jena, Germany
2021 *Distorted Astrophysical Discs*, Cambridge, UK (Virtual)
2021 *Sagan Summer Workshop - Circumstellar Disks and Young Planets*, USA (Virtual)
2021 *Towards the Comprehensive Characterization of Exoplanets*, STScI, USA (Virtual)

(Outside academia April 2016 - December 2019)

2015 *In the Spirit of Lyot*, Montreal, Canada
2014 *Characterizing Planetary Systems Across the HR Diagram*, Cambridge, UK
2013 *Protostars and Planets VI*, Heidelberg, Germany

Publications

Invited first-author reviews

- Debris disks around main-sequence stars
  Pearce, 2024, accepted (arXiv: 2403.11804). To be published as a chapter in the undergraduate textbook *Encyclopedia of Astrophysics*, 1st Edition, Elsevier

First-author papers

- The effect of sculpting planets on debris-disc inner edges
  Pearce, Krivov, Sefilian et al., 2024, MNRAS, 527, 3876
- Hot exozodis: cometary supply without trapping is unlikely to be the mechanism
  Pearce, Kirchschlager, Rouillé et al., 2022, MNRAS, 517, 1436
- Planet populations inferred from debris discs: insights from 178 debris systems in the ISPY, LEECH and LIStEN planet-hunting surveys
  Pearce, Launhardt, Ostermann et al., 2022, A&A, 659, A135
- Fomalhaut b could be massive and sculpting the narrow, eccentric debris disc, if in mean-motion resonance with it
  Pearce, Beust, Faramaz et al., 2021, MNRAS, 503, 4767
- Gas trapping of hot dust around main-sequence stars
  Pearce, Krivov & Booth, 2020, MNRAS, 498, 2798

(Outside academia April 2016 - December 2019)

- Double-ringed debris discs could be the work of eccentric planets: explaining the strange morphology of HD 107146
  Pearce & Wyatt, 2015, MNRAS, 453, 3329
- Constraining the orbits of sub-stellar companions imaged over short orbital arcs
  Pearce, Wyatt & Kennedy, 2015, MNRAS, 448, 3679
- Dynamical evolution of an eccentric planet and a less massive debris disc
  Pearce & Wyatt, 2014, MNRAS, 443, 2541
- Imaged substellar companions: not as eccentric as they appear? The effect of an unseen inner mass on derived orbits
  Pearce, Wyatt & Kennedy, 2014, MNRAS, 437, 2686

Invited second-author reviews

- Review and prospects of hot exozodiacal dust research for future exo-Earth direct imaging missions
  Ertel, **Pearce**, Debes et al., 2025, PASP, 137, 31001

Second-author papers

- Increasing planet-stirring efficiency of debris disks by "projectile stirring" or "resonant stirring"
  Costa, **Pearce** & Krivov, 2024, MNRAS, 527, 7317
- The clumpy structure of ϵ Eridani's debris disc revisited by ALMA
  Booth, **Pearce**, Krivov et al., 2023, MNRAS, 521, 6180
- ISPY-NACO Imaging Survey for Planets around Young stars. The demographics of forming planets embedded in protoplanetary disks
  Cugno, **Pearce**, Launhardt et al., 2023, A&A, 669, A145
- Gap carving by a migrating planet embedded in a massive debris disc
  Friebe, **Pearce** & Löhne, 2022, MNRAS, 512, 4441

Other co-author papers

- Dust populations from 30 to 1000 au in the debris disk of HD 120326: panchromatic view with VLT/SPHERE, ALMA, and HST/STIS
  Desgrange, Milli, Chauvin et al., accepted for publication in A&A (arXiv: 2504.15352)

- JWST/NIRCam 4-5 μm Imaging of the Giant Planet AF Lep b
  Franson, Balmer, Bowler et al., 2024, ApJL, 974, L11
- How much large dust could be present in hot exozodiacal dust systems?
  Stuber, Kirchschlager, **Pearce** et al., 2023, A&A, 678, A121
- Self-gravity of debris discs can strongly change the outcomes of interactions with inclined planets
  Poblete, Löhne, **Pearce** et al., 2023, MNRAS, 526, 2017
- Astrometric Accelerations as Dynamical Beacons: A Giant Planet Imaged Inside the Debris Disk of the Young Star AF Lep
  Franson, Bowler, Zhou, **Pearce** et al., 2023, ApJL, 950, L19
- High resolution ALMA and HST images of q1 Eri: an asymmetric debris disc with an eccentric Jupiter
  Lovell, Marino, Wyatt et al., 2021, MNRAS, 506, 1978
- LIStEN: L' band Imaging Survey for Exoplanets in the North
  Musso Barcucci, Launhardt, Müller et al., 2021, A&A, 645, A88
- Resolving the outer ring of HD 38206 using ALMA and constraining limits on planets in the system
  Booth, Schulz, Krivov et al., 2021, MNRAS, 500, 1604

(Outside academia April 2016 - December 2019)

- An M-dwarf star in the transition disk of Herbig HD 142527
  Lacour, Biller, Cheetham et al., 2016, A&A, 590, A90