UNIVERSITY OF LEICESTER

Evolution and dynamics of planet-forming discs

• Creating new theoretical/computational models of planet-forming discs. • Simulating observations, in order to compare these models directly to ALMA and JWST observations. • Using high-performance computing to study protoplanetary disc evolution.	**Level**	PhD
	First Supervisor	Prof. Richard Alexander
	Second Supervisor	Dr. Paul McMillan
	Application Closing Date	17th January 2027
	PhD Start date	27th September 2027

Project Details:

Planets form in cold discs of dust and gas around young, newly-formed stars, but so-called protoplanetary discs are observed to evolve dramatically over the planet-forming epoch. Discs evolve due to a combination of accretion on to the star, and mass-loss in winds. Observationally we see evidence for both processes, but we cannot yet tell which is the dominant driver of disc evolution. In this project the student will build new computational models of disc evolution where accretion can be either turbulent or wind-driven, and investigate how these processes change the observable properties of protoplanetary discs. We will first build new models of dust dynamics during the final stages of gas disc dispersal. We will then use radiative transfer simulations to generate synthetic observations, in order to test our models against new data from ALMA and JWST. Further calculations will consider the effects of structures (such as rings and gaps) in both the gas and dust discs, and also consider the effects of infall on to the disc at late times. The overall aim of the project is to understand the key processes driving the transition from gas-rich protoplanetary discs to gas-less debris discs, and how this transition shapes young planetary systems.

Images:



Artist's impression of a disc wind dispersing a planet-forming disc around a young star. Credit ESO / M. Kornmesser.

[Image from UoL press release JWST observations of disc winds, March 2024.]

Further Reading:

- *The distribution of accretion rates as a diagnostic of protoplanetary disc evolution*
- *The dispersal of protoplanetary disks*
- *JWST/MIRI reveals the evolution from molecular to atomic disk winds*
- *Turbulence and dust fragility in protoplanetary discs*

Further Details:

- **Proposed Funding Source:** STFC
- **Proposed Start Date:** 27th September 2027 for 3.5 years.
- **Closing Date:** 23:59 Sunday 17th January 2027.
- **Eligibility:** UK/EU/International; fee waivers will be available for small number of international students; otherwise international applicants must show that they can cover the fee difference between UK/International costs (~£16k/year).
- **Entry requirements:** Applicants are required to hold/or expect to obtain a UK Bachelor Degree 2:1 or better in a relevant subject. The University of Leicester English language requirements apply where applicable.
- **Application enquiries to pgradmissions@le.ac.uk**

Further information on how to apply and funding can be found here