

# Physics & Astronomy PhD Project Proposal

Project Title: Understanding protoplanetary disc evolution

Project reference: STFC - Alexander

Groups: Astrophysics

Supervision Team:

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## Three Key Points

- 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.

## Project Description

Planets form in cold discs of dust and gas around young, newly-formed stars, but their 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 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 use a combination of 1-D, 2-D and potentially 3-D calculations to study disc dynamics and evolution over a wide range of time-scales. We will then use radiative transfer modelling to generate synthetic observations, in order to test our models against new data from ALMA and JWST. The overall aim of the project is to build up a detailed understanding the key physical processes that shape the appearance and evolution of planet-forming discs

Further Reading:

- [\*The distribution of accretion rates as a diagnostic of protoplanetary disc evolution\*](#)
- [\*The dispersal of protoplanetary disks\*](#)
- [\*JWST MIRI MRS observations of T Cha: discovery of a spatially resolved disk wind\*](#)
- [\*Demographics of young stars and their protoplanetary disks: lessons learned on disk evolution and its connection to planet formation\*](#)

Images/Graphics:



*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 on new JWST paper on disc winds, March 2024.]

**Application advice: Please see web page**

<https://le.ac.uk/study/research-degrees/funded-opportunities/stfc>