

Formation of Planetary Systems

MPAGS Module AS8

Richard Alexander, Autumn Term 2023

This lecture course is intended to give PhD students a broad overview of how planets form. Our approach will largely consider planet formation from an astrophysical perspective (rather than a planetary science one), and the course will discuss both observational and theoretical research into planets and their formation.

The course consists of five two-hour lectures, Tuesdays at 1–3pm (beginning on November 7th). The course will take (roughly) the following structure:

Lecture 1: Observations of planetary systems

Review of Solar System properties; exo-planet detection techniques; summary of exo-planet observations.

Lecture 2: Protoplanetary discs

Summary of protoplanetary disc observations; disc formation, structure and evolution; angular momentum transport.

Lecture 3: Planetesimal formation

Dust dynamics; grain growth; planetesimal formation and dynamics.

Lecture 4: Planet formation

Formation of planetary cores & terrestrial planets; core accretion; gravitational instability.

Lecture 5: Planetary dynamics

Migration of planets in gaseous discs; migration in planetesimal discs; the Nice & Grand Tack models.

Assessment: The assessment will take the form of a short essay (~1500 words), reviewing and critiquing a recent research paper in this field. A list of potential papers will be provided, but you are welcome to consider others. The only restriction is that students doing primarily observational/instrumental work for their PhDs must review a theoretical paper, and vice versa.

Prior to each lecture I will place copies of the “handouts” and slides on the course home-page:

https://rdalexander.github.io/planets_2023.html

The home-page also provides a list of background reading, and links to some on-line reference articles.

The lectures are intended to be fairly informal, and I encourage you to ask questions during these sessions (technology permitting!). I’m also always interested in hearing any feedback you may have about the course or its content. Please email me with any questions or comments (or feel free to stop by my office if you’re in Leicester).

Richard Alexander
September 2023