AS5524 – Astrophysical Fluid Dynamics

Credits: 15.0  
Number of Lectures: 27  
Academic Year: 2018-19  
Semester: 2  
Lecturer: Dr Christiane Helling

Overview
Fluid dynamics is the study of all things that 'flow', whether they are liquids or gases. The underlying concepts and techniques used in this study are of wide ranging use, finding application in such diverse problems as the collision of galaxies, spacecraft re-entry into the Earth's atmosphere, or the structure and stability of fusion plasmas. Closer to home, the behaviour of fluid flows can readily be observed in rivers, on shorelines and in cloud formations. Fluid mechanics describes the types of flows that result from different forces (such as gravity). It explains how (and why) flows become supersonic and when they may become unstable. These basic principles can then be applied to a variety of problems.

Aims & Objectives
- To present an introduction to fluid dynamics, focussing particularly on the underlying physics including the use of conservation relations (mass, momentum, energy) to describe flows
- A physical understanding of vorticity and its evolution in a flow
- The role of viscosity and its effect on flows at boundaries
- The use of conservation relations to describe the behaviour of fluids at a shock
- The onset of simple instabilities

Learning Outcomes
By the end of the module students will have an understanding of the physics of fluid flow as presented in the lectures and will be able to:

- Apply conservation relations to determine the properties of given flow patterns
- Determine the vorticity of a flow and describe its behaviour
- Use Bernoulli's equation to analyse simple flows - describe the role of viscosity and solve for simple ideal fluid flows
- Use the shock relations to relate fluid properties on each side of a shock
- Describe and calculate the onset of simple instabilities

Synopsis

Pre-requisites
BSc or equivalent in the physical sciences

Co-requisites
AS5500

Assessment
2-hour Written Examination = 75%, Coursework = 25%

Recommended Books
Please view University online record: http://resourcelists.st-andrews.ac.uk/modules/as5524.html

General Information
Please also read the general information in the School's honours handbook.