FLUID MECHANICS

Advanced level course by visiting lecturer
February 26 - March 21, 2019

Dr. Antonio Ferriz Mas

SUMMARY:

Fluid Mechanics (or "Hydrodynamics") is the branch of Continuum Mechanics dealing with gases and liquids ("fluids"). It can be derived from first principles using the mathematical tools that any student of Physics is supposed to master. Historically many interesting results in Mathematics have their origin when trying to solve problems that appeared in the study of Fluid Mechanics.

This course consists of two parts. In the first one the fundamentals of Fluid Mechanics are developed. Many of the results actually belong to the broader field of Continuum Mechanics and, as a consequence. are common to results also appearing in a course on, say, Theory of Elasticity. After introducing the constitutive relations for a Newtonian fluid (i.e., a linearly visocus fluid), the subsequent results are specific to Fluid Mechanics.

The thermodynamic aspects relevant to Hydrodynamics are introduced in a coherent manner, in such a way that there is not any discontinuity in logic, mathematical difficulty or notation with respect to the "mechanical" part.

After dealing with some fundamental results for incompressible fluid flows, several special topics are considered where the theory developed so far is applied to everyday aspects of Hydrodynamics such as sound waves or fluid motion in a rotating frame (having in mind to understand the basics of weather patterns). Other possible special topics include the Virial Theorem of Chandrasekhar and Fermi (with applications to several astrophysical problems) as well as the derivation of the jump conditions across shocks and a discussion of shock waves.

For more info: `www.oulu.fi/astronomy/teaching.html`

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