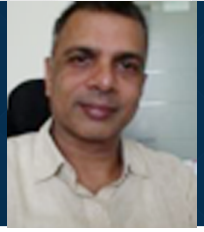

FLUID DYNAMICS FOR ASTROPHYSICS

PROF. PRASAD SUBRAMANIAN
Department of Physics
IISER Pune

TYPE OF COURSE : Rerun | Elective | PG
COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)
EXAM DATE : 24 Apr 2022

PRE-REQUISITES : Participants should have a good grounding in classical mechanics, electrodynamics, kinetic theory of gases. Some exposure to Astrophysics would be good, but not essential

COURSE OUTLINE :
This course provides a broad overview of fluid phenomena in Astrophysics. The first few weeks cover the basics of fluid dynamics, with an emphasis on compressible phenomena. These basic concepts will be applied in understanding astrophysical phenomena ranging from the solar wind to black hole accretion disks. Magnetic fields are often important in astrophysical situations - we therefore treat the basics of magnetohydrodynamics and use it to understand astrophysical dynamos and jets. Students of this course will be equipped with the basics needed for understanding the research literature in several areas in astrophysics.

ABOUT INSTRUCTOR :
Prof. Prasad Subramanian is a professor of Physics at the Indian Institute of Science Education and Research (IISER), Pune. He has been regularly teaching courses in electrodynamics, fluid dynamics, plasma physics and physical processes in Astrophysics over the last 10 years. He studies the effects of eruptive phenomena in the solar corona on the near-Earth space environment. He is also interested in the manner in which astrophysical black holes attract matter from their surroundings and release energy in the process.

COURSE PLAN :

Week 1**:** Introduction to the goals of the course. The continuum hypothesis

Week 2**:** Kinematics, conservation laws 1: the mass continuity equation

Week 3**:** Conservation laws 2: the momentum continuity equation

Week 4**:** Dimensionless numbers in fluid dynamics

Week 5**:** Dynamic similarity in fluid dynamics and aerodynamics

Week 6**:** Compressible flows and the speed of sound

Week 7**:** An introduction to shocks

Week 8**:** Applications to Astrophysics: transonic flows spherical accretion and he solar wind

Week 9**:** Applications to Astrophysics: the de Laval nozzle, astrophysical jets

Week 10**:** Applications to Astrophysics: Accretion disks

Week 11**:** Including magnetic fields basics of magnetohydrodynamics

Week 12**:** Magnetohydrodynamic phenomena in Astrophysics: dynamos, magnetized jets