# Physical Research Laboratory
# Ahmedabad

## *Space & Atmospheric Sciences Division*

## *Special Area Seminar*

Title**: "Multi-scale physics of turbulence and magnetic reconnection in space plasmas"**

Speaker: **Dr. Kirit D. Makwana**
PDF, Deutsches Elektronen-Synchrotron (DESY), Zeuthen, Germany

Date: **12 December 2019**

Venue: **Ground Floor Lecture Hall**

Time: **11:00 hrs**

**Highlight of the talk:**

Turbulence and magnetic reconnection are ubiquitous phenomena in a variety of space plasmas. Turbulence involves transfer of energy from large to small scales via nonlinear interactions, for ex. in the solar wind. Magnetic reconnection involves conversion of magnetic energy to particle energy via change in magnetic topology, for ex. in Earth's magnetosphere. Plasmas at large scales can be described as a fluid in the magnetohydrodynamic (MHD) approach while at small scales a kinetic particle-in-cell (PIC) approach is needed to model the interactions of plasma particles with electromagnetic waves. I will describe these computational approaches and recent advances made by using them. We find that the rate of reconnection in large-scale solar magnetic flux tubes can still be dictated by small-scale kinetic physics, having implications for coronal dynamics and space weather. Turbulence coupled with large-scale current sheets can trigger explosive reconnection like in solar flares. Turbulence itself shows a rich multi-scale behavior with MHD simulations at large scales identifying a novel regime of low Mach number, compressively driven turbulence which is dominated by fast magnetosonic modes, having implications for cosmic ray transport. In PIC simulations of turbulence we identify kinetic scale current sheets which are also observed in the solar wind. These sheets accelerate particles by means of reconnection, having fundamental implications for plasma heating & particle acceleration in a variety of plasmas. I will present future challenges and opportunities in this field, including space missions.

**All interested are welcome.**