National Institute of Technology Rourkela

Departmental Seminar

Seminar Title	: Investigation of coronal origin periodic solar wind proton number density structures using OMNI, PSP & STEREO Observations
Speaker	: Karan Sahu
Supervisor	: Prof Susanta Kumar Bisoi
Venue	: Committe Room
Date and Time	: 20 Mar 2024 (11:30 AM)
Abstract	: Observations of the solar wind near 1 AU have revealed discrete fluctuations in the proton density; some are more frequent than others, occur regularly, and are referred to as periodic density structures (PDS). Different dynamic mechanisms can cause the PDS to form locally at 1 AU or in the solar corona and be convected outward to 1 AU. Previous investigations sought to pinpoint the PDS's coronal origin by combining in-situ solar wind measurements at 1 AU with remote imaging observations of the corona. In this paper, we performed a statistical analysis of the observed PDS from 2018 to 2023, when measurements from Parker's Solar Probe (PSP) were available. When the solar wind proton density (Np) and alpha to proton solar wind abundance ratio (AHe) observations near 1 AU were subjected to a Fourier spectrum analysis, common periodicities of a few minutes to hours were discovered. Because the AHe does not vary significantly during its transit to 1 AU, the common periodicities obtained in AHe and Np suggest that the periodic changes in solar wind proton density could have formed somewhere in the corona. Thus, when evaluated using PSP observations and cross-correlated with the near-Earth PDS, the comparable PDS near the Sun revealed a very strong correlation. Common periodicities of a few minutes to hours were discovered in solar wind proton densities near the solar surface and at 1 AU using Fourier spectrum analysis. Furthermore, we were able to link the origin of the near-sun solar wind to coronal dynamic processes using distant imaging studies obtained by Sun Earth Connection Coronal and Heliospheric Investigation (SECCHI) onboard the STEREO spacecraft. Our findings confirm that the PDS observed at 1 AU originated in the corona, were frozen in the solar wind, and then convected out to 1 AU.