

In-situ measurements of space plasma: recent progress and future challenges

Daniel Verscharen

Mullard Space Science Laboratory, University College of London

Space plasmas such as the solar wind or the Earth's space environment offer unique opportunities to measure fundamental plasma processes and their impact in situ. With modern spacecraft instrumentation, we measure the velocity distribution function of the plasma particles as well as the electromagnetic fields at high resolution and with minimal perturbation of the observed plasma systems. These measurements are often not possible in laboratory plasmas on the ground.

This presentation will focus on modern diagnostic methods for the in-situ detection of plasma particles in space plasmas. I will highlight recent results from the electrostatic analysers on the heliospheric space missions Parker Solar Probe and Solar Orbiter that demonstrate the capabilities of modern space plasma instrumentation. I will also discuss future directions and challenges for the diagnostics of space plasma systems. These include, for example, the measurement requirements for new missions such as the operational space weather mission Vigil, the Mars mission M-MATISSE, the multi-spacecraft mission Plasma Observatory, or missions for the study of electron-scale processes like Debye.