Energetic Particles in the Inner Heliosphere: Solar Orbiter

Robert F. Wimmer-Schweingruber¹, Javier Rodriguez-Pacheco², Stephan Böttcher¹, Ignacio Cernuda², Nina Dresing¹, Wolfgang Dröge¹, Sandra Eldrum¹, Francisco Espinose Lara², Raul Gomez-Herrero², Bernd Heber¹, George Ho³, Andreas Klassen¹, Alexander Kollhoff¹, Shrinivasrao Kulkarni¹, Gottfried Mann⁵, César Martin⁵, Glenn Mason³, Daniel Pacheco¹, Manuel Prieto⁵, Sebastian Sanchez², and the Robert F. Wimmer-Schweingruber*¹

¹University of Kiel, Institut für Experimentelle und Angewandte Physik, Kiel, Germany (wimmer@physik.uni-kiel.de)
²Space Research Group, University of Alcala de Henarez, Spain
³Applied Physics Laboratory, Johns Hopkins University, Laurel, MD, USA
⁴University of Würzburg, Germany
⁵Astronomisches Institut Potsdam, Germany
⁶DLR Adlershof, Berlin, Germany

*¹A full list of authors appears at the end of the abstract

To be measured as energetic particles in the heliosphere ions and electrons must undergo three processes: injection, acceleration, and transport. Suprathermal seed particles have speeds well above the fast magnetosonic speed in the solar wind frame of reference and can vary from location to location and within the solar activity cycle. Acceleration sites include reconnecting current sheets in solar flares or magnetospheric boundaries, shocks in the solar corona, heliosphere and a planetary obstacles, as well as planetary magnetospheres. Once accelerated, particles are transported from the acceleration site into and throughout the heliosphere. Thus, by investigating properties of energetic particles such as their composition, energy spectra, pitch-angle distribution, etc. one can attempt to distinguish their origin or injection and acceleration site. This in turn allows us to better understand transport effects whose underlying microphysics is also a key ingredient in the acceleration of particles.

In this presentation we will present some clear examples which link energetic particles from their observing site to their source locations. These include Jupiter electrons, singly-charged He ions from CIRs, and ³He from solar flares. We will compare these examples with the measurement capabilities of the Energetic Particle Detector (EPD) on Solar Orbiter and consider implications for the key science goal of Solar Orbiter and Solar Probe Plus – How the Sun creates and controls the heliosphere.

Robert F. Wimmer-Schweingruber: Javier Rodriguez-Pacheco2, fsrodriguez@uah.es Stephan Böttcher1, boettcher@physik.uni-kiel.de Ignacio Cernuda2, ignacio.cernuda@uah.es Nina Dresing1, dresing@physik.uni-kiel.de Wolfgang Dröge4, Wolfgang.Droege@astro.uni-wuerzburg.de Sandra Eldrum1, eldrum@physik.uni-kiel.de Francisco Espinosa Lara2, francisco.espinosal@uah.es Raul Gomez-Herrero2, raul.gomezh@uah.es Bernd Heber1, heber@physik.uni-kiel.de George Ho3, george.ho@jhuapl.edu Andreas Klassen1, klassen@physik.uni-kiel.de Alexander Kollhoff1, kollhoff@physik.uni-kiel.de Shrinivasrao Kulkarni1, kulkarni@physik.uni-kiel.de Gottfried Mann5, GMann@aip.de Cesar Martin1, 6, Cesar.MartinGarcia@dlr.de Glenn Mason3, glenn.mason@jhuapl.edu Daniel Pacheco1, pacheco@physik.uni-kiel.de Manuel Prieto2, manuel.prieto@uah.es Sebastian Sanchez2, ssp@aut.uah.es Christoph Terasa1, terasa@physik.uni-kiel.de