

# Unexpected energetic particle observations near the sun by Parker solar probe and solar orbiter

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Solar Energetic Particles (SEPs) from suprathermal (few keV) up to relativistic (~few GeV) energies are accelerated at the Sun in association with solar flares and Coronal Mass Ejection (CME)-driven shock waves. Although our knowledge of the origin, acceleration and transport of these particles from close to the Sun through the interplanetary medium has advanced dramatically in the last 40 years, many puzzles have still remained unsolved due to the scarcity of in situ measurements well inside 1 AU. Furthermore, energetic particle intensity enhancements associated with high-speed streams or Stream Interaction Regions (SIRs) have been routinely observed at interplanetary spacecraft near Earth orbit since the 1960s. Since only a small sample of SIR events were observed by the Helios spacecraft inside 1 AU, additional observations well inside 1 AU were also needed to further investigate the energization and transport effects of SIR-associated ions and to compare with expectations from contemporary SIR-associated particle acceleration and transport models and theories. The Solar Orbiter (SolO) and Parker Solar Probe (PSP) pioneering missions have been providing unprecedented measurements of energetic particles in the near-Sun environment. This talk will present a review of the unexpected observations of SEP and SIR-related ion events as measured by the PSP/IS $\odot$ IS and SolO/EPD experiments, which revealed surprises that challenge our understanding.

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