Energetic Particle Environment near the Sun from Parker Solar Probe

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NASA’s Parker Solar Probe (PSP) mission recently plunged through the inner heliosphere to perihelia at \textasciitilde 24 million km (~35 solar radii), much closer to the Sun than any prior human made object. Onboard PSP, the Integrated Science Investigation of the Sun (ISʘIS) instrument suite made groundbreaking measurements of solar energetic particles (SEPs). Here we discuss the near-Sun energetic particle radiation environment over PSP’s first two orbits, which reveal where and how energetic particles are energized and transported. We find a great variety of energetic particle events accelerated both locally and remotely. These include co-rotating interaction regions (CIRs), “impulsive” SEP events driven by acceleration near the Sun, and events related to Coronal Mass Ejections (CMEs). These ISʘIS observations made so close to the Sun provide critical information for investigating the near-Sun transport and energization of solar energetic particles that was difficult to resolve from prior observations. We discuss the physics of particle acceleration and transport in the context of various theories and models that have been developed over the past decades. This study marks a major milestone with humanity’s reconnaissance of the near-Sun environment and provides the first direct observations of the energetic particle radiation environment in the region just above the corona.

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