

Quiet-time Suprathermal Intensities and Composition Observed by Solar Orbiter

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The joint ESA/NASA Solar Orbiter mission has observed suprathermal and energetic particles throughout much of Solar Cycle 25, spanning the period from 2020 to 2025, providing unprecedented coverage of the inner heliosphere. Measurements of protons, and heavy ions show substantial temporal variability in particle intensities over the solar cycle. In particular, the Suprathermal Ion Spectrograph (SIS) of the Solar Orbiter Energetic Particle Detector (EPD) measures suprathermal ion abundances from hydrogen through iron with high precision. Previous studies have shown that the suprathermal ion population in the heliosphere arises from multiple source populations. In this work, we focus on the composition and origin of the quiet-time suprathermal population, using Solar Orbiter/SIS composition measurements to examine how source contributions vary with solar activity level and heliocentric distance. We find that during periods of low solar activity and relatively stable particle intensities, the suprathermal heavy-ion composition closely resembles that of the ambient solar wind and/or corotating interaction regions, indicating that these sources make a dominant contribution under quiet conditions. Impulsive material, such as 3He-rich ions, becomes more prominent during more active intervals but represents a reduced fraction of the suprathermal pool during quiet times. These observations demonstrate that the quiet-time suprathermal population in the inner heliosphere is largely controlled by solar-related sources, providing important constraints on the seed population available for subsequent energetic particle acceleration.