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Observations of Solar Gamma-Ray Flares by ISOIS/EPI-Hi/HET on Parker Solar Probe

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The ISOIS/EPI-Hi/HET instrument on Parker Solar Probe can detect neutrals if they interact in the instrument and produce a charged particle (e.g., a gamma ray Compton scattering to produce an electron) when that particle stops in a shielded central region of silicon detectors without triggering the surrounding guards or outer detectors. A background of gamma rays is continuously created when high-energy galactic cosmic rays interact with material in the spacecraft or instrument, and this background increases when solar energetic particles (SEPs) also generate such locally produced gamma rays. A solar gamma-ray flare can be distinguished from this background provided the neutral rate increases significantly before the arrival of SEP particles. In a preliminary survey of the neutral rate data we have found at least 7 gamma-ray flares to date, ranging in duration from <1 minute to ~15 minutes, with intensities as high as ~100 times the quiet-time background level. The largest gamma-ray flare yet seen at Parker occurred on 20 May 2024 and was associated with an x-ray flare estimated to be GOES class X16 as observed at Solar Orbiter. The source region, AR13664, had earlier produced the tremendous May 2024 geomagnetic storm but had rotated to the far side of the Sun (as seen from Earth) by this time and was no longer geoeffective. We present time profiles and energy spectra of the HET solar gamma ray observations, describe the associated SEP events, and compare with X-ray, radio, and other observations in these events where available.

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