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Evidence for a New Component of Solar Gamma-Ray Emission

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The Sun is not expected to be a bright gamma-ray source above 1 GeV, due to the moderate strength of solar magnetic fields. However, the Sun may act as a passive gamma-ray source, through the hadronic interaction of galactic cosmic rays with the Solar atmosphere. The Fermi-LAT has detected a bright solar gamma-ray flux, which implies that solar magnetic fields efficiently redirect incoming cosmic rays and produce outgoing gamma-ray emission. Here, I will show new observations, including the first resolved imaging of this gamma-ray signal across the solar surface, that find three surprising results. First, the gamma-ray emission extends to energies exceeding 200 GeV, implying that Solar magnetic fields can redirect TeV protons. Second, the morphology and spectrum of gamma-ray emission varies significantly over the solar cycle. Third, a significant “spectral-dip” appears between energies of 30-50 GeV. These observations are in significant tension with all current models of solar gamma-ray production. I will conclude by focusing on possible theoretical interpretations of these results, and their implications for our understanding of our nearest stellar neighbor.

Summary

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