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The first variable gamma-ray pulsar: challenging the models of high-energy magnetospheric emission

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Pulsar variability, including mode changes and intermittent behavior, is a powerful probe of neutron star magnetospheres and represents a challenge for current emission models. In the gamma-ray domain where the bulk of their spindown luminosity is radiated, however, pulsars were believed to be steady emitters on timescales longer than those needed for their detections. Surprisingly, Fermi observed a 20% flux decrease in PSR J2021+4026 near 2011 October 16th (MJD 55850), over a time scale shorter than a week. At the same time, the spindown rate increased by 4% and there were significant changes in the pulse profile. We speculate that the flux change is due to a modification in the emission beaming precipitated by a shift in the magnetic field structure, leading to a change of either effective magnetic inclination or effective current. This “jump” of PSR J2021+4026 breaks the axiom of pulsars as steady gamma-ray emitters, opening new avenues for investigating pulsar magnetospheres through variability studies at gamma-ray energies.

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