Pulsed Gamma-Ray Emission from AR Scorpii and AE Aquarii using Fermi LAT Data

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We report the detection of steady and pulsed gamma-ray emission from AR Scorpii and AE Aquarii using data from the Fermi Large Area Telescope (LAT). Both sources exhibit a detection significance above Fermi LAT threshold (5 σ), despite not being listed in the Fermi LAT catalog due to the standard analysis approach rendering them insignificant. Previous studies have indicated a detection for AR Scorpii at a marginal significance level ($\leq 4.3 \sigma$), but no firm detection above Fermi LAT threshold had been reported. By employing time gating techniques for event selection alongside standard analysis, we enhanced the detection significance to exceed Fermi LAT threshold for both sources. Additionally, we searched for pulsed emission within a 0.6-degree region of interest and observed AR Scorpii with a significance just above Fermi LAT threshold at the fundamental ($P_{spin} = 117s$) but no indication of double pulse was observed using all events in the region of interest. To further refine event selection for timing analysis, we utilized the HDBSCAN clustering method, which allowed us to associate events with AR Scorpii and AE Aquarii. Accordingly, both systems showed significant pulsed emission above Fermi LAT threshold at the fundamental pulsed emission above Fermi LAT threshold at the fundamental pulsed emission above Fermi LAT threshold at the fundamental pulsed emission above Fermi LAT threshold at the fundamental pulsed emission above Fermi LAT threshold at the fundamental pulsed emission above Fermi LAT threshold at the fundamental pulsed emission above Fermi LAT threshold at the fundamental and second harmonic frequencies, with double-peaked light curves providing further evidence of the periodic nature of the emissions.

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