Two pulsars with spin-down power greater than $10^6$ erg/s, PSR J1837-0604 and PSR J1831-0952, are now detected with the Fermi-LAT. The Fermi-LAT is a gamma-ray detector on the Fermi Space Telescope, which is designed to study gamma-ray astronomy. The Fermi-LAT collaboration detected these pulsars using a new reconstruction strategy developed by the Fermi-LAT collaboration. They show their light curves and spectral properties as well as other promising high spin-down-powered pulsars not yet seen in gamma-rays.

Abstract

More than 50% of the known pulsars with spin-down power greater than $10^6$ erg/s show pulsations in gamma rays, as seen with the Fermi Large Area Telescope. Many non-detections are thought to be a consequence of a high background level due to the signal to noise ratio or a large distance leading to a flux below the sensitivity limit of the instrument. Pass 8 is a new reconstruction and event selection strategy developed by the Fermi-LAT collaboration. Thanks to improved acceptance at low energy, the new Pass 8 data now allows the detection of gamma-ray pulsations from two of these faint high spin-down pulsars, PSR J1837-0604 and PSR J1831-0952. We report on their gamma-ray light curves as well as their spectral properties.

Detection of pulsars with known ephemerides

Pass 8

This pulsar was discovered during the Parkes Multibeam Pulsar Survey [2]. The gamma-ray pulsations were detected thanks to radio timing provided by the Jodrell Bank Observatory (JBO). Strong radio polarization is measured [3]. This pulsar is a potential counterpart to the TeV source HESS J1831-098 [4]. The latter could be a pulsar wind nebula powered by this energetic pulsar. The gamma-ray energy flux measured for this pulsar is $1.0 \times 10^{-11}$ erg cm$^{-2}$ s$^{-1}$, which is among the lowest measured in [5].

This pulsar was also discovered during the Parkes Multibeam Pulsar Survey [6]. The gamma-ray pulsations were detected using radio timing provided by the Parkes telescope and the Fermi-LAT [7]. Strong radio polarization is measured at 3000 MHz [5]. This position is compatible with the EGRET source 3EG J1837-0604 [7] but its low gamma-ray energy flux of $4.0 \times 10^{-10}$ erg cm$^{-2}$ s$^{-1}$ seems to show that the pulsar is one contributor to the EGRET source in this complicated region.

Promising candidates

<table>
<thead>
<tr>
<th>Name</th>
<th>Galactic latitude (deg)</th>
<th>Period (ms)</th>
<th>Distance (kpc)</th>
<th>$E_{35}$ (erg)</th>
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</thead>
<tbody>
<tr>
<td>PSR J1917-5914</td>
<td>0.457</td>
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<td>0.267</td>
<td>3.3</td>
<td>4.5 x10^{20}</td>
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<tr>
<td>PSR J1857+1434</td>
<td>0.571</td>
<td>0.140</td>
<td>5.7</td>
<td>4.5 x10^{20}</td>
</tr>
</tbody>
</table>

Table 5. Promising candidates for gamma-ray pulse detection among the pulsars with spin-down power $10^3$ erg/s with available ephemerides based on distance and preliminary H-Int TS values.

References