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GEMINGA-LIKE PULSARS

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The Compton Gamma-Ray Observatory revealed new and unexpected celestial gamma-ray sources, like gamma-loud radio-silent pulsars. While Geminga remains the only object of this kind known, it is believed that a population of radio-silent pulsars resides among the unidentified EGRET sources. At least four EGRET sources comply with all the characteristics of such objects.

The Third EGRET Catalog contains 271 sources of γ-rays, of which 170 are unidentified. The spatial distribution of these indicates that most of them belong to our Galaxy. The finding that Geminga is a radio-quiet γ-ray loud pulsar leads to the inference that several of these objects must be present among the unidentified EGRET sources. Geminga's observed spectrum is completely dominated by the high-energy emission: $L_\gamma/L_X \sim 10^3$; $L_\gamma/L_{opt} \gtrsim 10^5$ and $L_\gamma/L_{radio} \gtrsim 10^7$. Such γ-ray dominated objects are more likely to be found through γ-ray observations and to be difficult to identify. The high proportion of unidentified objects within the Third EGRET Catalog is more than tantalizing.

Gehrels et al. (2000) showed that stable unidentified EGRET sources can be divided in two distinct groups: bright sources with $|b| \leq 5°$ and faint sources with $|b| \geq 5°$). The two exceptions are the bright sources 3EG J0010+7309 ($|b| \simeq 10°$) and 3EG J1835+5918 ($|b| \simeq 30°$). These two are among the four best Geminga pulsar candidates known.

3EG J2020+4017: X-ray imaging of this bright EGRET source shows extended emission and a faint point source most likely unrelated to a positionally coincident K0V star.

3EG J0010+7308: located 10° above the Galactic plane, X-ray imaging shows extended emission and several point sources. The brightest of them coincides with the maximum of the nebular emission and has been pointed by some authors as a likely pulsar.

3EG J1835+5918: the only stable bright high-latitude unidentified EGRET source, it has been object of two deep studies. No extended X-ray emission has been found and the preferred X-ray counterpart seems to have a very soft spectrum. Its characteristics suggest this might be an older Geminga pulsar, with an even more extreme spectrum.

3EG J2227+6122: extended emission both in radio and X-rays has been found. Radio observations of the preferred X-ray counterpart located a weak 51-ms radio pulsar, PSR J2229+6114. Confirmation of the pulsations in the γ-ray data has not been made.

The chances to confirm these as Geminga pulsars in the near future reside in multi-wavelength observations, namely deep X-ray (or even optical) observations seeking to find coherent pulsations. These can be then confirmed for the brightest EGRET sources ($F(E \geq 100$ MeV$) \geq 10^7$ phot cm^{-2} s^{-1}. In the long term *GLAST* will allow to perform direct periodicity searches on most of the unidentified EGRET sources.

REFERENCES

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