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Counterpart candidates to unassociated gamma-ray sources: the case of 3FGL J0133.3+5930

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The identification of high energy sources in the Galactic Plane is often a difficult but rewarding task as it can lead to the discovery of exotic stellar accelerators, such as gamma-ray binaries and microquasars. Here, we report a multi-wavelength analysis of the unassociated Fermi source 3FGL J0133.3+5930 at low galactic latitude. Two candidate counterparts have been identified inside its 95% confidence ellipse. One of them is the AGN source 2MASS 01325529+5932158 at a redshift $z = 0.1143$. This object could be a low-luminosity blazar although this point remains to be confirmed. The other one is the bright Be star LS I+59 79 ($V = 10.7$), also known as TYC 3683-985-1, whose eclipsing binary nature is reported in this work. With a photometric period of 1.94 d, its multi-colour light curves are apparently consistent with a semi-detached binary system with two early-type components. Possible gamma-ray emission mechanisms are tentatively proposed in a stellar context that, at present, does not fully match a typical gamma-ray binary scenario. However, this situation could change when further spectroscopic data are available that better constrain the nature of the system components.

Primary author(s) : Prof. MARTÍ, Josep (University of Jaén)

Co-author(s) : Mr. GALINDO, Daniel (University of Barcelona); Prof. PAREDES, Josep M. (University of Barcelona); Prof. IWASAWA, Kazushi (ICREA-ICCUB); Dr. RIBÓ, Marc (University of Barcelona); Prof. LUQUE-ESCAMILLA, Pedro Luis (University of Jaén)

Presenter(s) : Prof. MARTÍ, Josep (University of Jaén)

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