Astrophysical parameters of LS2883 and implications for the PSR B1259-63 gamma-ray binary

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Only a few binary systems with compact objects display TeV emission. The physical properties of the companion stars represent basic input to understand the physical mechanisms behind the particle acceleration, emission, and absorption processes in these so-called gamma-ray binaries. Here we present high-resolution and high signal-to-noise optical spectra of LS2883, the Be star forming a gamma-ray binary with the young non-accreting pulsar PSR B1259-63, showing it to rotate faster and be significantly earlier and more luminous than previously thought. Analysis of the interstellar lines suggest that the system is located at the same distance as (and thus is likely a member of) CenOB1. Taking the distance to the association, d=2.3kpc, and a color excess of E(B-V)=0.85 for LS2883, results in Mv=-4.4. Because of fast rotation, LS2883 is oblate (R_eq=9.7R_sun and R_pole=8.1R_sun) and presents a temperature gradient (T_eq=27500K, log g_eq=3.7; T_pole=34000K, log g_pole=4.1). If the star did not rotate, it would have parameters corresponding to a late O-type star. We estimate its luminosity at log(L*/L_sun)=4.79, and its mass at M=30M_sun. The mass function then implies an inclination of the binary system i_orb=23deg,slightly smaller than previous estimates. We discuss the implications of these new astrophysical parameters of LS2883 for the production of high energy and very high energy gamma rays in the PSR B1259-63/LS2883 gamma-ray binary system. In particular, the stellar properties are very important for prediction of the line-like bulk Comptonization component from the unshocked ultra-relativistic pulsar wind.

Reference: Astrophysical Journal Letters 732, L11
Status: Manuscript has been accepted

Weblink: http://stacks.iop.org/2041-8205/732/L11

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