RevMexAA (Serie de Conferencias), **40**, 278–278 (2011)

ANALYSIS OF TIDAL FORCES IN ASYNCHRONOUS BINARY SYSTEMS: X-RAY EFFECTS

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We compute the energy dissipation rates, $\dot{E}$, due to the shear flows induced by tidal forces in a set of asynchronously rotating B-type binaries selected from the catalogue of Berghoefer et al. (1996). We find a linear correlation between $\dot{E}$ and the X-ray luminosity, L_X, reported for these systems where the X-ray emission mechanism is not well understood. The correlation suggests that in asynchronously rotating binary stars an X-ray generating mechanism is excited.

We used a numerical model that computes the perturbations produced on the surface of a binary star (Moreno & Koenigsberger 1999; Toledano et al. 2007). The computation of the surface velocity field allows the calculation of the energy dissipatetion rate from viscous forces. We used the stellar and binary parameters for each individual binary system from the compilation of Juarez (2006), who used the catalogue of Berghoefer et al. (1996) to select a subsample of B-type binary systems with X-ray emission. The principal result is shown in Figure 1 which illustrates the plot of the derived values of $\log(\dot{E})$ vs $\log(L_X)$. We find a correlation of the form:

$$\log(L_X) = 2.1\ \log(\dot{E}) - 31.3. \qquad (1)$$

A second linear fit performed using only the late B-type systems (B8/B9) shows an even tighter correlation of the form

$$\log(L_X) = 1.93\ \log(\dot{E}) - 27.3. \qquad (2)$$

A second result is that the maximum energy dissipation does not always occur along the equator, with maxima occasionally appearing at intermediate polar angles.

A systematic observational study of the B-type stars listed in the Berghoefer et al. (1996) catalogue is required in order to more firmly establish the values of their rotation velocity and radii and therefore expand the sample of systems available for our investigation.

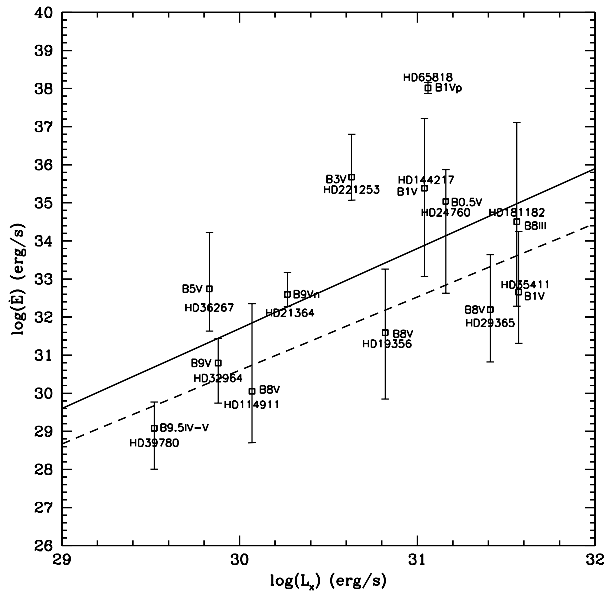

Fig. 1. The solid line shows the least square fit for all the sample of systems. The short dash line represents the least square fit only for the B8 and B9 systems. It is also shown the spectral type and the number from the HD catalogue for each system.

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