Tidal star-planet interaction revealed by its impact on stellar activity

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- *Hypothesis*: If a star tidally interacts with its planet(s), its rotation rate increase
- This tidal 'spin-up' can be traced by an enhanced magnetic activity
- Stellar companions as a reference for expected activity when no star-planet interaction (SPI) occurs
- *Method*: Measure the X-ray luminosity difference between stellar companions and compare it to SPI models
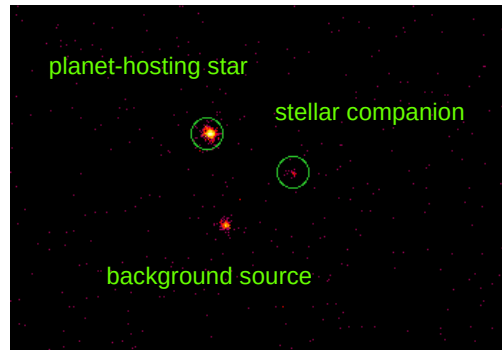

Fig. 1. Chandra X-ray observation of the system HD 189733. Marked are the planet host, the stellar companion, and a background source which is not gravitationally bound to the binary stellar system.
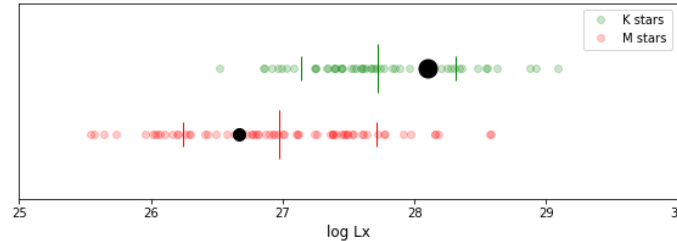

Fig. 2. Green and red circles represent the log Lx distribution of nearby K and M field star (Schmitt & Lifke, 2004), respectively. The vertical lines represent the mean and the standard deviation, which are used to calculate the activity difference of the two stellar components. The larger black circle marks the X-ray luminosity of the planet-hosting star in HD 189733 system, while the smaller circle marks the luminosity of its stellar companion.

- Systems observed with Chandra and XMM Newton space based observatories (Fig. 1)
- Luminosity normalization in systems where the components have different SpT (Fig. 2)
- Calculating SPI parameters (e.g. gravitational perturb.) to account for planet's influence on the host
- **Results point to a positive correlation between the activity level of the planet host and the strength of the SPI (Fig. 3)**

Fig. 3. On the y-axis we have the difference in activity of the planet host and its stellar companion: the markers above the zero value are the systems where the planet host is more active than its stellar companion, while the opposite is true for the markers bellow the dashed line. On the x-axis is the gravitational perturbation parameter accounting for the tidal interaction between the planet and its host star: the higher value of this parameter points to a stronger SP tidal interaction (more details in the upcoming paper: Ilic et al. in prep).