Identifying Low-Mass Companions of Intermediate-Mass Stars: X-rays in Cepheids

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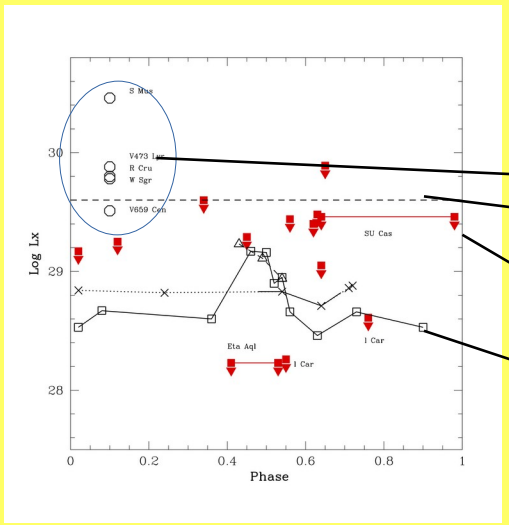
The Challenge: It is difficult to detect low mass companions in binary systems.

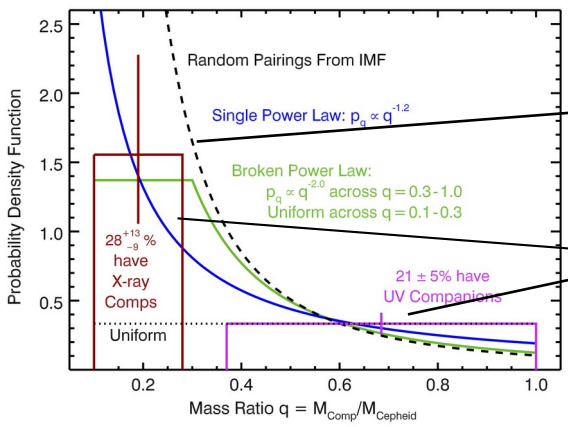
X-Rays are the wavelength region where a low mass main sequence star can outshine a cool supergiant Cepheid in a young star system.

Sample: 20 Cepheids have been observed with Chandra and XMM-Newton. The results are summarized in the plot of Log L_x as a function of pulsation phase.

28 per cent of Cepheids have a low mass companion. Others have an upper limit (red) below the F,G, K dwarf detection limit.



Mass ratio q distribution for Cepheids from X-Rays and UV



Summary: The mass ratio distribution is skewed toward small values compared with a uniform distribution, but is still top heavy compared to random pairings from the initial mass function (IMF). This is the first survey of intermediate-mass stars that reaches mass ratios this small, which provides information about star formation processes.

Reference: Evans, et al. 2022, ApJ, 938, 153