GD 394: A mystery at all wavelengths

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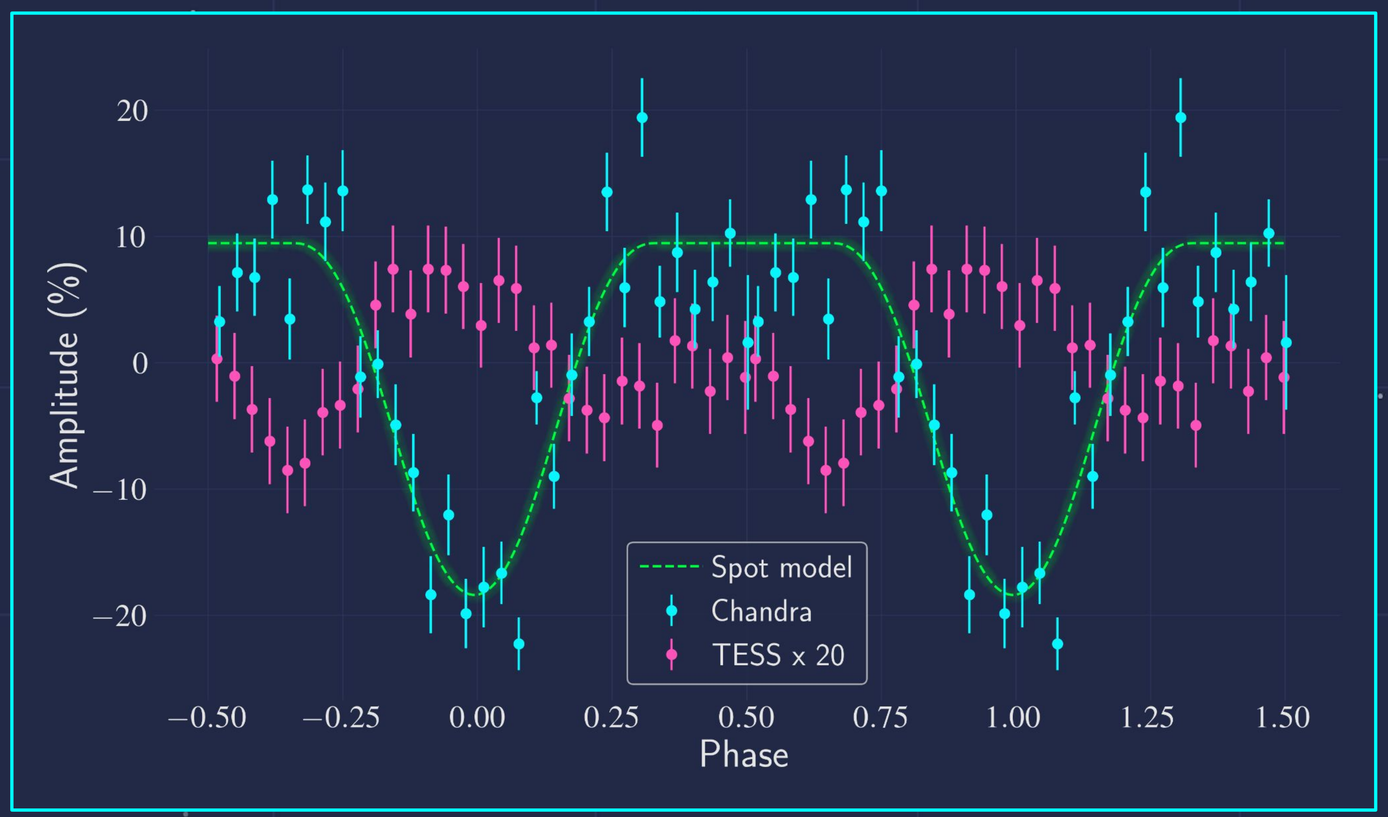
The hot, metal polluted white dwarf GD 394 exhibits a ~25% flux variation in the extreme ultraviolet with a 1.15 day period, detected in the 1990s with EUVE (Dupuis et al 2000). No other white dwarf is known to behave like this, and no consistent explanation has been found for the variation, or for many other observational oddities.

A proposed explanation of a metal rich spot predicted that: (a) Flux redistribution should produce optical anti-phase variation; (b) Metal absorption lines should vary in strength with phase.

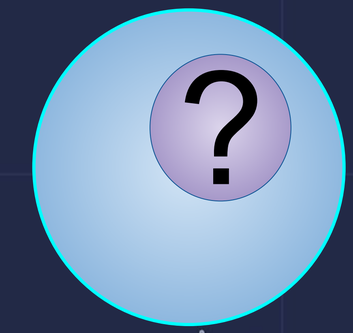
Using TESS data we have finally re-detected the variation in the optical, albeit with a much reduced amplitude of 0.1% (Wilson et al. 2020). With Chandra we confirm that the EUV variation is still there, and in anti-phase with the optical variation (Wilson et al in prep.). However HST ultraviolet data shows that the metal lines are constant with phase (Wilson et al. 2019). What is going on?

Further analysis of the Chandra data will test if the variation is caused by absorption line or continuum flux changes. TESS will be used to track the evolution of the variation over time, and to search for similar low level variation at other hot white dwarfs (NGN summer student project).



Anti-phase variation consistent with an metal-rich spot....

References: Dupuis et al. (2000), ApJ, 537, 977; Wilson et al. (2019), MNRAS, 483, 2941; Wilson et al. (2020), ApJL, 897, 31



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...but the metal absorption lines remain constant?