

Binary Parameters for the Massive Eclipsing Binary CC Cassiopeiae

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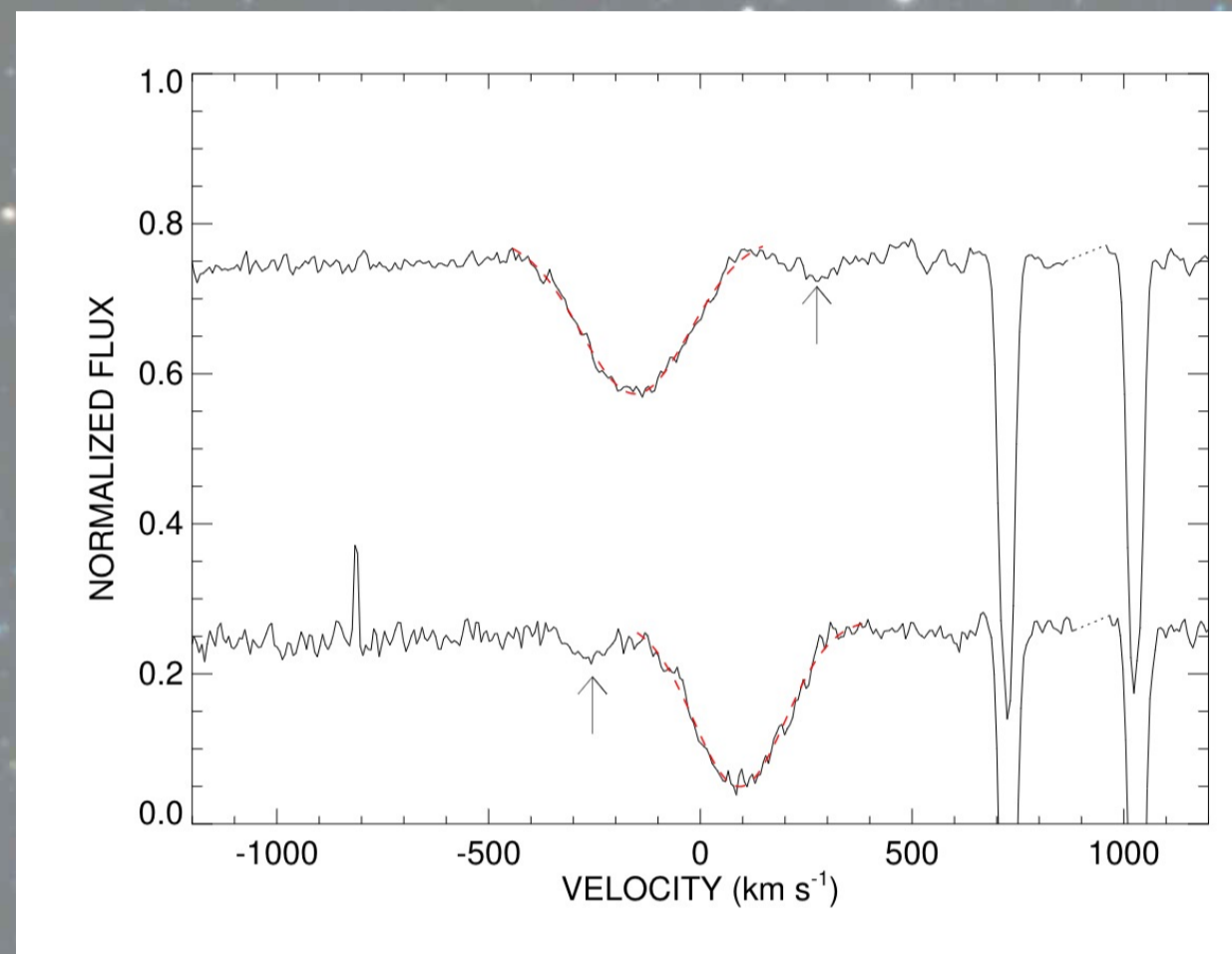
Introduction to CC Cas:

- Discovered to be a spectroscopic binary by Pearce (1927)
- Eclipsing nature discovered by Guthnick & Prager (1934)
- Hill et al. (1994) – tomographic separation of component stars and eclipse model – conclusions seem to show that the stars are undermassive for spectral types of O8.5III(n)((f)) + B0V
- Gorda (2013) provide first CCD spectra of system – third body causing long-term changes in γ -velocity.

New results:

- Masses and radii agree with spectral types.
- Secondary variability in TESS light curve is not periodic, and seems to show that the primary star has surface spots like those seen on ξ Per or ζ Pup (Ramiaramanantsoa et al. 2014, 2016).
- Will be submitted to MNRAS once the errors are finalized.

New Spectroscopy:



We collected a total of 36 new spectra collected to get primary and secondary velocities using He I 5876 line. Our spectra were taken both with LCO/NRES and with a 0.4-m telescope and a Shelyak eshel spectrograph on the campus of Embry-Riddle Aeronautical University in Prescott, AZ.

Here we show two example spectra taken at opposite quadratures and offset for clarity. The red dashed lines show the primary star fit, while the arrows indicate the secondary's velocities.

The deep narrow absorption lines on the right are from interstellar Na D and are not variable.

On the right, we show the preliminary model for the binary using the PHOEBE code (Prša et al. 2016). The top panel shows the TESS light curve (only 10% of the points from Sectors 18 and 19 in 2019). The bottom panel shows our radial velocity measurements. The open black points represent those of Gorda (2013), while the solid red points show our primary star measurements and the blue asterisks show the points where we could measure the secondary star.

The interesting parameters are given below, with errors being calculated currently through a Monte Carlo approach.

Parameter	Value
Period	3.3663955 d
e	0.01368
ω	127.5°
M_{primary}	31.02 M_{\odot}
R_{primary}	10.17 R_{\odot}
$T_{\text{eff, primary}}$	35560 K
$M_{\text{secondary}}$	10.66 M_{\odot}
$R_{\text{secondary}}$	8.37 R_{\odot}
$T_{\text{eff, secondary}}$	31700 K

