The Multiple-component Binary Hyad, vA351 Final Results

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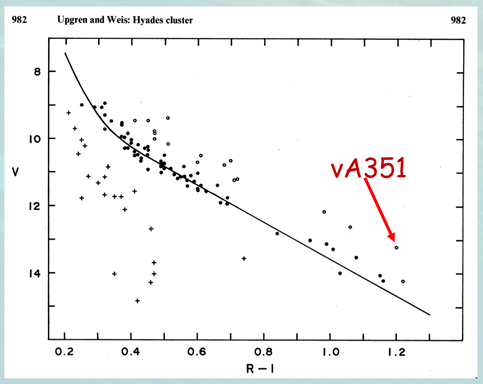
V = 13.27 {Ben21}

B-V = 1.54 {Upg77}

vA351 was never this simple M dwarf because of this….



Binary nature first confirmed during a blind survey of the Hyades using HST/FGS 3 in TRANS mode. Project proposed and executed by Otto Franz.

Observational Material

-HST Fine Guidance Sensor 3
Feb 1994 to October 1998 (13 orbits TRANS, 7 with POS mode)

-Speckle Interferometry (Horsch 2012)

-Radial Velocity, McDonald 2.1m + Cass Echelle, September 1995 to February 2009

-Radial Velocity, CfA Digital Speedometers, January 1982 to October 1999

-IGRINS on McDonald 2.7m and Lowell Discovery Telescope

$\mathcal{M}_{tot}=a^3/P^2$, period, P, in years, a in AU.

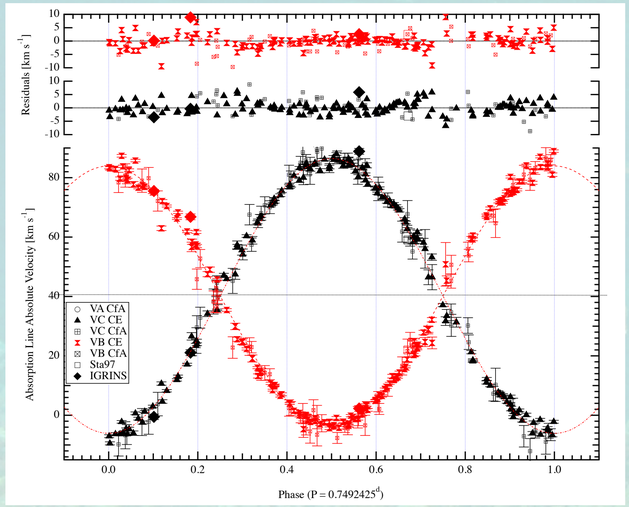
Need a parallax, π, to establish a in AU,

to obtain $\mathcal{M}_{tot}$. Assuming Hyades π = 0.0211" (McA11), $\mathcal{M}_{tot}=1.87\mathcal{M}_\odot$, suggesting

the existence of an unseen white dwarf companion.

Hence,"vA351 - A Quadruple Hyad Containing a White Dwarf?",{Fra98}.

Absorption line radial velocities yields this RV orbit with P=0.749[d];



and vA351 becomes this

We have POS mode astrometry with which to establish parallax, π, and mass fraction, f, as we did for other M dwarf binary systems, {Ben16}.

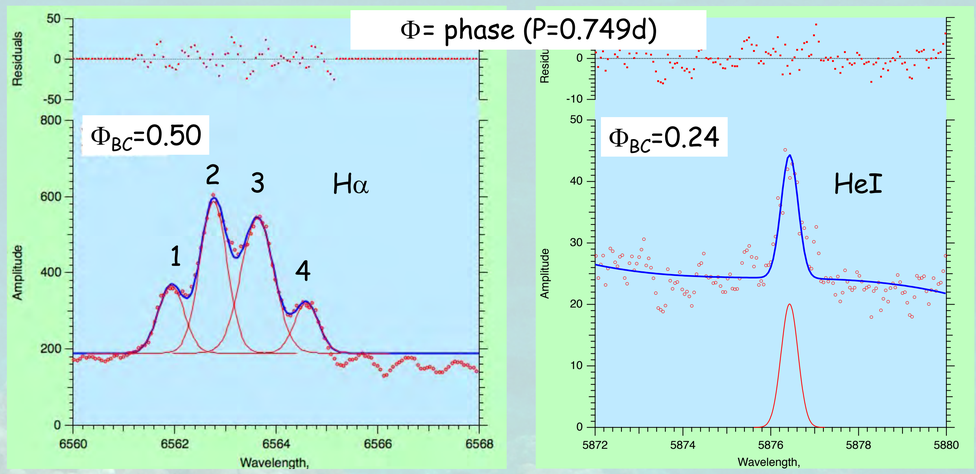
Using the FGS pipeline scale, solving only for roll, we obtain parallax

π =18.37±0.65 mas, mass fraction f = 0.433±0.022, and $\mathcal{M}_{tot}=2.06\pm0.24\mathcal{M}_\odot$. These results are not up to our usual precision standards, partly because of the astrometric modeling of a smaller than typical number of reference stars, partly because of necessary and uncertain photo center corrections.

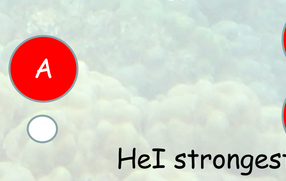
Mass values that satisfy the astrometry and these constraints (V_{tot}=13.27, ΔV=0.0, $\mathcal{M}_C/\mathcal{M}_B$ =0.945 from RV, Mass-Luminosity relation from {Ben16}

$\mathcal{M}_A=0.57\mathcal{M}_\odot$, $\mathcal{M}_B=0.48\mathcal{M}_\odot$, $\mathcal{M}_C=0.45\mathcal{M}_\odot$, $\mathcal{M}_{WD}=0.53\mathcal{M}_\odot$

Ongoing puzzles include the origin and locations of Hα emission varying from one to four peaks and HeI (λ587nm) emission varying from one to three peaks, both having components with the same period as BC absorption line RV.



Φ_{BC}= 0.25 or 0.75 (syzygy)



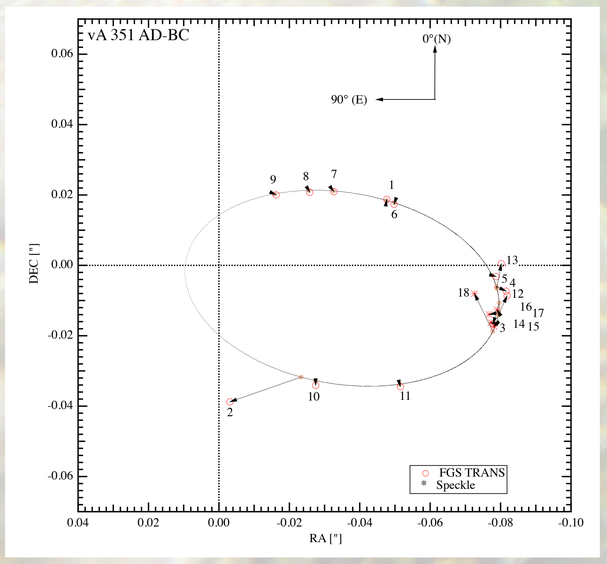
HeI strongest, single peaked

Hα strongest, double peaked

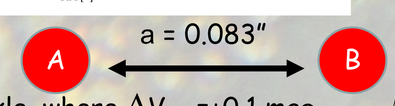
Φ_{BC} = 0.5 or 1.0

HeI weaker, triple peaked

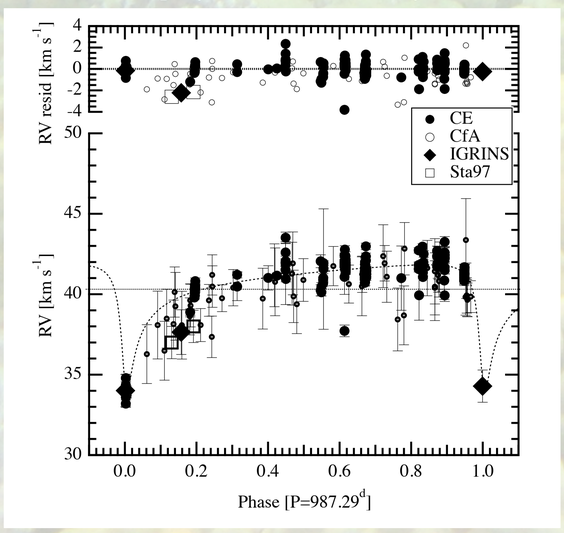
Hα weaker, quad peaked

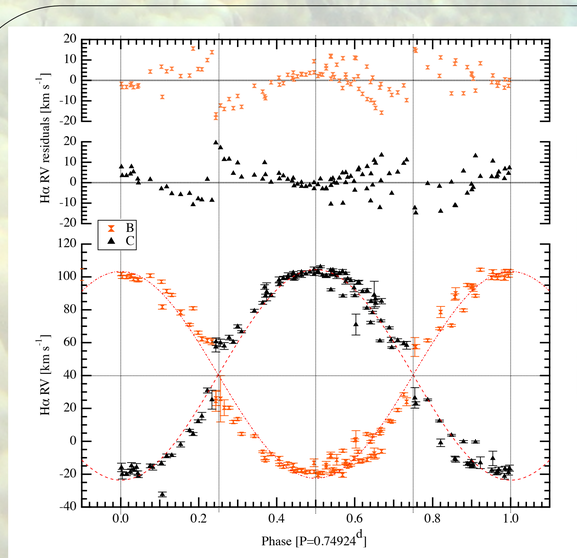


Relative orbit from HST/FGS and Speckle, where ΔV_{A-B}=±0.1 mag, P=2.705±0.004y

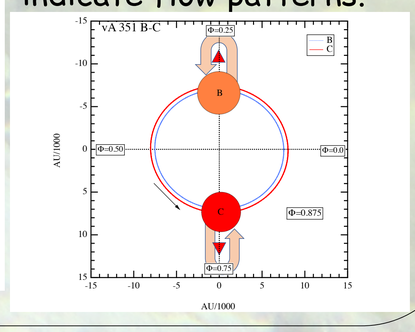


RV confirm a highly eccentric, nearly face-on orbit





Hα BC RV amplitudes suggest emission in regions more distant from the center of mass, locations ▲ shadowed by each from the other. Residuals could indicate flow patterns.



References
{Ben16} Benedict et al. 2016, AJ, 152, 141
{Fra98} Franz et al. 1998, BAAS, 30, 1402
{Upg77} Upgren, A. & Weis, E. 1977, AJ, 82, 978
{Ben21} submitted to AJ

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