

## Two Unresolved Double Stars: CHR 139 Aa,Ab and HDS 2003

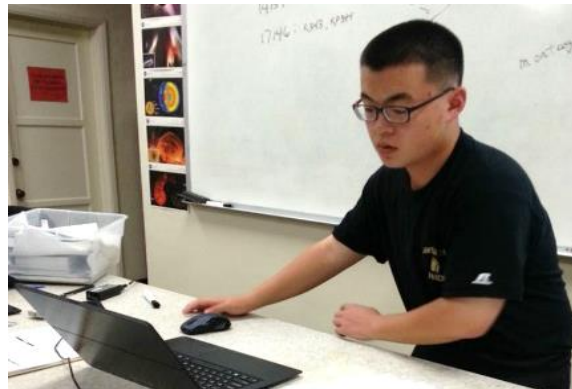
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**Abstract** CHR 139 Aa,Ab (WDS 17146+1423) has had only three previous measurements (1986, 1989, and 1991) and many “no result” attempts over the past 30 years. We were not able to resolve this pair with speckle interferometry observations on a 2.1-meter telescope at Kitt Peak National Observatory. HDS 2003 (WDS 14157+1911) was reported as a double from Hipparcos data. We attempted to confirm this double with the same 2.1-meter telescope as a secondary measurement, but were unable to see any secondary star. Both double stars were observed in April 2014.

### Discussion of CHR 139 Aa,Ab

This system contains the well-observed AB component STF 2140, AC pair (AGC 16), and Aa,Ab component (CHR 139). Our research focused on the Aa,Ab pair with the first published measurement in 1986 and the most recent in 1991 (McAlister 1989 and 1993). One other measurement was made in 1989 (McAlister 1989). Speckle interferometry observations were made in the present study using a 2.1-meter telescope at Kitt Peak National Observatory in April 2014, with the process detailed in Genet et al. (2014). Figure 1 shows the Army and Navy Academy student, Cao, leading the project.



*Figure 1: Cadet Zhixin Cao of the Army and Navy Academy in Carlsbad, CA.*

The Washington Double Star Catalog (WDS) states that the primary star has a magnitude of 3.48 and a spectral type of M5Ib-II. There is no reported magnitude or spectral type for the secondary. Baize & Petit (1989) noted:

Aa,Ab: A premature orbit has been computed. See Baize & Petit (1989) catalog of doubles with variable component. Radial velocity measures by Smith (1988 private communication) for alp Her A since 1984 have shown an increase in velocity by about 11 km/sec during a three-year interval, then an apparent turnover in velocity during the fourth year. This suggests a component with a period of the order of a decade; it now appears that this system may have at least five physical components.

It was further noted that this pair had been “resolved 3 times 1986-1991 at separations ranging from 0.16-0.19”.” The three successful measures reported in the WDS are summarized in Table 1, but “unresolved by Balega at the 6-m in 1997 and 10 times 1985-1997 at 4m and 2.5m telescopes” (Baize & Petit, 1989). The WDS measurement record also detailed six epochs without a recorded measurement.

CHR 139 Aa,Ab			
EPOCH	Position Angle	Separation	Reference Code
1986	085.8	0.19	McA1989
1989	116.6	0.16	McA1990
1991	230.7	0.19	McA1993

Table 1: Historical Measurements of CHR 139 Aa from the WDS.

The autocorellogram created using PlateSolve 3 of our observation of CHR 139 Aa,Ab is shown in Figure 2 (Rowe and Genet 2015). A single star was used for deconvolution. No secondary star was found.

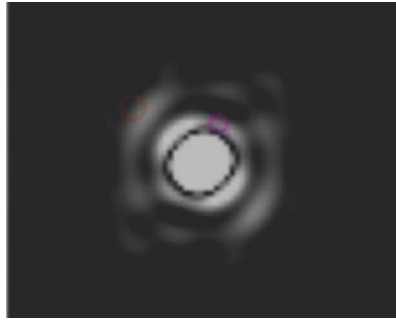


Figure 2: An autocorellogram for CHR 139 Aa,Ab developed with PlateSolve 3.

### Discussion of HDS 2003

The second star we studied was HDS 2003 (WDS 14157+1911). This potential double star was detected using data from Hipparcos with reported primary and secondary magnitudes of 0.16 and 3.49, and a spectral type of K2IIIp for the primary with none reported for the secondary. A position angle of  $198.0^\circ$  and  $0.30''$  separation was reported. The Hipparcos report was the only published observation of this close double star.

The PlateSolve 3 (Rowe and Genet 2015) autocorellogram of our observation of HDS 2003 is shown in Figure 3. A single star was used for deconvolution. No secondary star was found.

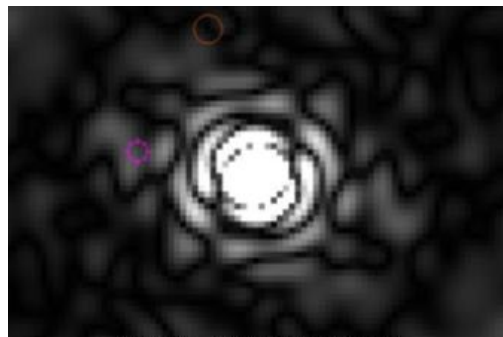


Figure 3: An autocorellogram for HDS 2003 developed with PlateSolve 3.

### Acknowledgements

We thank Kitt Peak National Observatory for the use of their 2.1-m telescope. We utilized Dave Rowe's Plate Solve 3 program for speckle reduction. Data was extracted from the Washington Double Star Catalog and Brian Mason provided past observational data. We thank external reviewers Russell Genet, Richard Harshaw, and Vera Wallen.

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