

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

Zhixin Cao<sup>1</sup> and Grady Boyce<sup>2</sup>

1. Army and Navy Academy, Carlsbad, CA
2. Boyce Research Initiatives and Educational Foundation, San Diego, CA

**Abstract** CHR 139 Aa (WDS 17146+1423) has had three previous measurements between 1986 and 1991 and many “no result” attempts over the past 30 years. We were not able to resolve this pair with speckle interferometry measurements on the 2.1-meter telescope at Kitt Peak. HDS 2003 (WDS 14157+1911) was reported as a double by Hipparcos. We attempted to confirm this double with the 2.1-meter telescope with a confirming secondary measurement, but were unable to see any secondary star.

### CHR 139 Aa

This system contains the well-observed AB component STF2140, AC pair (AGC 16), and Aa component (CHR 139). Our research focused, Figure 1, on the Aa pair with the first published measurement in 1986 (McAlister 1989). Speckle interferometry observations were made using the 2.1-meter telescope at Kitt Peak National Observatory in the process detailed in Genet et al. (2014).



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

From the WDS records, the Aa system had only three past measurements, with a magnitude of 3.48 for the primary with a spectral type of M5Ib-II. There is no reported magnitude or spectral type for the secondary.

Baize & Petit (1989) noted that

*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 0.16-0.19” 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 three successful measures contained in the WDS are summarized in Table 1. However the WDS measurement record also detailed six epochs without a recorded measurement.

WDS 17146+1423Aa			
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 17146+1423Aa from the WDS.

The autocorellogram of our observation of CHR 139 is shown in Figure 2. A single star was also observed and used for deconvolution. No secondary star was found.

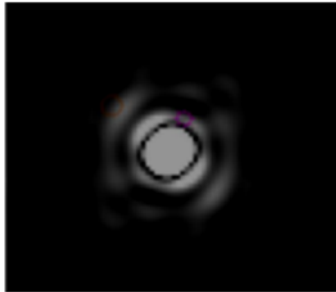


Figure 2: WDS 17146+1423Aa PlateSolve 3 autocorellogram.

## HDS 2003

The second star we studied was HDS 2003 (WDS 14157+1911). This potential double star was observed by Hipparcos who reported primary and secondary magnitudes of 0.16 and 3.49, and a spectral type of K2IIIp for the primary with none reported for secondary. A position angle of 198.0° and 0.30" separation was reported. The Hipparcos report was the only published observation of this potential close double star.

The PlateSolve 3 (Rowe and Genet 2015) autocorellogram of our observation of CHR 139 is shown in Figure 3. A single star was also observed and used for deconvolution. No secondary star was found.

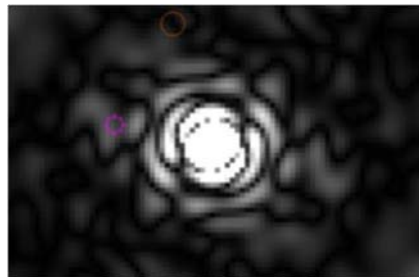


Figure 3: WDS 14157+1911 PlateSolve 3 autocorellogram.

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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 maintained by the U.S. Naval Observatory. Brian Mason, at the U.S. Naval Observatory, provided past observational data. We thank external reviewers Russell Genet, Richard Harshaw, and Vera Wallen.

## References

Baize, P. & Petit, M. 1989. "Binary Star Speckle Measurements During 1992-1997 From The SAO 6-m and 1-m Telescopes", *Astronomy & Astrophysics Supplement Series*, 77, 497-511.

- Genet, R. 2014. Kitt Peak Speckle Interferometry. Proceedings for the 33<sup>rd</sup> Annual Conference of the Society for Astronomical Sciences 77.
- McAlister, H.A., Hartkopf, W.I., Sowell, J.R., Dombrowski, E.G., & Franz, O.G. 1989. AJ 97, 510.
- McAlister, H.A., Hartkopf, & Franz, O.G. 1990. AJ 99, 965M.
- McAlister, H.A., Mason, B.D., Hartkopf, W.I., & Shara, M.M. 1993. AJ 106, 1639M.
- Rowe, D. and Genet, R. 2015. Submitted to the *Journal of Double Star Observations*.