

Two New CPM Pairs in Libra

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Abstract: In this paper two new double stars are reported in the constellation of Libra that are currently not in the WDS catalog, the components of which share common proper motions. On observed photometric characteristics, calibration of distances, and other assumptions, all the indications are that both pairs comprise possible wide physical systems.

Introduction

Starting with a detailed study of the naked-eye double star Zubenelgenubi (α Librae), a systematic exploration was carried out to identify possible new binary pairs in the immediate vicinity. This was partly as a diversion away from studying the planet Saturn, its ring system, and its moons, which were also on view in Libra in the early morning skies during January and February 2014 (Figure 1) when the search campaign was undertaken. Attention was particularly focused toward brighter pairs accessible in small aperture telescopes and having PMs greater than 20 mas yr^{-1} to avoid the error noise levels which would ensue in the lower proper motion, more distant pairs. Five new CPM pairs were identified within a field radius of 10° centered on α Librae, out of which three had to be discarded. They did not fit the binarity criteria, even though they appeared to be sharing common proper motions, which was perhaps just fortuitous. The two remaining pairs that seemed to fit the binarity criteria were then further evaluated, with positive end results. The primary (A-component) of the first pair has the Henry-Draper designation HD130192, and the primary of the second pair is USNOA2 0750-08663620.

Measurements and Analysis

High resolution FITS images, originally taken in the J-band, were obtained from 2MASS as shown in Figure 2.

Astrometric measurements on these images confirmed the latest PA and Sep. These were then combined with proper motion data and R-magnitudes from



Figure 1. Locations of the proposed new double stars in Libra [Credit: Stellarium]

the PPMXL and UCAC4 catalogs [1] [2], and photometric J and K magnitudes from the 2MASS catalog [3], yielding the results summarized in Table 1.

We note that the PM vectors (μ_α , μ_δ) are sufficiently large and are equated in their respective magnitudes and in their directions within each pair, which would rule out the possibility of alignments occurring purely out of random chance. Within the integrity of the data in these catalogs, the two pairs can therefore be categorized as genuine CPM double stars in this finding. In Table 1, the columns headed 'Spec Type' and 'Spec Dist' are the likely spectral types and projected spectral distances, inferred from a unique combination of the 2MASS (J-K) color indices, the proper motions, and the distance modulus methods already systematized by the

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Table 1: Identification, measurements, and results

Pair		RA	Dec	μ_{α}	μ_{δ}	R mag	θ (deg)	ρ (as)	Epoch	Spec Type	Spec Dist (ly)
14471-0946	A	14 47 06.0	-09 45 58	-4.9	-34.7	9.5	276.0	15.07	1999.208	F8V	~358
	B			-7.5	-35.4	11.1				K0V	
14510-1329	A	14 51 02.4	-13 28 53	-26.5	-19.5	10.5	194.0	12.13	1998.605	K0V	~206
	B			-25.1	-19.7	11.0				K8V	

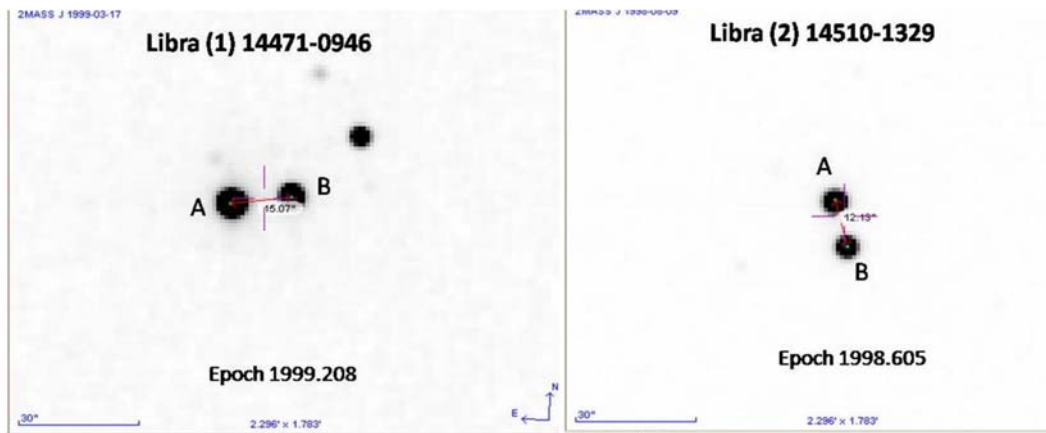


Figure 2. Visualisation of components [Credit: 2MASS]

author through earlier papers [4], [5], [6].

In Table 1, at a projected distance of some 358 ly (110 pc) away, the first pair would have a physical separation between components of: $\tan(15.07'') \times 63240 \times 358$, which equates to 1654 A.U. Although this distance may seem excessively wide for orbital gravitational interactions to take place between the binary components (on the assumption they are both at the same distance), it is still within acceptable limits. A good comparison system to illustrate this fact is the naked eye binary α Librae in this very same constellation. α^1 and α^2 Lib are separated by 231 arc seconds in the sky and the system lies at a parallax-measured distance of 77 ly (23.6 pc). It is widely accepted that the two stars of α Librae are gravitationally connected. Projecting their orbit onto the plane of the sky, they are physically separated by: $\tan(231'') \times 63240 \times 77 = 5453$ A.U. in 3D space, which is almost as much as a tenth of a light-year. That's far apart!

Through similar projections and calculations, the components of the second pair are found to have a much tighter separation of just 766 A.U.

Conclusions

The two new pairs identified in this paper both satisfy photometric and spectral criteria of having main-sequence components that share very similar proper motions. They also appear to be within angular and physical distance thresholds in order to form possible wide visual binary systems.

References

- [1] *PPMXL Catalog*, Roeser, et al., 2010.
- [2] The Fourth US Naval Observatory CCD Astrograph Catalog (UCAC4), Zacharias, et al., 2012.
- [3] The Two Micron All-Sky Catalog of Point Sources, Cutri, et al., 2003.
- [4] Ahad, A., *Webb Society Double Star Section Circular*, **18**, 49, 2010.
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- [6] Ahad, A., "A New Common Proper Motion Double Star in Cetus", *JDSO*, **8**, 332-334, 2012.