

## Two New Stellar Pairs Discovered Using SDSS Imagery

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**Abstract:** Two previously uncatalogued stellar doubles were discovered by the author while searching the online DSS and SDSS images for variable stars. One of the candidates is a definite proper motion double.

In December 2016, I accidentally stumbled upon two previously uncatalogued double stars during a hunt for variable objects in DSS and SDSS. SIMBAD, Vizier, and The Washington Double Star catalog (WDS) had no mention of these objects. Brian Mason of the USNO confirmed both pairs as being two new double stars.

### **Candidate 1: UCAC3 171-146981**

The first stellar pair was listed as a single star according to SIMBAD (UCAC3 171-146981), but when inspecting the DSS and SDSS images, it was clear that it was made up by two components of nearly identical brightness and color (see Figure 1). The SDSS9 (Adelman-McCarthy et al, 2012), USNO-B1.0 (Monet et al, 2003), PPMXL (Roeser et al, 2010), and 2MASS (Cutri et al, 2003) catalogs listed both components separately. The data extracted and derived from these catalogs was used to determine a B-V color index, Visual magnitude, and proper motion (see Table 1) for both components.

The 2MASS data was used to indirectly determine the B-V color indexes, using the J and K filters. The results summarized in Table 1 show that both components have a similar B-V index.

Individual optical magnitude measurements for each component were difficult to find, especially due to errors in the SDSS data. Using the previously calculated B-V color index and the USNO-B1.0 Blue magnitude measurements, I was able to deduce the visual magnitudes. But these values are approximate as the USNO-B1.0 filters are not purely monochromatic. Furthermore, the USNO-B1.0 Blue magnitude for one of the components was listed as unreliable, adding to the uncertainties. The proper motion was extracted from

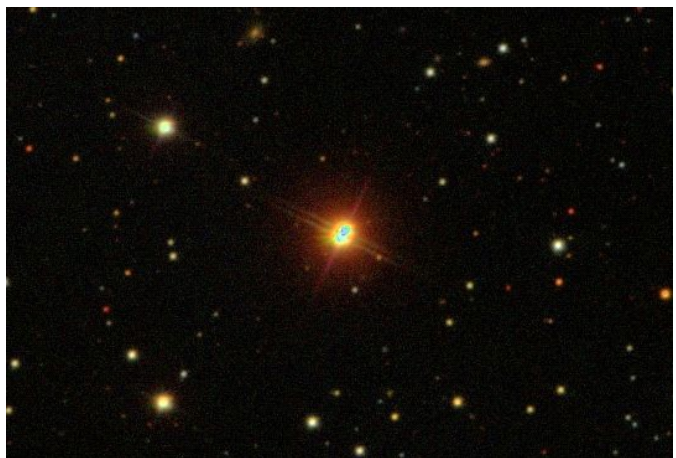


Figure 1: Discovery SDSS image showing the binary nature of UCAC3 171-146981 (centered in this image). The image was extracted from Skymap.org. Image taken B2005.4287.

the PPMXL catalog. As the table shows, they are rather similar.

The similarity in the B-V color index and the proper motion of both components is a good argument in favor for their binary nature. Even though the visual magnitude for one of the components is very uncertain, the “length” of the diffraction spikes in SDSS is definitely an indication that both objects are similar in apparent brightness. I tried to search for additional companions to this system using the PPMXL catalog, but none could be found within  $2''$ . Separation is about  $4''$ .

### **Candidate 2: [SLS2012] PYC J16014+2116**

The second candidate was listed by SIMBAD as a single star, [SLS2012] PYC J16014+2116. A close inspection of the SDSS image (Figure 2) shows however

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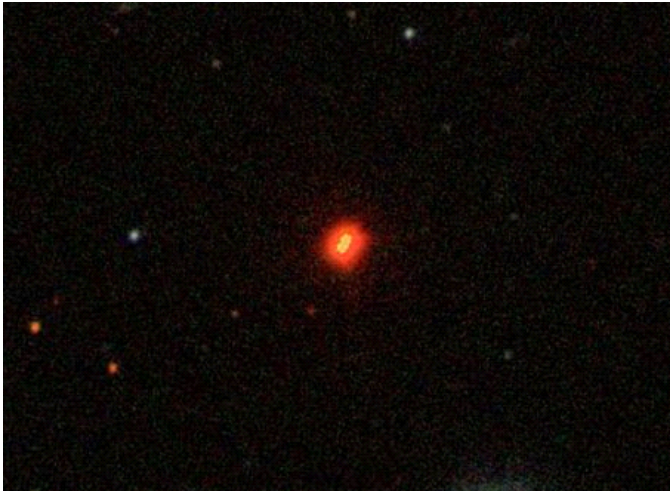


Figure 2: Discovery SDSS image showing the binary nature of [SLS2012] PYC J16014+2116 (centered in this image). The image was extracted from Skymap.org. Image taken B2004.2929.

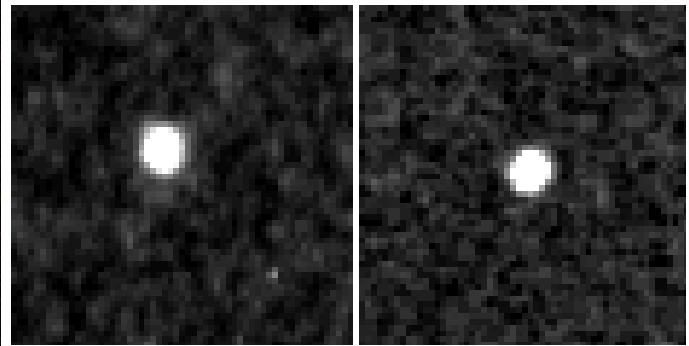


Figure 3: DSS1 and DSS2 Blue images of [SLS2012] PYC J16014+2116. In both images the object appears rather stellar. The small difference in elongation might be an artifact. Images are from the DSS Plate finder.

two apparently close (separation: 2") components of very similar brightness.

The SDSS9 catalog listed both components separately. A B-V color index for both components was thus derived based on this data (from the “g”, “r” and “u” SDSS filters). SDSS data was also used to calculate a visual magnitude for both components.

No catalog listed the proper motion for each component separately. However, the PPMXL catalog listed [SLS2012] PYC J16014+2116 having a proper motion of pmRA (mas/year)= -62.9; pmDEC(mas/year)=-89.5. Its proper motion was thus clearly detectable by comparing DSS1 and DSS2 images. The object appeared just as stellar in all these images, which could be an

indication that both components have a rather similar proper motion (see Figure 3). The similarity of the B-V color index and possibly the proper motion are good arguments in favor for their binary nature.

**Acknowledgments**

I wish to thank Brian Mason of the USNO/NRL/ Navy for his expertise and rapid response. I also want to thank amateur astronomer Laurent Ferrero (Marseille, France) for his opinion regarding UCAC3 171-146981, and Sebastian Otero (AAVSO) for having provided me with the tools allowing the magnitude conversions.

Table 1: Results for both candidates

Name	RA+DEC	PM (RA)	PM (DEC)	PA	Sep	B-V	Mags	Date
Candidate 1	163341+044336	-88.9, -83.0	+26.1, +26.8	336°	≈3.4"	1.11, 1.21	11.9, 11.2 (?)	2005.4287
Candidate 2	160127+211613	-62.9	-89.5	329°	≈1.6"	1.65, 1.64	16.2, 16.0	2004.2929

