

Discovery of 4 New Double Stars in Constellation Serpens

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Abstract: During observations in the constellation Serpens, four new double stars could be found: USNO B1.0 1007-0241735, USNO B1.0 1004-0244945, USNO B1.0 0950-0252685 and USNO B1.0 0949-0248260. All these double stars are listed as single stars in USNO catalog but can be separated into two components. Separations are between 4 and 10 arc seconds. In 3 cases proper motions are known and comply with Halbwachs' criteria for possible common proper motion pairs.

Report

The observations were made with a 12-inch Newtonian telescope in combination with a Canon EOS 1100D camera. The focal length was 1500 mm; the field of view was about 0.9 x 0.6 square degrees. The reproduction scale was about 0.70 as/pixel [Schlimmer, 2013]. The planetary software Redshift 7 was used for telescope control. The data analyses were done with the software program REDUC [Losse].

For each observation, four field images with exposure times of 60 seconds were chosen. To correct the stacked image, flat and dark images were made. Deep Sky Stacker 3.3.4 [Coiffier] was used to stack the images.

In the analysis of the stacked images, four new double stars were found. All of the new double stars are listed in the SIMBAD astronomical database as single stars.

1. USNO B1.0 1007-0241735

This star is located in the neighborhood of δ Serpens. Coordinates for USNO B1.0 1007-0241735 are 15 35 50.7 in R.A and 10 43 35.6 in declination. Brightness is 10.29 magnitudes. The star can be separated into two components of similar brightness. Separation is 9.60 arc seconds, position angle is 1.6 degrees. There is no known proper motion. If the given brightness of USNO B1.0 1007-0241735 is interpreted as the combined magnitudes, the individual brightnesses of the compo-

nents can be found. If brightness of both components is known, the Aiken criteria can be calculated. Because the separation is greater than maximum separation of Aitken's criteria [Romero, 2006], it can be expected that USNO B1.0 1007-0241735 is not a binary star.



Figure 1. USNO B1.0 1007-0241735, north is down, east is left

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2. USNO B1.0 1004-0244945

The coordinates for USNO B1.0 1004-0244945 are 15 36 20.9 in R.A. and 10 26 51.3 in declination. It can be found only 39 arcsec from the high proper motion star TYC 933-563-1. USNO B1.0 1004-0244945 can also be separated into two components of similar brightness. The separation is about 4.39 arcsec and the position angle is 238.9° . There is a small proper motion of -4 mas/yr in R.A. and 4 mas/yr in declination. Separation doesn't satisfy Aitken's criteria for physical double stars, but with $T = \text{separation/proper motion} = 776$ years < 1000 years it achieves Halbwachs' criterion for possible common proper motion pairs [Halbwachs, 1986].



Figure 2. USNO B1.0 1004-0244945, north is down, east is left

3. USNO B1.0 0950-0252685

The observation field was centered on TYC 0361-00161-1 between ϵ Serpens and 43 Serpens. USNO B1.0 0950-0252685 can be found 1.9 arc minutes from TYC 361-1137-1. The coordinates for USNO B1.0 0950-0252685 are 15 54 31.4 in R.A. and 05 05 16.2 in declination. The brightness is 12.88 magnitudes. The star can be separated into two components. Separation is 5.46 arcsec, position angle is 320.3° . Proper motion is -6 mas/yr in R.A. and 4 mas/yr in declination. With $T = 757$ years for moving the distance of its own separation, it satisfies Halbwachs' criterion for possible common proper motion pairs [Halbwachs, 1986].

4. USNO B1.0 0949-0248260

This star is located in the same observation field as the previous star and can be found 3.8 arc minutes from



Figure 3: USNO B1.0 0950-0252685 north is down, east is left

HD142576. USNO B1.0 0949-0248260 is the brightest star of these new double stars. Its brightness is 9.84 magnitudes, separation is 9.97 arcsec, and position angle is 296.4° . Proper motion is 4 mas/yr in R.A. and -24 mas/yr in declination. With $T = 410$ years for moving the distance of its own separation, it satisfies Halbwachs' criterion for possible common proper motion pairs [Halbwachs, 1986].



Figure 4: USNO B1.0 0949-0248260 north is down, east is left

The four double stars are listed in Table 1. First column lists the catalog name of the star, second and third columns are the R.A. and dec. coordinates, fourth col-

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Table 1: New double stars in constellation Serpens

Name	RA	Dec	Mag	PM R.A.	PM Dec.	d Mag	Mag A	Mag B	date	Theta	p	Aitken limit	T=p/PM	Field centered
USNO-B1.0 1007-0241735	15 35 50.7	10 43 35.6	10.29	0	0	0	11.05	11.05	2014.504	1.6	9.6	5.50		del Serpens
USNO-B1.0 1004-0244945	15 36 20.9	10 26 51.3	12.09	-4	4	0	12.85	12.85	2014.504	238.9	4.39	2.40	776.05	del Serpens
USNO-B1.0 0950-0252685	15 54 31.4	05 05 16.2	12.88	-6	4	1	13.2	14.2	2014.463	320.3	5.46	1.71	757.17	TYC 0361-00161-1
USNO-B1.0 0949-0248260	15 55 18.4	04 59 21.2	9.84	4	-24	1	10.2	11.2	2014.463	296.4	9.97	6.8	409.76	TYC 0361-00161-1

umn gives the brightness, fifth and sixth columns give the proper motion in mas/yr if known, seventh column is the estimated difference in brightness, eighth and ninth columns give the calculated individual magnitude, column ten gives the date of observation, column eleven and twelve give the measured angle in degree and measured separation between the components in arc seconds, the thirteenth column shows the calculated Aitken limit p max in arc seconds, column fourteen gives the time in years how long the pair needs to move the distance of its own separation if proper motion is known, and column fifteen gives a short note to the image field in the neighborhood.

Acknowledgment

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