Study of Neglected Double Stars by LIADA Double Star Section in 2004, II: Astrometry, Astrophysical Properties and Nature.

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Abstract: LIADA's (Liga Iberoamericana de Astronomía) Double Star Section presents angular separations, position angles as well as V magnitudes for 113 neglected visual double stars obtained in 2004. A total of 548 measures were averaged into 246 mean positions that range in separation from 2.6" to 421.9". Our observations were made by means of several techniques (CCD detectors, astrometric eyepieces and photographic and digital surveys). About 31% of the double stars were unconfirmed pairs discovered by John Herschel which remained neglected since before 1850. BVIJHK photometries, astrometric and kinematical data were used/obtained to determine astrophysical parameters (spectral types and luminosity classes, photometric distances, etc). Their nature was determined using several professional criteria classifying them as optical, physical or common origin pairs. Only 12 % were physical double stars. New systems were discovered.

Introduction

Very neglected and unconfirmed double stars were selected to design our observational programs. This sample of double stars have little astrophysical interest (only about 5-10 % are physical pairs), but the task to update their parameters and characterize them is important. Other objects studied were unconfirmed double stars discovered recently by the North American amateurs James Daley (DAL) and Dave Arnold (ARN) and the French amateur J.F. Courtot (CTT).

We present 548 individual relative measures for 113 double stars which were performed using different techniques. These observations are averaged into 246 mean positions and angular separation ranges from 2.6" (for the newly discovered FMR 4 AB) to 421.9" (for STF2417 AC). About 43% of the observed double stars were closer than 15". Thirty-five of them (31%) were discovered by John Herschel and they have remained unconfirmed since 1820-1850!

From January 2004 through December 2004, CCD cameras, micrometric eyepieces, on-line surveys such as the Digitized Sky Survey (hereafter DSS) and SuperCosmos Sky Survey (Hambly et al. 2001a,b,c, hereafter SCSS), astrometric catalogs like Two Micron All Sky Survey (Cutri et al. 2000, hereafter 2MASS), and AC2000 (Urban et al. 1998) were used to perform the astrometric measures.

Forty-five double stars have been confirmed and of the programmed unconfirmed double stars, 7 of them could not be identified (see Table 1). A brief study of all measured doubles showed the suspected physical nature for 13 double stars and others 13 pairs were classified as common origin pairs.

In 2004 we discovered 15 new double stars. Ten of them are suspected to be binaries of common origin (that is, pairs of stars that be born together but do not orbit each other), others are physical binaries, gravitationally bounded. Francisco Rica discovered nine systems and Rafael Benavides discovered three systems. Several of these systems were discovered during a work carried out by Francisco Rica consisting of characterization of about 300 proper motion stars

recently discovered in 1999 by Wroblewski & Costa (1999).

We studied the nature of the programmed double stars. About 62% were optical pairs, that is, pairs with unrelated members. About 24% were physical pairs (whose members orbit each other) or common proper motion pairs.

One of the main goals for our group is the dessimination of our work and results to the professional and amateur double star community. In our last circular in 2004 we communicated our results to more than 10,000 amateurs and tens of professionals. Surprisingly to us, professional astronomers were more interested in our work than amateur astronomers. Well known professionals such as Dimistris Sinachopoulos, Brian Mason, Josefina Ling and others requested the last LIADA circular. Our last circular have traveled to different places in Europe, North America, Spanish America and even South Africa and Japan. Same well known amateurs have asked for our last circular, including Christian de Villiers (from South Africa), James Daley (from the U.S.A.), Andreas Alzner (from Germany) and the Spaniard Tofol Tobal.

Confirmation of Visual Double Stars

The WDS catalog includes several thousand double stars that have only been measured at their discovery epoch and some hundreds of them have not been even resolved since 1900. These double stars are unconfirmed and they need a second measure.

In the period between January 2004 to December 2004, LIADA confirmed the existence of 45 visual double stars.

There are several reasons for this neglect: poor coordinates or large proper motion, erroneous magnitude or delta-m estimates or truly neglected (it is nearly impossible to measure the large amount of neglected double stars due to the few constant observers).

WDS No.	Designation	Mg.A	Mg.B	Epoch	ρ["]	θ[°]
22446+1137	HJ 300	11	12	1820	2	220
19314+1841	HJ 890	10	12	1820	6	240
19331+3252	HJ 1415	11	13	1828	4	16
19331+3252	HJ 1415AC	11	14	1828	4	76
22051+4504	HJ 1723	9	10	1828	15	185
22267+6011	HJ 1769	10	11	1828	6	50
22077+0913	HJ 3090	12	12	1830	4	82

Table 1: Unidentified, Unconfirmed Double Stars

Of all programmed unconfirmed double stars, seven were not identified. These pairs are shown in Table 1. In the first and second columns, the WDS identifier and discoverer code with their sequential number are listed; in the followed columns, from left to right,the magnitude for primary and secondary are listed; in column five the epoch of the single measure; and in the last two columns, the relative astrometry, ρ and θ.

Measurements

Relative Astrometry

The results of 548 individual relative measures, averaged into 246 mean positions, made with different techniques, are listed in Table 2. These observations range in separation from 2.6" to 421.9".

From January 2004 through December 2004, CCD cameras, micrometric eyepieces, DSS and 2MASS images were used to measure the relative astrometry of 113 binaries. Forty-five double stars have been confirmed.

Several observational techniques were used to obtain astrometry and photometry. A Microguide eyepiece was used by Rafael Benavides (Astronomical Society of Córdoba (Spain)) in a 9 inch telescope. 0.2-0.3 meters (8-12 inches) telescopes with a CCD were used by John Ryan – North-American amateur living in Salamanca (Spain)—and Jim Jones (from U.S.A.). Francisco Rica – Astronomical Society of Mérida (Spain) – used astrometric catalogs and online surveys.

The Lahuerta' brothers are members of the Grupo de Estudio, Observación y Divulgación de la Astronomía (G.E.O.D.A.) and they work from Manises' Observatory (MPC-IAU Code J98) in Valencia (Spain). They used a S/C Meade LX200 telescope with a 0.25 meters (10 inches) diameter objective and a 2,500 mm (98.4 inches) focal length. A Starlight Xpress MX516 CCD has a chip with 500 x 290 pixels and was used to obtain digital images. The size of the pixels is 9.8 x 12.60 μm. The Lahuertas' brothers worked with an f/6.3 focal reduce (with a JMI motofocus) resulting in a focal length of 1,478 mm (58.2 inches). The pixel size is 1.37 x 1.76 arcseconds and the field of view is 11.39 x 8.50 arcminutes. For astrometry and photometry they used Charon software and the GSC-ACT catalogue. Jim Jones from U.S.A. used a 0.28 meter (11 inches) telescope with a CCD SBIG ST7 with a KAF401E chip. Jim take 20 images for each pair which were reduced using Astrometrica and

UCAC-2 catalog.

Internet resources were also used for astrometry. The astrometric catalogs 2MASS and AC2000, enabled us to obtain measures of great accuracy. In the case of AC2000, the astrometry is very important because it allowed us to obtain early data from more than 100 years ago. DSS was also used for astrometry. Guide 6.0/7.0, Astrometrica and FitsView software were used for documentation and astrometry.

Table 2 lists relative astrometry for 113 double stars. In the first and second columns, the WDS identifier and discoverer code with their sequential numbers are listed; in the following columns, from left to right, the Besselian epoch of the astrometry; the number of measurements; the position angle and the angular separation; the V magnitude of the primary and secondary. If the magnitude listed has two decimal numbers these came from Tycho-2 (Hog et al. 2000) or else they came from calibrated GSC-I/GSC-II/ USNO-B1.0 photometry or inferred by spectral distribution using JHK photometry. The spectral type and luminosity class were estimated using photometric and kinematics data.

Column 11 lists the observer code as follow: ARU (Alejandro Russo, amateur from Argentina); BVD (Rafael Benavides, Astronomical Society of Córdoba, Spain); JRY (John Ryan, amateur from Spain/U.S.A.); DOS (Daniel Osanai, amateur from Argentina); FMR (Francisco Rica, Astronomical Society of Mérida, Spain); JJO **(**Jim Jones, amateur from USA); MRI (Edgardo Masa [member of SYRMA-MED group] amateur from Valladolid, Spain), OMG (Lahuerta's brothers from Spain); . In total 7 observers contributed to this circular.

The observation methods are listed in the next column (CCD: CCD camera; MCG**:** MicroGuide eyepiece; 2MASS: 2MASS project images; DSS: Digitized Sky Survey, SCSS: Super Cosmos Sky survey; AC2000: Astrographics Catalogue 2000; MICROM: Micrometers). Figure 1 shows a bifilar micrometer used in this study.

In column (12) the nature of the double star code is as follow: PHY = Physical; OPT = Optical; CO = Common Origin; CPM: Common Proper Motion; "¿?" = unknown; "--" = nature not studied. A "?"character at the end means that the nature listed is the most probable. In the last column the confirmed double stars show a "C"; a number indicates the years since the last measure. A "#" character followed by a number refers to a note number.

Spectral Types and luminosity classes estimates.

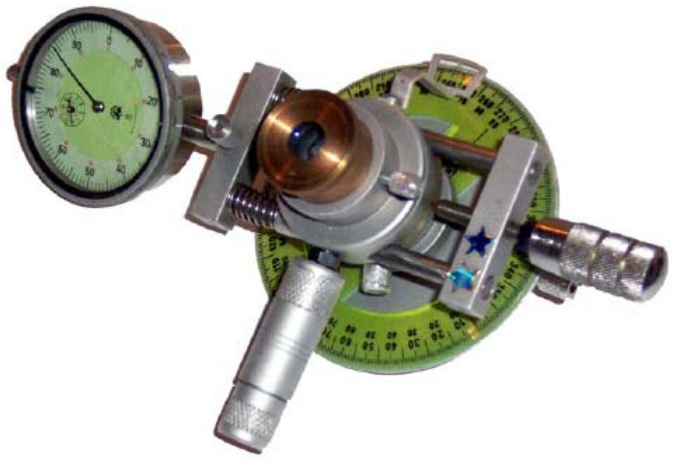

Figure 1: Filar micrometer made by Edgardo Masa. This is one of the techniques used by members of the LIADA Double Star Section to obtain measures in 2004.

Columns (9) and (10) of Table 2 list, for both components, the spectral types and luminosity classes estimated by the LIADA group. When the luminosity class is unknown then the spectral type matches with the main sequence dwarf is listed. The process to estimate spectral types and luminosity classes using BVJHK photometry and kinematical data were explained in detail in Rica (2005).

Table 2 lists 150 spectral types estimated by LIADA group; of these, only 15 stars have spectral types published in the professional literature.

Table 3 lists components with spectral types and luminosity classes in the literature. LIADA spectral type estimates are also listed. In Table 2 there are many spectral types that were estimated using only JHK photometry due to the star component not being listed in Tycho-2, so their results are of lower accuracy than those obtained using BVJHK photometry.

Studying the Nature of Visual Double Stars

To study the nature of visual double stars and classify them as optical, physical, common proper motion or common origin pairs, BVJHK photometric and astrometric (proper motions and relative astrometry) data were used. The historical relative astrometry (θ corrected by precession and proper motions) in addition to our own measures are plotted in X ($=\rho*\cos(\theta)$) against Epoch and Y ($=\rho*\sin(\theta)$) against Epoch diagrams. A linear fit shows the relative proper motion of B with respect to A. These data are very important because nearly all the methods that allow us to

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WDS Id.	Discover	Epoch	N	θ (°)	ρ (")	V_A	V_B	SP_A	SP_B	Obs.	Method	Type	Notes
00003+5651	CTT 1	**1983.776**	1	92.3	47.03	**8.56**	**11.35**			**FMR**	**DSS**	**OPT**	#1
00515+5630	**DAL 11**	**1954.752**	**1**	**231.2**	**40.76**	**8.11**	**12.7**	**G2V**	**M0V**	**BVD**	**DSS**	**CO/ PHY**	**C**
		1993.623	1	231.5	40.69					BVD	DSS		
		1998.968	3	231.6	40.72					FMR	2MASS		
01572+2618	**FMR 7BC**	**1997.842**	**1**	**354**	**85.80**	**10.77**	**20.2**	**G5V**	**M V**	**2MASS**	**2MASS**	**CO?**	**New**
02053+2906	**CTT 12 AC**	**1894.870**	**1**	**74.4**	**66.82**	**7.84**	**11.43**	**K1III**	**G7V**	**BVD**	**AC2000**	**OPT**	**C. #2**
02361+5706	**DAL 6**	**1997.772**	**3**	**128.5**	**8.57**	**12.35**	**13.12**	**F/G**	**K0III:**	**FMR**	**2MASS**	**OPT?**	C. #3
03528-0557	**HJ 2212**	**1955.884**	**1**	**296.9**	**27.39**	**9.58**	**13.3**	**A8V**	**G6V**	**BVD**	**DSS**	**OPT**	**C. 175. #4**
		1982.709	1	294.5	28.65					BVD	DSS		
		1997.024	1	294.2	28.87					BVD	DSS		
04021-3429	**BU1004AB-C**	**1912.739**	**1**	**137.5**	**55.87**	**6.73**	**11.8**	**G2V**	**K0V**	**BVD**	**AC2000**	**OPT**	**#5**
		1996.852	1	163.9	42.26					DOS	DSS		
		1996.852	1	163.9	42.26					DOS	DSS		
04180-0700	**HJ 23**	**1892.448**	**1**	**274.3**	**45.14**	**11.6**	**12.1**	**F6V**	**G6V:**	**FMR**	**AC2000**	**OPT**	**C. 173**
		1953.932	1	274.8	45.72					BVD	DSS		
		1989.894	1	275.4	46.20					BVD	DSS		
04289+3926	**HJ 3258**	**1953.025**	**1**	**252.8**	**14.76**	**11.75**	**12.6**	**F3V**	**G4V**	**BVD**	**DSS**	**OPT**	C. 173. #6
		1993.730	1	253.1	14.89					BVD	DSS		
		1999.756	3	252.8	15.03					FMR	2MASS		
		2004.124	20	252.6	14.96					JJO	CCD		
04524+7052	**HJ 1151AB**	**1953.785**	**1**	**10.2**	**10.38**	**10.53**	**12.4**	**K2III**	**G6V**	**FMR**	**DSS**	**OPT**	**101**
		1994.834	1	12.4	10.76					BVD	DSS		
		2004.090	4	13.6	10.60					JRY	CCD		
04524+7052	**HJ 1151AC**	**1953.785**	**1**	**331.2**	**20.22**	**10.53**	**13**	**K2III**	**K0V**	**FMR**	**DSS**	**OPT?**	**174**
		1994.834	1	333.7	21.42					BVD	DSS		
		2004.090	4	334	21.18					JRY	CCD		
04550+3411	**HJ 351AB**	**1955.861**	**1**	**86.6**	**15.29**	**9.72**	**12.1**	**K2V**	**F2V:**	**BVD**	**DSS**	**OPT**	**57. #7**
		1995.897	1	79.1	17.26					BVD	DSS		
		2002.507	2	41.5	35.98					BVD	MCG		
		2004.090	4	78.5	18.13					JRY	CCD		
04550+3411	HJ 351AC	1955.861		**27.4**	**22.23**	**9.72**	**18.4**	K2V	**K2:**	**BVD**	**DSS**	**OPT**	**C. 185. #7**
		1995.897		28.1	24.60					BVD	DSS		
04550+3411	HJ 351AC	**1955.861**	1	27.4	**22.23**	**9.72**	**18.4**	**K2V**	**K2:**	**BVD**	**DSS**	**OPT**	**C, 185, #7**
		1995.897	1	28.1	24.60					BVD	DSS		

Table 2: Double star measurements made by LIADA in 2004.

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WDS Id.	Discover	Epoch	N	θ (°)	ρ (")	V_A	V_B	SP_A	SP_B	Obs.	Method	Type	Notes
04550+3411	HJ 351AD	**1955.861**	1	64	**31.68**	**9.72**	**13.7**	**K2V**	**G6V**	**BVD**	**DSS**	**OPT**	**C, 185, #7**
		1995.897	1	61.5	34.10					BVD	DSS		
04550+3411	**HJ 351AE**	**1955.861**	**1**	**240.7**	**66.23**	**9.72**	**12.9**	**K2V**	**G7V**	**BVD**	**DSS**	**OPT**	**C, 185, #7**
		1995.897	1	240.7	64.11					BVD	DSS		
		2004.090	4	241.4	63.24					JRY	CCD		
04586+2918	**HJ 353**	**1954.995**	**1**	**242.5**	**14.22**	**11.84**	**12.6**	**G1III:**	**K5III**	**BVD**	**DSS**	**OPT?**	**C, 185**
		1996.049	1	242.0	15.09					BVD	DSS		
		2004.090	4	241.3	14.92					JRY	CCD		
05012+0844	HJ 5462	**1954.083**	**1**	**300.2**	**12.81**	**11.42**	**12.7**	**K2III**	**F5III:**	**BVD**	**DSS**	**CO?**	**C, 182**
		2004.090	4	300.7	12.88					JRY	CCD		
05225+2916	**HJ 362AB**	**1896.150**	**1**	**160.5**	**13.69**	**9.46**	**11.07**	**F4V**	**F4V**	**BVD**	**AC2000**	**OPT?**	
		1901.960	1	157.1	13.13					BVD	AC2000		
		1955.807	1	154.9	13.99					BVD	DSS		
		1955.809	1	157.3	13.73					BVD	DSS		
		1996.774	1	157.4	13.66					BVD	DSS		
		2004.090	4	155.7	13.88					BVD	MCG		
05225+2916	**HJ 362AC**	**1896.150**	**1**	**246.3**	**32.31**	**9.46**	**12.1**	**F4V**	**A4V**	**BVD**	**AC2000**	**OPT**	
		1901.960	1	246.5	32.39					BVD	AC2000		
		1955.809	1	247.9	32.03					BVD	DSS		
		1996.774	1	248.7	32.05					BVD	DSS		
		2004.090	4	248.7	31.88					JRY	CCD		
05225+2916	**HJ 362AD**	**1955.809**	**1**	**317.6**	**29.08**	**9.46**	**15.5**	**F4V**	**K4III:**	**BVD**	**DSS**	**¿?**	**C, 181**
		1996.774	1	317.4	29.44					BVD	DSS		
05252-1119	**HJ 5538AD**	**2004.090**	**4**	**85.5**	**54.67**	**8.6**	**12.55**	**A2V:**	**G4V**	**JRY**	**CCD**	**CO?**	**#8**
05252-1119	**STF 710AB**	**2004.090**	**4**	**195.6**	**10.78**	**8.6**	**8.9**	**A2V:**	**A1V:**	**JRY**	**CCD**	**PHY**	**#9**
05289+3239	**HJ 366**	**1913.365**	**1**	**17.8**	**15.20**	**8.7**	**12**	**M6.5III**		**BVD**	**AC2000**	**¿?**	**C, 185, #10**
		1955.809	1	16.5	15.47					BVD	DSS		
		1993.809	1	17.0	15.78					BVD	DSS		
		2004.090	4	17.9	16.20					JRY	CCD		
05294+3230	**BVD 7**	**1955.809**	**1**	**108.4**	**7.09**	**11.6**	**12**	**A2V:**	**A6V:**	**BVD**	**DSS**	**¿?**	**New, #11**
		1993.809	1	108.0	6.91					BVD	DSS		
05316+3131	**HJ 703**	**1903.100**	**1**	**276.4**	**18.02**	**8.45**	**11.3**	**K3III**	**K5III**	**BVD**	**DSS**	**OPT**	**C, 185, #12**
		1955.809	1	277.3	16.96					BVD	DSS		
		1996.774	1	279.6	16.34					BVD	DSS		
		2004.090	4	279.4	16.46					JRY	CCD		

Table 2 continued on next page.

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WDS Id.	Discover	Epoch	N	θ (°)	ρ (")	V_A	V_B	SP_A	SP_B	Obs.	Method	Type	Notes
05386+2002	DAL 8AC	**1951.908**	1	84.5	**13.11**	**9.72**	**13.3**	**G1:V:**	**G5**	**BVD**	**DSS**	**¿?**	**C, #13**
05402+0157	**HJ 2275**	**1951.911**	**1**	**314.4**	**24.19**	**11.22**	**12.4**	**G0V:**	**K5V:**	**BVD**	**DSS**	**CO?**	**C, 174**
		1990.869	1	314.7	24.36					BVD	DSS		
		1999.774	3	314.7	24.24					FMR	2MASS		
		2004.090	4	314.7	24.08					JRY	CCD		
05439+5548	**HJ 2274**	**1998.985**	**3**	**303.2**	**7.42**	**11.7**	**14.5**	**G4**	**K2**	**FMR**	**2MASS**	**¿?**	**C, 174, #14**
		2004.090	4	303.8	7.33					JRY	CCD		
05512+2817	**HJ 711**	**1955.812**	**1**	**350.8**	**13.81**	**10.33**	**12.1**			**BVD**	**DSS**	**OPT**	**105, #15**
		1993.798	1	352.5	15.67					BVD	DSS		
		2004.090	4	353.7	16.12					JRY	CCD		
06581+1414	**ARN 1AD**	**1903.633**	**1**	**285.8**	**85.35**	**7.3**	**10.26**	**B8V**	**F2V**	**AC2000**	**AC2000**	**CO/OPT**	**C**
07154-0126	**DAL 13**	**1897.100**	**1**	**338.3**	**36.49**	**10.43**	**10.48**	**F4V**	**F4V**	**BVD**	**AC2000**	**CO**	**C, #16**
		1955.894	1	338.4	36.47					BVD	DSS		
		1990.205	1	338.6	36.75					BVD	DSS		
07275+7302	**DAL 12**	**1898.583**	**1**	**94.8**	**27.03**	**10.55**	**11.38**	**G0V**	**G8V**	**BVD**	**AC2000**	**CO**	**C**
		1953.113	1	94.8	26.76					BVD	DSS		
		1998.001	1	94.0	26.87					BVD	DSS		
11040+4321	**YEU 1**	**1955.212**	**1**	**123.7**	**19.04**	**15.5**	**18**	**M0.5V**	**M2.5V**	**FMR**	**DSS**	**CO**	**New**
		1990.070	1	123.2	19.32					FMR	SCSS		
		1997.183	1	123.8	19.07					FMR	SCSS		
		1998.939	1	123.7	19.31					2MASS	2MASS		
11053-0623	**LDS4056**	**1954.158**	**1**	**42.9**	**14.16**	**13.1**	**15.5**	**M2V**	**M3V**	**FMR**	**SCSS**	**PHY**	**45**
		1984.056	1	41.8	14.33					FMR	SCSS		
		1985.056	1	42.9	14.07					FMR	SCSS		
		1996.199	1	42.1	14.06					FMR	SCSS		
		2001.042	1	43.0	14.22					2MASS	2MASS		
11368+2923	**FMR 3AC**	**2000.097**	**3**	**208.7**	**194.52**	**11.59**	**10.93**	**G5V**	**G3V**	**FMR**	**2MASS**	**CO**	**New, #17**
12028+2841	**HJ 514**	**1955.275**	**1**	**86.9**	**20.45**	**11.73**	**13.6**	**F5**	**G0**	**BVD**	**DSS**	**OPT?**	**C, 185, #18**
		1996.212	1	87.6	20.88					BVD	DSS		
		2004.251	20	87.8	20.95					JJO	CCD		
		2004.456	4	87.8	21.04					JRY	CCD		
12079+0648	**HJ 2597**	**1957.321**	**1**	**151.4**	**41.40**	**10.98**	**13.3**	**G1V**	**G5V**	**BVD**	**DSS**	**OPT**	**#19**
		1998.327	1	149.8	44.71					BVD	DSS		
		2004.456	4	149.7	45.30					JRY	CCD		

Table 2 continued on next page.

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WDS Id.	Discover	Epoch	N	θ (°)	ρ (")	V_A	V_B	SP_A	SP_B	Obs.	Method	Type	Notes
13220+1028	HJ 225AB	**1910.430**	1	183.7	**34.17**	**11.57**	**12.59**	**F8V:**	**G6V**	**BVD**	**AC2000**	**OPT**	**#20**
		1921.400	1	183.5	34.26					BVD	AC2000		
		1955.370	1	181.4	35.41					BVD	DSS		
		1997.278	1	180.2	35.94					BVD	DSS		
		2004.459	3	180.3	35.90					JRY	CCD		
13220+1028	**HJ 225AC**	**1955.370**	**1**	**55.4**	**80.62**	**11.57**	**13.83**	**F8V:**	**G9III:**	**BVD**	**DSS**	**OPT**	**#20**
		1997.278	1	55.5	80.97					BVD	DSS		
		2004.459	3	55.4	81.03					JRY	CCD		
13220+1028	**HJ 225AD**	**1955.369**	**1**	**16.1**	**42.66**	**11.57**	**15.4**	**F8V:**	**K3V**	**BVD**	**DSS**	**OPT**	
13300-1430	**HJ 2654**	**1954.392**	**1**	**336.9**	**17.61**	**12.1**	**13.2**	**K5V**	**K4V**	**DOS**	**DSS**	**OPT**	**C, 174, #49**
		1982.300	1	328.1	17.79					BVD	DSS		
		1983.355	1	328.4	16.91					DOS	DSS		
		1983.360	1	328.3	17.78					DOS	DSS		
		1988.303	1	326.2	17.63					DOS	DSS		
		1988.303	1	327.0	18.07					BVD	DSS		
		1993.403	1	325.2	18.17					DOS	DSS		
13351-0933	**FMR 4**	**1999.147**	**1**	**305.0**	**2.60**	**15.4**	**15.6**	**M1.5V**	**M3V**	**2MASS**	**2MASS**	**CPM**	**New**
13368-0139	**HJ 1235**	**1952.081**	**1**	**252.4**	**14.19**	**11.16**	**12.4**	**G4**	**K0**	**BVD**	**DSS**	**OPT?**	**C, 177, #21**
		1996.230	1	252.7	16.42					BVD	DSS		
		2004.459	4	252.4	16.52					JRY	CCD		
13393-0436	**BVD 6BC**	**1952.400**	**1**	**111.6**	**6.46**	**13.2**	**14.4**	**K6V**	**M0V**	**FMR**	**DSS**	**PHY?**	**New**
		1999.290	**3**	112.8	6.46					FMR	2MASS		
13393-0436	**HJ 1236**	**1952.393**	**1**	**98.0**	**28.72**	**11.3**	**13.2**	**G6V**	**K6V**	**BVD**	**DSS**	**OPT**	**C, 177**
		1983.347	1	97.1	30.09					BVD	DSS		
		1999.291	3	98.1	30.74					FMR	2MASS		
		2004.459	3	97.5	31.52					JRY	CCD		
13403+0726	**HJ 2668**	**1919.423**	**1**	**290.6**	**10.16**	**12.3**	**12.4**	**K5V**	**K7V**	**BVD**	**AC2000**	**CO**	**C, 175**
		1950.300	1	290.0	9.92					BVD	DSS		
		1996.231	1	293.1	10.01					BVD	DSS		
		2000.229	3	294.4	9.93					FMR	2MASS		
		2004.459	4	294.1	10.15					JRY	CCD		
13419+1159	**BVD 8BC**	**1954.247**	**1**	**75.6**	**2.76**	**13.8**	**14**			**BVD**	**DSS**	**¿?**	**New**
		1993.316	1	69.9	2.99					BVD	DSS		
		1998.994	1	69.2	3.01					FMR	2MASS		

Table 2 continued on next page.

Study of Neglected Double Stars by LIADA Double Star Section in 2004 ...

WDS Id.	Discover	Epoch	N	θ (°)	ρ (")	V_A	V_B	SP_A	SP_B	Obs.	Method	Type	Notes
13419+1159	HJ 229AB	**1954.247**	1	34.8	**16.48**	**11.9**	**13.2**	**K7III:**		**BVD**	**DSS**	**OPT**	**C, 185, #22**
		1993.316	1	32.5	16.83					BVD	DSS		
13445+0732	**HJ 1240**	**1919.420**	**1**	**288.8**	**10.53**	**11.33**	**13.2**	**G2III:**	**G4V:**	**BVD**	**AC2000**	**¿?**	**175**
		1950.300	1	288.7	10.61					BVD	DSS		
		1996.231	1	289.0	10.34					BVD	DSS		
		2004.459	4	288.5	10.32					JRY	CCD		
13494+0524	**HJ 1242**	**1918.360**	**1**	**118.1**	**10.83**	**11**	**12.3**	**G1V**	**G5V**	**BVD**	**AC2000**	**PHY**	**C, 177, #23**
		1950.300	1	118.4	10.74					BVD	DSS		
		1996.231	1	118.6	10.66					BVD	DSS		
		2004.462	4	118.3	10.77					JRY	CCD		
13549-1442	**HJ 2691**	**1956.349**	**1**	**108.7**	**13.29**	**11.8**	**14.4**	**F5V**	**G8V**	**BVD**	**DSS**	**OPT**	**C, 174**
		1995.406	1	108.4	13.74					BVD	DSS		
		2004.462	4	108.4	13.84					JRY	CCD		
14214+1335	**HJ 235**	**1950.272**	**1**	**265.5**	**10.90**	**11.87**	**13.4**	**F1V**	**G6V**	**BVD**	**DSS**	**OPT**	
		1994.338	1	260.9	11.25					BVD	DSS		
		2004.462	1	259.6	11.05					JRY	CCD		
14310+1344	**HJ 238AB**	**1994.338**	**1**	**73.5**	**26.52**	**11.64**	**12.91**	**G3V**	**G9V**	**ARU**	**DSS**	**OPT**	**#24**
		2004.315	7	72.9	26.88					JJO	CCD		
		2004.320	7	72.9	26.88					JJO	CCD		
		2004.462	4	72.9	26.90					JRY	CCD		
14310+1344	**HJ 238AC**	**1994.338**	**1**	**92.3**	**52.20**	**11.64**	**12.09**	**G3V**	**F9V**	**ARU**	**DSS**	**OPT**	**#24**
		2004.315	7	92.3	52.36					JJO	CCD		
		2004.320	7	92.3	52.31					JJO	CCD		
14426+1929	**LDS 968AB-C**	**2000.187**	**3**	**309.6**	**135.09**	**9.11**	**10.11**	**K0V**	**K8V**	**MRI**	**2MASS**	**PHY/CO**	**#25**
14443-1826	**FMR 6**	**1954.183**	**1**	**177.4**	**16.64**	**14.1**	**18.3**	**K7V**	**M2.5V**	**FMR**	**DSS**	**CO**	**New**
		1976.414	1	178.0	16.47					FMR	DSS		
		1985.317	1	178.6	16.54					FMR	DSS		
		1994.194	1	178.5	16.32					FMR	DSS		
		1994.530	1	179.0	16.61					FMR	DSS		
15017-0707	**GIC 123**	**1953.453**	**1**	**110.9**	**47.53**	**13.8**	**14.9**	**K7V**	**M2V**	**FMR**	**DSS**	**OPT**	**C**
		1984.548	1	112.1	44.00					FMR	DSS		
		1991.264	1	111.8	43.43					FMR	DSS		
15092-0532	**FMR 8**	**1999.190**	**3**	**236.3**	**5.25**	**13.3**	**13.9**	**M3V**	**M3V**	**FMR**	**2MASS**	**PHY?**	**New**

Table 2 continued on next page.

Study of Neglected Double Stars by LIADA Double Star Section in 2004 ...

WDS Id.	Discover	Epoch	N	θ (°)	ρ(")	V_A	V_B	SP_A	SP_B	Obs.	Method	Type	Notes
15208-1749	FMR 11	**1953.379**	1	332.6	**4.53**	**14.4**	**19.4**	**M2.5V**	**M5.5V**	**FMR**	**SCSS**	**PHY?**	**New**
		1998.235	1	330.3	5.18					2MASS	2MASS		
15236-1504	**FMR 12**	**1999.298**	**1**	**153.1**	**6.73**	**11.79**	**14.8**	**K9V**	**M3V**	**2MASS**	**2MASS**	**PHY?**	**New**
15256-1513	**WRO 1**	**1998.241**	**1**	**141.5**	**7.67**	**12.5**		**M0V**		**2MASS**	**2MASS**	**CPM**	**New**
16044-1127	**STF1999AB**	1999.234	3	98.9	11.74					FMR	2MASS	**PHY**	**#26**
16044-1127	**STF1999AC**	1999.234	3	84.2	83.14					FMR	2MASS	**OPT**	
17010+3755	**HJ 262**	**1982.554**	**1**	**303.4**	**20.23**	**12.7**	**13.1**	**G4III:**	**G2III:**	**FMR**	**DSS**	**OPT?**	**C, 186**
		2004.563	20	303.8	20.35					JJO	CCD		
		2004.721	3	303.6	20.44					OMG	CCD		
17291+1727	**DAL 14**	**1899.510**	**1**	**183.9**	**14.93**	**8.75**	**11.6**	**A3V**	**G1V**	**BVD**	**AC2000**	**OPT**	**#26b**
17299+2246	**DAL 3AC**	**1997.455**	**1**	**262.7**	**63.16**	**12**	**13.1**	**K1III**	**G4V**	**2MASS**	**2MASS**	**OPT**	**#27**
17391+0202	**SHJ 251BC**	**2004.741**	**3**	**69.6**	**100.40**	**7.74**	**10.67**			**OMG**	**CCD**	**OPT**	**#28**
18099+4824	**STF2293**	**1902.813**	**1**	**83.8**	**12.40**	**8.03**	**10.26**	**F6V**	**G8V**	**BVD**	**AC2000**	**PHY**	**#99**
18546+2754	**DAL 5AC**	**2000.264**	**1**	**273.5**	**26.30**	**12.2**	**12.3**	**G0V**	**K1III**	**2MASS**	**2MASS**	**OPT**	**#29**
18548+3306	**DAL 10**	**1983.513**	**1**	**51.9**	**30.49**	**10.31**	**12.1**	**K2III**	**K5III**	**FMR**	**DSS**	**OPT**	**#30**
18562+0412	**STF2417AB**	**2004.627**	**2**	**104.0**	**22.34**	**4.62**	**4.98**			**MRI**	**MICROM**	**PHY**	**#31**
18562+0412	**STF2417AC**	**2004.627**	**2**	**58.0**	**421.94**	**4.62**	**6.71**	**A5V**	**F9V**	**MRI**	**MICROM**	**OPT**	**C, 52, #32**
18562+0412	**STF2417BC**	**2004.627**	**1**	**57.0**	**407.05**	**4.98**	**6.71**	**A6V**	**F9V**	**MRI**	**2MASS**	**OPT**	**#33**
19020+1907	**ARN 18AE**	**1982.476**	**1**	**339.3**	**174.97**	**6.94**	**7.8**	**K0III**	**F9V:**	**FMR**	**DSS**	**OPT**	**#35**
19020+1907	**HJ 2851AB**	**1999.844**	**1**	**159.1**	**13.91**	**6.94**	**12.1**	**K0III**	**K1III**	**2MASS**	**2MASS**	**OPT**	**#34**
19020+1907	**HJ 2851AC**	**1982.476**	**1**	**294.1**	**47.92**	**6.94**	**11.5**	**K0III**	**G6V:**	**FMR**	**DSS**	**OPT**	
19020+1907	**WAL 102AD**	**1999.844**	**1**	**134.9**	**47.03**	**6.94**	**12.6**	**K0III**	**K4III**	**2MASS**	**2MASS**	**OPT**	**C, 62, #36**
19125+2812	**HJ 1375**	**2004.686**	**20**	**85.4**	**12.33**	**10.97**	**13**	**F7V**	**K3III:**	**JJO**	**CCD**	**OPT**	**C, 178, #37**
		2004.721	3	86.8	12.64					OMG	CCD		
19290+0343	**HJ 2872AC**	**2004.721**	**3**	**227.9**	**13.38**	**9.95**	**12.5**	**G9V**	**K6**	**OMG**	**CCD**	**¿?**	**C, 176, #38**
19294+4052	**HJ 1405**	**1894.832**	**1**	**47.7**	**15.16**	**10.8**	**12.03**	**K2III:**	**G5V:**	**AC2000**	**AC2000**	**OPT**	**C, 178**
		2004.721	3	40.0	16.76					OMG	CCD		
19303+3320	**HJ 1406AB**	**2004.743**	**3**	**300.9**	**12.80**	**11.9**	**11.8**	**K2III**	**F7V**	**OMG**	**CCD**	**OPT**	
19303+3320	**HJ 1406AC**	**2004.743**	**3**	**208.2**	**12.18**	**11.9**	**12.8**	**K2III**	**G2V**	**OMG**	**CCD**	**OPT**	
19308+2929	**HJ 1407**	**1898.779**	**1**	**287.9**	**11.64**	**10.26**	**12.3**	**F5V**	**A6V:**	**AC2000**	**AC2000**	**OPT**	**C, 178, #39**
		2004.743	3	302.3	11.74					OMG	CCD		
19347+3152	**HJ 1416**	**1912.901**	**1**	**244.9**	**9.13**	**11**	**11.9**	**A6V:**	**K1III:**	**AC2000**	**AC2000**	**OPT**	**#40**
		2004.743	3	235.0	10.06					OMG	CCD		
19373+3254	**HJ 1424**	**2004.743**	**3**	**30.7**	**15.12**	**11.8**	**11.92**	**F1V**	**G5V**	**OMG**	**CCD**	**OPT**	**C, 178, #41**

Table 2 continued on next page.

Study of Neglected Double Stars by LIADA Double Star Section in 2004 ...

WDS Id.	Discover	Epoch	N	θ (°)	ρ(")	V_A	V_B	SP_A	SP_B	Obs.	Method	Type	Notes
19377+3255	FMR 10AC	**1924.707**	1	9.2	**39.95**	**11.17**	**10.92**	**K0III:**	**K4III**	**AC2000**	**AC2000**	**CO**	**New**
		1998.326	1	9.1	40.00					2MASS	2MASS		
19377+3255	**HJ 1425AB**	**1924.707**	**1**	**236.5**	**12.03**	**11.17**	**11.9**	**G3III:**	**G1III:**	**AC2000**	**AC2000**	**OPT**	**C, 178**
		2004.473	3	240.5	12.11					OMG	CCD		
19414+3313	**BKO 78AC**	**1988.453**	**1**	**197.9**	**7.47**	**10.23**	**14.9**	**G2III:**	**K1**	**ARU**	**DSS**	**¿?**	
19414+3313	**HJ 1430AB**	**1921.926**	**1**	**152.3**	**17.43**	**10.23**	**11.51**	**G2III:**	**A4V:**	**AC2000**	**AC2000**	**OPT**	
		1988.453	1	153.8	17.14					ARU	DSS		
		2004.538	20	153.7	17.31					JJO	CCD		
		2004.566	20	153.9	17.28					JJO	CCD		
		2004.743	3	153.8	16.87					OMG	CCD		
19415+0255	**HJ 600**	**1999.591**	**1**	**165.2**	**22.06**	**10.92**	**11.37**	**K3III**	**F7**	**2MASS**	**2MASS**	**OPT**	**C, 186**
		2004.743	3	164.5	21.31					OMG	CCD		
		2005.640	3	164.2	21.79					OMG	CCD		
19423+1937	**HJ 2891**	**2004.743**	**3**	**108.4**	**12.06**	**10.93**	**11.77**			**OMG**	**CCD**	**OPT**	**#42**
20599+4016	**SEI1363CR**	**1900.549**	**1**	**38.2**	**8.64**	**9.65**	**10.59**	**G6V**	**G8V**	**AC2000**	**AC2000**	**PHY**	
22017+0233	**HJ 3080**	**1983.680**	**1**	**292.7**	**20.49**	**10.01**	**13.2**	**K2III**	**G8**	**FMR**	**DSS**	**OPT?**	**C, 176, #43**
		2004.991	3	294.0	20.01					OMG	CCD		
22019+5506	**HJ 1718AB**	**2004.991**	**3**	**219.8**	**9.25**	**11.13**	**11.97**	**A1V**	**F5V**	**OMG**	**CCD**	**OPT**	**#43**
22019+5506	**HJ 1718AC**	**1983.516**	**1**	**277.1**	**13.18**	**11.13**	**12.75**	**B7V**	**K III**	**FMR**	**DSS**	**OPT**	**#44**
22019+5506	**HJ 1718BC**	**2004.991**	**3**	**296.9**	**13.19**	**11.97**	**12.75**	**F5V**	**K5:III**	**OMG**	**CCD**	**OPT**	
22035+0652	**HJ 3084**	**2004.991**	**1**	**52.6**	**14.32**	**12.3**	**13.5**	**K0III:**	**G1V**	**OMG**	**CCD**	**OPT**	
		2004.991	3	52.6	14.32					OMG	CCD		
22053+4629	**HJ 1725**	**2004.991**	**3**	**78.2**	**29.09**	**10.68**	**11.13**	**A7**	**G0V**	**OMG**	**CCD**	**OPT**	
22075+4152	**HJ 1731**	**1895.692**	**1**	**207.3**	**14.00**	**10.11**	**12.4**	**F9V**	**G6V**	**AC2000**	**AC2000**	**PHY?**	
		1999.986	1	207.6	13.99					2MASS	2MASS		
		2004.991	3	207.5	15.25					OMG	CCD		
22127+1134	**HJ 3099**	**1909.747**	**1**	**57.0**	**11.69**	**11.7**	**13.35**	**K5III**	**G7**	**AC2000**	**AC2000**	**OPT**	**C. 176**
		2004.991	3	57.9	11.46					OMG	CCD		
22157+3051	**FMR 13**	**1999.751**	**1**	**216.1**	**3.71**	**14**	**14.1**	**K0V:**	**K2V:**	**2MASS**	**2MASS**	**¿?**	**New**
22159+3051	**HJ 960**	**2004.991**	**3**	**79.3**	**7.95**	**13.1**	**13.9**	**G5**	**G0**	**OMG**	**CCD**	**¿?**	
22183+0442	**HJ 3103**	**2005.026**	**3**	**111.3**	**14.67**	**12.9**	**13.3**	**K3**	**G5V**	**OMG**	**CCD**	**OPT?**	**C, 176**
22217+5112	**HJ 1757**	**1998.854**	**1**	**315.0**	**8.49**	**9.6**	**11.8**	**A3V**	**M1III**	**2MASS**	**2MASS**	**OPT**	**C, 178, #45**
22276+0736	**HJ 3117**	**2005.026**	**3**	**254.6**	**34.19**	**11.33**	**13.5**	**F7V**	**G8V**	**OMG**	**CCD**	**OPT**	**C, 176**
22306+3706	HJ 1774AB	**2005.026**	**3**	**52.7**	**16.39**	**10.39**	**13**	**K2III**	**G7V**	**OMG**	**CCD**	**OPT?**	**C, 178**

Table 2 continued on next page.

Study of Neglected Double Stars by LIADA Double Star Section in 2004 ...

WDS Id.	Discover	Epoch	N	θ (°)	ρ (")	V_A	V_B	SP_A	SP_B	Obs.	Method	Type	Notes
22306+3706	HJ 1774AC	**2005.026**	**3**	322.9	**29.09**	**10.39**	**13.6**	**K2III**	**G6V**	**OMG**	**CCD**	**OPT?**	**C, 178**
22306+3706	**HJ 1774BC**	**1998.764**	**1**	**293.6**	**33.28**	**13**	**13.6**	**G7V**	**G6V**	**2MASS**	**2MASS**	**¿?**	
22337+1230	HJ 298AB	**2005.026**	**3**	**184.6**	**27.52**	**12.69**	**12.68**	**K5V**	**K4V**	**OMG**	**CCD**	**CPM?**	**#46**
22337+1230	**OMG 1AC**	**1997.720**	**1**	**91.6**	**10.54**	**12.68**	**12.3**	**K5V**	**G1V**	**2MASS**	**2MASS**	**OPT?**	**New**
		2005.026	3	90.3	11.13					OMG	CCD		
22338+1206	**HJ 3121**	**2005.026**	**3**	**32.2**	**17.97**	**9.28**	**11.9**	**M3III**	**G**	**OMG**	**CCD**	**OPT**	**#47**
22401+0628	**HJ 3131**	**1983.844**	**1**	**199.8**	**15.11**	**11.38**	**12.7**	**K3**	**G8V**	**FMR**	**DSS**	**OPT?**	**#48**
		2005.026	3	202.5	15.75					OMG	CCD		

Notes:

1. Discovered in 1997 by the French amateur J. F. Courtot (92º and 46.5"). Proper motion incompatible. Optical pair.
2. Discovered in 2002 by the french amateur J. F. Courtot. Proper motion incompatible. Optical pair. Primary is a K1III giant star according to the literature (catalog "New Periodic Variable" (Koen & Eyer 2002) in total agreement with LIADA's estimate. The radial velocity is -11.4±2.8 km/s.
3. Discovered in 2002 by the North-American amateur James Daley. Proper motion incompatible. Optical pair.
4. Primary is A1V+(G/K) [Michigan Catalog]
5. Proper motion incompatible. Optical pair. WDS lists measures of C with respect to A; this circular lists measures of AB with respect to C. The AB pair is a binary star with a high proper motion. They are G1/2V and G0 stars according to the literature. The AB pair was well studied by Nordstrom in the "Geneva-Copenhagen Survey of Solar Neighbourhood" catalog (Nordstrom et al. 2004).
6. A 13.3 magnitude star (spectral type estimated, F6V) located at 13.2" in direction 282º is not bounded to the primary star.
7. Primary is a K0 star according to Henry Draper catalog.
8. Abt & Corbally (2000) studied this system in a work titled "UBV Photometry and Ages of Trapezium Systems". Abt concluded that they were unbounded components. In our study we obtained very similar photometric parallaxes and so maybe be a common origin system.
9. ADS 4017. Spectral types A0 and A0 (Michigan Catalogue). Lineal elements calculated: Δx = -0.4 mas/yr; Δy = +1.0 mas/yr; θ =194.4º; ρ=10.96" (1991.545)
10. Primary is the variable star V401 Aur with spectral type M6.5III.
11. Spectral types estimated by LIADA were corrected by interstellar absorption.
12. Primary is a K0 star according to Henry Draper catalog with a radial velocity of -26.4 km/s.
13. Discovered by the amateur James Daley in 2002 (82º and 13.4").
14. In the NGC 2013 open cluster.
15. Hipparcos calculated a distance of 9 parsecs. It must be an error because the photometry and proper motion correspond to a main sequence star at a larger distance.
16. According to literature the components are F2 and G0 stars.
17. New common proper motion companion to HJ 2579 A. Spectral types G5 and G2 ("*Catalogue of Stellar Spectral Classifications*" [Skiff, 2003]).
18. A is an F6 star (*"Bergedorfe Spektral-Durchmusterung der 115 Nordlichen Kapteyn Eichfelder 44-67"* de 1947)
19. Due to the large proper motion of the primary we performed a search for new uncataloged compo-

nents. We used the ALADIN tool to search the Tycho-2, UCAC-2 and USNO-B1.0 catalogs for common proper motion stars. We also used photographic plates. No new companions were found.

20. Abt & Corbally (2000) listed the AB, AC and AD pairs in his catalog "*UBV photometry and Ages of Trapezium Systems*" . They concluded in the optical nature of these pairs.
21. The TASS2 catalog (Richmond et al., 2000) lists for primary magnitudes V = 11.10 and I = 10.36.
22. This double star is located 9 arcminutes southwest of the WDS position. The accurate coordinate is RA: 13h 41m 21s55 and DEC: +11º 55' 12.5".
23. This is a physical pair but Δ(V-Mv) = 0.7: is the primary an unresolved pair?
24. The professional Abt studied this triple star in 1988 obtaining UBV photometry (the V magnitude listed in Table II came from the Abt's work). Abt listed this system in his table "*UBV photometry and Ages of Trapezium Systems*". Abt concluded that the three components were optical in nature, in agreement with our result.
25. Spectral types M0 and M0 (Luyten, 1979, NLTT catalog).
26. The author edited a detailed work but it has not been published.
27. It was discovered by the North-American amateur James Daley in 2003 (184º and 17.8", mg. 8.75 and 11.7).
28. The amateur James Daley added a new member for the BRT 2434 system in 2003 measuring 262º and 64.4".
29. Primary is a K0 III + F4 IV star. Secondary is a F0 star (Henry Draper catalog); parallax from Hipparcos 0.009±0.001 arcsec. (110 parsecs).
30. The amateur James Daley added a new companion to the system BRT 3335 AB in 2001 (273º and 26.7").
31. Primary is a K2 star (catalog PPM); The amateur James Daley informed about this new pair in 2002. (51º and 30.9"). Galactic latitude of +13º so the spectral types must be corrected by interstellar reddening.
32. ADS 11853; literature lists spectral types A5 and A5.
33. It was only measured by Karl W. Kamper in 1954 (58º and 426"). Literature lists spectral types A5V and G5. The photometric distance of LIADA was of 33 parsecs. Hipparcos obtained distances of 40 and 27 pc. The main component is a suspected RR Lyrae catalogued as NSV 11558. The magnitud ranges between 4.59 and 4.72. The three components of this system are members of the Hyades association.
34. Literature lists spectral types A5Vn and G5. LIADA searched for unknown companions to component C. No companion was found.
35. ADS 11957; A is a giant K0 III ("MK Classification Extension").
36. A is a giant K0III ("MK Classification Extension"). The secondary is the binary STF2437 (15º and 0.5" in 1997) composed by two star of spectral types G2IV and F8IV (Stephenson. & Sanwal 1969). The Hipparcos parallax for the primary corresponds to a distance of 216±41 pc (LIADA obtained a photometric distance of 194 pc) and for the secondary a distance of 82±17 pc. The North-American Dave Arnold catalogued the component E in 2002 (340º and 173.8").
37. It was discovered by A. Wallenquist in 1944 (140º and 45").
38. There is a weak star (V=15.1; K=12.31) at 5.6 arcsec in direction 119 degrees. According to the study by LIADA this star is not bounded.
39. The primary is a K0 star (Henry Draper Catalog) although the Michigan Catalog lists G5/6 spectral type.
40. Spectral types F5 and A0 ("The LF Survey" (McCuskey 1947).
41. "The LF Survey" (McCuskey1947) lists spectral type of A2 for the primary.
42. The secondary star is brigther than the primary.
43. A is a K star (Henry Draper catalog).
44. A is a K0 star (PPM catalog).

45. This pair is on the Milky Way. Spectral types are corrected by reddening; Abt & Corbally (2000) obtained for the primary: spectral type A1V, E(B-V) = 0.22 and V - Mv = +9.6. Abt concluded that B component is a background star.
46. Located at 7 minutes of arc North from the WDS position.
47. A star of 12.30 magnitude (M2000 catalog, Rapaport et al. 2001) is located at 11.13" and 90.3 degrees (measured performed by Lahuerta' Brothers in 2005.026) relative to A component. According to our study this star is not a bound G1V star. We classified it as OMG 1.
48. In 1996 (31 degrees and 12.8"). This measure is not in agree with our measure. The spectral type of the primary is M3 ("Dearborn Catalogue of Faint Red Stars (Lee, Baldwin, & Hamlin 1947); M0 in PPM. Is a infrared source in 12-25-60-100 μm bands.
49. It was measured in 1989 (201 degrees and 14.8"; mg. 10.7 and 11.3)
50. A new high proper motion star located at α=13h 29m 47s72 y δ= -14º 25' 31.99" was detected in the field of this double star. According to the study performed by LIADA it is a M3V star at a distance of

Name#1	Name#2	MgV	Sp_Lit	Sp_LIADA	Differ.
HD 12728	CTT 12A	7.84	K1III	K1III	0
HD 175638	STF 2417A	4.62	A5V	A5V	0
HD 175639	STF 2417B	4.98	A5V	A6V	+1
HD 176973	HJ 2851A	6.94	K0III	K0III	0
GSC 3973-1501	HJ 1718A	11.13	A1V	B7V	-4

Table 3: Comparison of Spectral Types between LIADA and the Literature

WDS Identifier	Desig.	θ – ρ (epoch)	mag. A - B spT. A – B	E(a) (A.U.)	Period (yrs)	$\Delta\mu_x$ (mas*yr^{-1})	$\Delta\mu_y$ (mas*yr^{-1})
05252-1119	STF 710AB	195.6 - 10.78 (2004.090)	8.60 – 8.90 A0V – A0V	4,941	147,000	-0.4	+1.0
11053-0623	LDS4056	43.0 - 14.22 (2001.042)	13.1 – 15.5 M2V – M3V	1,087	42,000	-0.1	-1.5
13494+0524	HJ 1242	118.3 – 10.77 (2004.462)	11.0 – 12.3 G1V – G5V	3,554	149,000	-0.7	0.0
18099+4824	STF2293	*85 – 13.3 (2005)*	8.03 – 10.26 F6V – G8V	1,484	38,000	+1.2	-1.6
185622+0412	STF2417AB	104.0 – 22.34 (2004.627)	4.62 – 4.98 A5V – A6V	1,084	17,500	-3.5	-0.6
20599+4016	SEI1363CR	43.6 – 9.93 (2004.634)	9.64 – 10.58 G6V – G8V	1,079	27,000	-3.2	+2.6
22075+4152	HJ 1731	207.5 – 14.25 (2004.991)	10.11 – 12.4 F9V – G6V	4,000	180,000	-0.9	-0.3
17360+2100	STF2190AB	*21 – 10.3 (2008)*	6.13 – 9.48 A5V – F3V	2,005	43,000	-2.5	+0.2
	FMR 4AB	305 – 2.6 (1999.147)	15.4 – 15.6 M1.5V – M3V	372	8,400		
	FMR 8	236.3 – 5.25 (1999.190)	13.3 – 13.9 M3V – M3V	202	3,700		
	FMR 11	330.0 – 5.18 (1998.235)	14.4 – 19.4 M2.5V – M5.5V	370	10,000	-11.0	+11.0
	FMR 12	153.1 – 6.73 (1999.298)	11.79 – 14.8 K9V – M3V	433	10,100		

Table 4: Orbital Data of Physical Pairs

Study of Neglected Double Stars by LIADA Double Star Section in 2004 ...

(Continued from page 80)

know their nature use them. If a double star is physical then these data will give us the projected relative orbital motion and velocity.

The Tycho-2 optical BV photometry and the 2MASS infrared JHK photometry in addition to the individual proper motions allow us to obtain the spectral type and luminosity class (see the last paragraph).

Finally the photometric and astrometric data are analyzed using up to 6 methods or criteria that allow us to classify visual double stars according to their nature.

Table 2 shows in column (12) the conclusion of this study. LIADA studied the nature of all 113 visual double stars measured. About 62% (71 visual double stars) were optical or suspected optical, while only 12% (13 doubles) were physical or suspected physical. Of the double stars studied, there were pairs with photometric and astrometric data consistent with pairs located at the same distance with the same kinematic but not gravitationally bounded: they are called 'common origin' and were 12% of all double stars studied. The common proper motion (CMP) pairs are composed by two stars with similar or very similar proper motion but with no nature suspected.

About 11% of visual double stars have an undetermined nature due to insufficient or no accurate data and more astrometric and photometric data are needed. These results are summarized in Figure 2 and are similar to those of the last year. As in previous surveys the very low percent of physical pairs did not surprise us because we previously know the low astrophysical interest of the very neglected and unconfirmed visual double stars where the most of them are bona-fide or candidate optical pairs.

Physical Pairs Orbital Data.

Table 4 shows same orbital data for the physical pairs studied in 2004 by LIADA. In the first and second columns, the WDS identifier and discoverer code with their sequential number are listed; in the following columns, from left to right, are listed ρ, θ and epoch for the last measure in LIADA database (if this column is in cursive came from WDS), magnitudes and spectral types for both components (determined by LIADA), expected semi major axe (in A.U.), crude period in years). The last two columns list the relative motion of the system (in mas/yr) in RA and DEC. A Digitized Sky Survey image of the first of these pairs (STF 710 AB) is shown in Figure 3.

The projected separation in A.U. is calculated

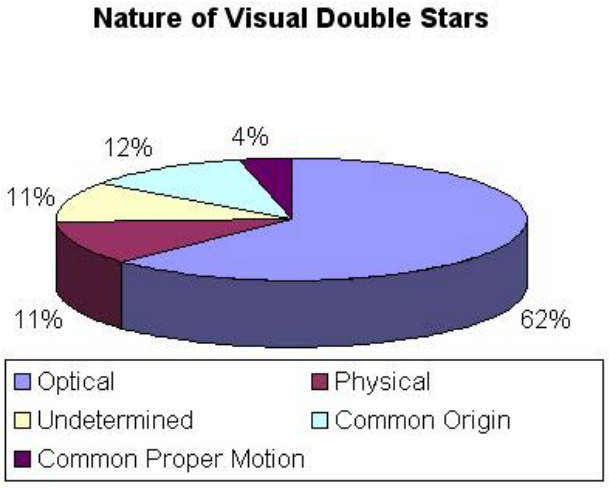

Figure 2: Results of the nature of visual double stars. Most of the neglected and unconfirmed visual double stars are optical pairs with no astrophysical interest.

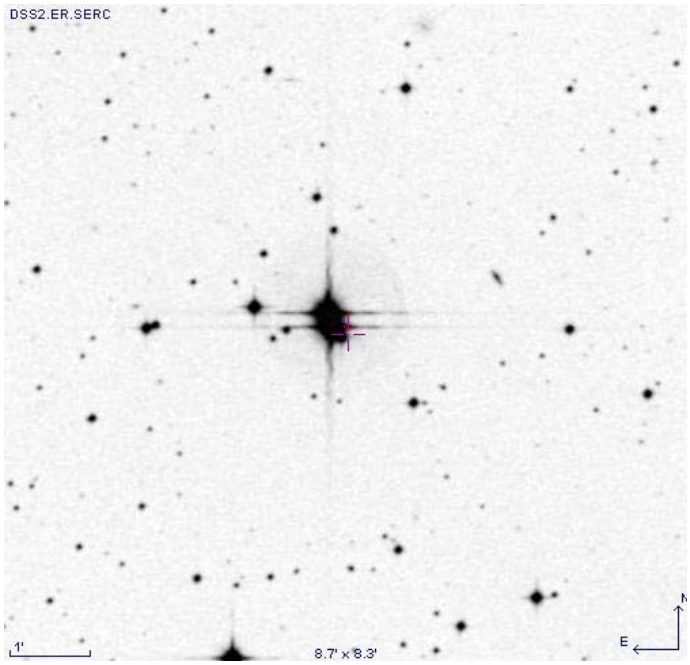

Figure 3: The binary STF 710 AB. Composed of white twin stars of 8.6 and 8.9 magnitudes, which seem to orbit about 147,000 years. Digitized Sky Survey photographic plate taken on January 21, 1985.

using the followed simple formula:

$$Projected\_separation = \rho / \pi$$

where ρ is the angular separation and π is the mean parallax of the binary. LIADA considered the mean angular separation and the mean photometric parallaxes of the components. The photometric parallaxes were calculated using spectral types and luminosity class estimates and the absolute magnitude obtained from several professional references.

The expected semi-major axis, $E(a)$, in arcseconds, was calculated using the work of Paul Couteau (1960) by the followed formula:

$$Log\ E(a) - Log\ (\rho) = 0.146$$

Where a and ρ are the semi-major axis and the angular separation. The orbital period was calculated using the followed formula derived from the Kepler Laws:

$$P = \sqrt{\frac{E(a)^3}{\sum M_\Theta}}$$

The values of relative proper motion are showed in the two last columns. Since all double star in Table IV are physical then relative proper motion give us the projected relative orbital velocity.

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The Digitized Sky Survey was produced at the Space Telescope Science Institute under U.S. Government grant NAG W-2166. The images of these surveys are based on photographic data obtained using the Oschin Schmidt Telescope on Palomar Mountain and the UK Schmidt Telescope. The plates were processed into the present compressed digital form with the permission of these institutions. This research is based on data from the SuperCOSMOS Sky Surveys (SSS) at the Wide-Filed Astronomy Unit of the Institute for Astronomy, University of Edinburg.

This publication has made use of the Washington Double Star Catalog, UCAC2 and USNO-B1.0 maintained at the U.S. Naval Observatory.

The data mining required for this work has been made possible with the use of the SIMBAD astronomical database and VIZIER astronomical catalogs service, both maintained and operated by the Center de Données Astronomiques de Strasbourg (http://cdsweb.u-strasbg.fr/)

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