RevMexAA (Serie de Conferencias), **34**, 133–134 (2008)

GICLAS 112-29 (=NLTT 18149), A VERY WIDE COMPANION TO GJ 282 AB WITH COMMON PROPER MOTION, COMMON PARALLAX, COMMON RADIAL VELOCITY AND COMMON AGE

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RESUMEN

En una búsqueda de compañeras con movimiento propio común para las binarias separadas de la vecindad solar encontramos que GJ 282AB tiene una compañera distante (NLTT 18149), a una separación de $s = 1.09°$. Las paralajes trigonométricas (Hipparcos), velocidades radiales y edades son similares, y sugieren que éste es un sistema físico.

ABSTRACT

We have made a search for Common Proper Motion Companions to the wide binaries in the solar vicinity. We found that the binary GJ 282AB has a very wide CPM companion (NLTT 18149) at a separation $s = 1.09°$. Hipparcos trigonometric parallaxes, radial velocities and ages are very similar, suggesting a physical system.

Key Words: stars: binaries

1. INTRODUCTION

Our long standing interest in the process of dissociation of very wide binaries led us to search for common proper motions companions (CPMC) to the primaries of our catalogue of wide binaries in the solar neighborhood (Poveda et al 1994). For this purpose we set an upper limit of separation to be 1.5° (we note that Proxima has a separation of 2.18° from α Centauri AB), a difference of their proper motions $\mid \Delta\mu \mid \leq 0.05\ '' \text{ yr}^{-1}$ and a difference of their position angles of less than 10°. Our search produced a handful of interesting systems; probably the most remarkable one, is GJ 282AB – NLTT 18149[2], with $\mid \Delta\mu \mid = 0.042\ '' \text{ yr}^{-1}$ and a separation s=1.09°. The very similar Hipparcos parallaxes, very similar radial velocities, and similar ages, suggest that GJ 282ABC is a physical system.

2. A COMMON PROPER MOTION COMPANION TO GJ 282AB

We searched every primary in our catalogue (Poveda et al. 1994), having $Mv \leq 9$ and a parallax in Hipparcos, for common proper motion companions from the NLTT closer than 22 pc. We looked for CPM companions within a circle of 1.5° radius centered on each primary of our catalogue and having a difference $\mid \Delta\mu \mid$ in their proper motions of less than $0.05\ '' \text{ yr}^{-1}$ and a difference $\delta\theta \leq 10°$ in the position angles of their proper motions.

From the NLTT and Hipparcos Catalogues we estimated the average surface density of NLTT stars closer than 22 pc to be $n = 0.05$ stars per square degree; thus the probability of a system having a NLTT companion closer than 1.5°, is $p = 0.35$.

From the frequency distribution of $\mid \Delta\mu \mid$ for a representative sample of the NLTT stars we find the probability P($\mid \Delta\mu \mid \leq 0.05$) = 0.05, and the probability of their proper motion vectors differing by less than 10° in position angle is less than 0.03.

From the above we find the probability for a primary from our catalogue to have an NLTT companion, satisfying these restrictions to be $p = 5.25 \times 10^{-4}$, and thus the expected number of opticals, (CPM NLTT) associated to the 140 systems in our catalogue to be 0.07.

Our search revealed that the system GJ 282 AB - NLTT 18149 with $\mid \Delta\mu \mid = 0.042'' \text{ yr}^{-1}$, $\Delta\theta = 6.4°$, $s = 1.09°$ seems to be one of the most interesting (see Figure 1) among those satisfying the restrictions of the search.

3. A COMMON PARALLAX

A search for GJ 282AB and NLTT 18149 in the Hipparcos Catalogue produced the following results: π (GJ 282A) = $0.07044'' \pm 0.00094''$, π (NLTT 18149) = $0.06985'' \pm 0.00153''$. These parallaxes are so similar that we reject the possibility of a chance alignment. In depth, these two stars differ by about 24000 AU.

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[2]For shortness we shall name, indistinctly, this system GJ 282ABC.

TABLE 1

SOME ASTROMETRIC AND PHYSICAL PARAMETERS OF GJ 282A AND NLTT 18149

GJ	NLTT	π^1 [mas]	$\mu_\alpha{}^2$ arcsec yr^{-1}	$\mu_\delta{}^2$ arcsec yr^{-1}	μ arcsec yr^{-1}	Vr km s^{-1}	sep $''$	sep AU	age [yr]
282A	18257	70.44	0.0717	-0.2761	0.2852	-21.1			3×10^8
282B	18260		0.0668	-0.2862	0.2939	-23.0	58	824	6×10^8
	18149	69.85	0.0363	-0.2535	0.2561	-26.0	3892	55733	2×10^8

[1]Simbad - CDS. [2]Salim & Gould (2003).

4. A COMMON RADIAL VELOCITY

High dispersion Echelle spectra of NLTT 18149 and of GJ 282 A and B show the former to be a late K- or early M-type star with H alpha and H beta lines in emission. Using the IRAF *rvcor* task, cross-correlation of the three 900-second spectra of NLTT 18149 with that of GJ 282 A, a radial velocity difference of -4.9 ± 2.5 km s^{-1} (one sigma error) is obtained between NLTT 18149 and GJ 282 A (between components B and A the difference is -1.9 km s^{-1}). The small former difference further reinforces the physical association of NLTT 18149 with the binary.

5. A COMMON AGE

Since two of the components of this system are late type Hα-emission stars, we suspect they are young, chromospherically active stars which may be X-ray sources. In fact, the three components of this system are bright X-Ray sources, as observed by ROSAT Satellite (NEXXUS 2 Database). It is well known that there is a relation between X-Ray luminosity and the age T of low mass stars. The X-Ray luminosities of the three components A, B, C are:

$$\mathrm{Lx(A)} = 2.45\times10^{28}\ \mathrm{erg\ s^{-1}}\ \ \mathrm{Lx(A)/L_{bol}} = 2.6\times10^{-5}$$

$$\mathrm{Lx(B)} = 5.75\times10^{27}\ \mathrm{erg\ s^{-1}}\ \ \mathrm{Lx(B)/L_{bol}} = 1.0\times10^{-5}$$

$$\mathrm{Lx(C)} = 1.48\times10^{28}\ \mathrm{erg\ s^{-1}}\ \ \mathrm{Lx(C)/L_{bol}} = 5.5\times10^{-5}$$

According to the relation: log T = $5.58-0.64$ log(Lx/L$_{\mathrm{bol}}$) (See Figure 1 from Kunte, Rao, & Vahia 1988), we obtain the following ages: T(A) = 3×10^8 years, T(B) = 6×10^8 years, T(C) = 2×10^8 years. We see that the three components have a common age, within the uncertainties. The relevant data are collected in Table 1.

6. CONCLUSIONS

The four common properties shared by the system GJ 282 AB- C are strong arguments to reject the hypothesis that component C is optical or a casual intruder; however, the difference in their proper motions $|\Delta\mu| \approx 0.04''$ yr^{-1} are large enough (compared to their errors) to be significant.

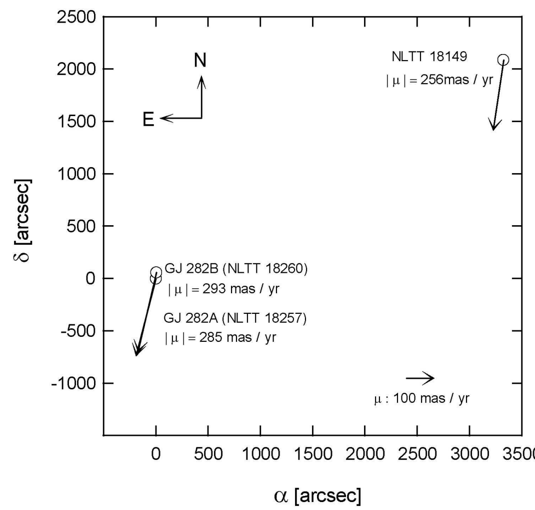

Fig. 1. GJ 282 AB - NLTT Positions and proper motions.

To reconcile this inconsistency we propose that the system GJ 282 AB - NLTT 18149 is disintegrating. This system together with θ_1 ABCD - E (Allen et al. 1974, 2006; Sánchez et al. 2008) and BN - I - n (Rodríguez et al. 2005) represents an interesting new class of system caught in the processes of gravitational disintegration.

We are gratefull to the DGSCA-UNAM for the facilities granted.

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