Study of a New CPM Pair
2Mass 17474909 + 0621022

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Abstract: **:** In this paper I present the results of a study of 2Mass 17474909 + 0621022 as components of a common proper motion pair. I used the PPMXL catalog's proper motion data to select this system which presents high RA and Dec proper motion. On the other hand, with the absolute visual magnitude of both components, I obtained distance modulus 7.98 and 7.98, which put the components of the system at a distance of 394.5 parsecs. Taking into account errors in determining the magnitudes, this means that the probability that both components are situated at the same distance is 100%. I suggest that this pair be included in the WDS catalog .

Introduction

The main purpose is to study the pair 2Mass 17474909 + 0621022 (Figures 1, 2) to determine some important astrophysical features such as distance, spectral type of the components, etc. Then, using kinematic, photometric spectral and astrometrical data, obtaining enough information to determine if there is a gravitational tie between both components and its nature.

In this study I used Francisco Rica Romero's spreadsheets [1] that makes many astrophysics calculations.

Methodology

Proper motion

I started obtaining the proper motions for the pair given in the PPMXL catalog (a catalog that provides positions and proper motions), Table 1 shows the results that I obtained. I also obtain the resulting tangential velocity calculation (Table 2).
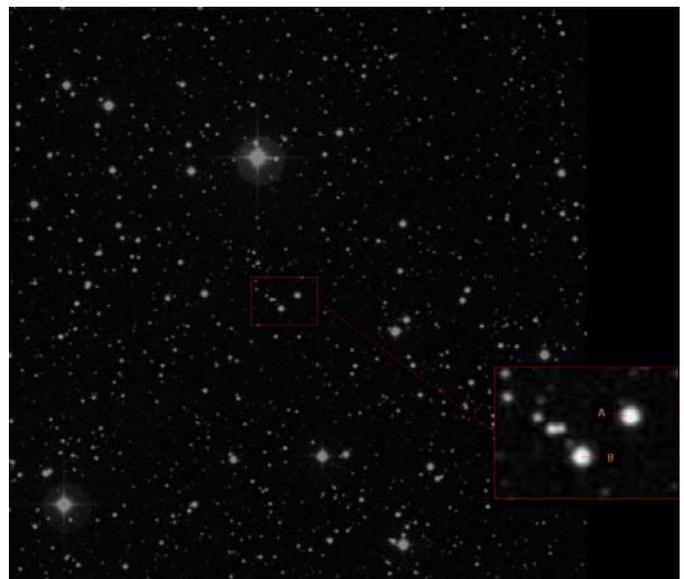
Figure 1: Picture based on a POSS plate that shows the system under study with the components identified in the inset.

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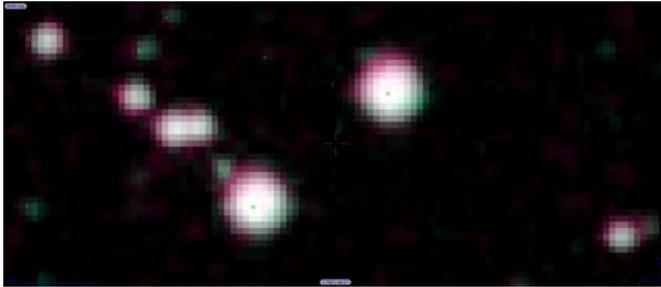
Figure 2: This image is an RGB superposition where each channel represents a different date. The result shows the common proper motion of the system.

Table 1: Proper motion of the pair described in this study

Component	Proper Motion RA	Proper Motion DEC
A	−14.5 ± 3.9	−22.8 ± 3.9
B	−17.3 ± 3.9	−23.1 ± 3.9

Relative Astrometry

Relative astrometry measurements were based on plates from different dates with resolution: 1.1", obtained from Aladdin software, I used Astrometrica software for obtaining angle deviation and applying that value on Reduc software calibration parameters for each plate. Reduc also let me obtain Theta and Rho values for each plate (see Table 3).

Photometry / Spectral type of the components

I retrieved all plates with plate resolution around 1 arcsecond/pixel and catalog data of the image field from 2MASS, CMC 14, UCAC3 and USNO B1.0 catalogs. Table 4 shows the photometric magnitudes obtained. Using Francisco Rica Romero's astrophysics spreadsheet "SDSS-2MASS-Johnson conversions", I obtained the results shown in Table 5.

With this set of photometry in bands J,H,K, the deduced B,V,I and using the Francisco Rica Romero's "Astrophysics" spreadsheet, I can evaluate and calculate the spectral type of each component from photometric data. I obtained K0V and K0V for the primary and secondary respectively.

Using the same spreadsheet, I obtained the reduced proper motions for the companions presented in Table 6 and for JHK Photometry shown in Table 7. The Reduced Proper Motion [3] and JHK Photometry [4] diagrams (Figures 3, 4) show that both components are situated in the dwarf/subdwarf region.

The results suggest that the primary component as well its companion are main sequence stars.

The absolute visual magnitude of both components allow us to calculate the distance modulus, I used Francisco Rica Romero's spreadsheet "Astrophysics", the results is shown in Table 8.

Distance modulus obtained for each component were quite similar, Which means that taking into account the errors in determining the magnitudes, I con-

Table 2: Tangential velocity calculation based on PPMXL proper motions

Tangential Velocity Calculation	A	B
Mu (alpha) =	− 0.015	− 0.017
Mu (delta) =	− 0.023	− 0.023
Pi (") =	0.0025	0.0025
Ta (km/s)	− 27	− 32
Td (km/s)	− 43	− 43
Vt (Km/s)	51	54

Table 3: Theta / Rho measurements obtained with Reduc Software

Besselian Date	Theta º	Rho "
1953.6121	129.93	28.558
1988,3649	129.99	28.298
1993.6238	130.17	28.577
1997.3178	130.2	28.718

Table 4: Photometric magnitudes pulled from 2MASS (infrared), CMC14, UCAC3 and USNO B1.0 catalogs

	J	H	K	r'	f	B2	R2
A	11.939	11.565	11.465	13.305	13.501	14.36	12.78
B	11.931	11.551	11.454	13.307	13.538	14.21	12.89

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Table 5: Based on JHK (2MASS), r' (CMC14), f (UCAC3), B2 - R2 (USNO-B1) photometric magnitudes and using Francisco Rica Romero's "SDSS-2MASS-Johnson conversions", I obtained color index (B-V), (V-I), Magnitude V and later with "Astrophysics" spread-sheet, Bolometric correction shown below.

	Color B-V	Color V-I	Magnitude V	Bolometric correction
A	0.76	0.85	13.55	– 0.216
B	0.76	0.85	13.55	– 0.216

Table 8: Reduced Proper Motion

BAND	Mag (A)	H(A)	Mag (B)	H(B)
V	13.55	10.7	13.55	10.9
K	11.465	8.6	11.454	8.8

Table 9: JHK Photometry

| COMPONENT	J-H	H-K
A	0.43	0.07
B	0.43	0.07
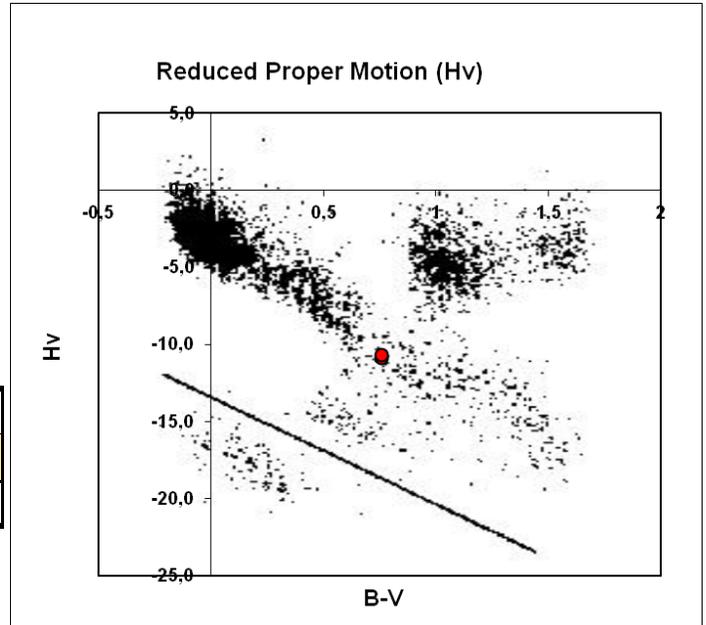
Figure 3: Reduced-Proper diagram. This diagram shows that both components are situated in the dwarf/subdwarf region.
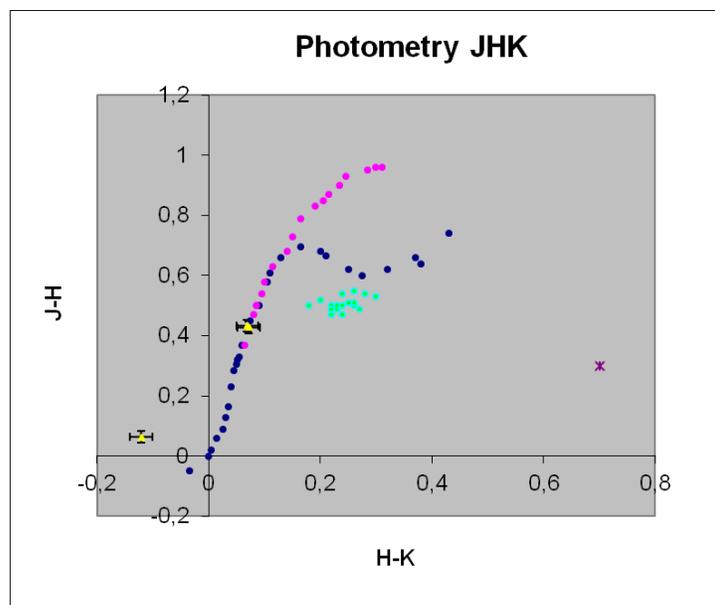

Figure 4: Photometry JHK diagram. This diagram shows that both components are situated in the dwarf/subdwarf region.

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clude that the probability that components are at the same distance is 100%

Conclusions

If the spectroscopy obtained above is reliable, the sum of the masses is estimated to be 1.82 solar masses at a distance calculated based on the data mentioned above. Wilson and Close criteria [2] indicates a physical system.

The distance modulus calculated above, put both components at the same distance 394.5 (primary) and 394.5 (secondary) parsecs Which means that the probability that both components are at the same distance is 100%, that value it's a good indicator about the possible physical relation between their components.

Respect to the kinematics, RA/DEC proper motion of this system are medium-high and quite similar, indicating that system is CPM. I used PPMXL catalogue values on this study.

The latest image available from aladdin software (1997.3178) gives astrometry values: Θ = 130.2º ρ = 28.718". According to these data and using the Francisco Rica Romero's spreadsheet "Astrophysics", I estimate the parameter (p/μ) representing the time it takes the star to travel a distance equal to their angular separation with its motion μ. This gives T = 1024 years, which would give us a 78% probability to be a physical system.

In summary with the present information I think that we could consider this pair as a binary and I suggest that this pair be included in the WDS catalog.

References

1 – Rica's Spreadsheet "Astrophysics" and "SDSS-2MASS-Johnson conversions" (private communication)

2 – Wilson & Close Criterions "Close SM et al (2003, Apj, 587, 407C)" , "A search for L dwarf binary systems", Neid Reid et al (2001), AJ, 121, 489

3 - "Reduced Proper-Motion Diagrams. II. Luyten's White-Dwarf Catalog", Eric M. Jones (Aj, 177, 245 -250 -1972-)

4 - "JHKLM Photometry: Standard systems, Passband and Intrinsic Colors", PASP, 100,1134-1151, 1988