

TW Hydrae astrometric parameters measurement

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Abstract. The primary goal of this study was measurement of trigonometric parallaxes and proper motions of a dozen members of the TW Hydrae Association (TWA) that are not present in the Hipparcos catalogue.

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1. Introduction

The TW Hydrae Association (TWA) is a young and nearby association composed of objects of particular scientific interest. Belonging to this association is the young brown dwarf 2MASSW J1207334-393254 (2M1207A) hosting the first ever imaged planet (2M1207b) with the estimated mass of about $5M_{Jup}$ and separation from 2M1207A of about 55 AU (Chauvin *et al.* 2004). Estimated distances from photometric and kinematic data for this planetary system are discrepant: 70 pc (Chauvin *et al.* 2004), 53 ± 6 pc (Mamaĵek 2005), 59 ± 7 pc (Song *et al.* 2006) and 66 ± 5 pc (Mamaĵek and Meyer 2007). Another interesting object of the TWA Association is SSSPM J1017-5354 (TWA22). This object, although being an accepted TWA member, has a proper motion that is double of that of the other association members and its estimated photometric distance is 22 pc (Song *et al.* 2003). If confirmed as a member of TWA, it will be the nearest known low mass object of TWA (Scholz *et al.* 2005).

Two main reasons motivated this trigonometric parallax program of TW Hydrae members. First of all, the physical characterization of the association and its individual members is strongly dependent of distances. Therefore, precise measurements of trigonometric parallaxes as done in this work are essential. Another point concerns the fact that due to its youth and proximity, the TWA is one of the best targets to test the pre-main sequence models. It is possible to derive dynamical age for this association using astrometric and spectroscopic measurements in a trace-back strategy (Ortega *et al.* 2002, Song *et al.* 2003, de La Reza *et al.* 2006) that is independent of stellar evolutionary models.

At present, about 25–30 TWA members are known and, except for 5 objects, their trigonometric parallaxes have not yet been measured. In this context we started an observational program with the ESO-La Silla NTT/SUSI2 telescope aiming to measure trigonometric parallaxes and proper motions for a dozen of TWA members with no Hipparcos parallax, as described in Ducourant *et al.* 2007.

2. Targets and first results

Table 1. TW Hydræ targets (Mamajek 2005) for our observational program.

<i>target</i>	<i>RA(hms)</i>	<i>DEC(dms)</i>	<i>target</i>	<i>RA(hms)</i>	<i>DEC(dms)</i>	<i>target</i>	<i>RA(hms)</i>	<i>DEC(dms)</i>
TWA22	10 17 27	-53 54 27	TWA02	11 09 14	-30 01 39	TWA23	12 07 27	-32 47 00
TWA06	10 18 28	-31 50 02	TWA03	11 10 28	-37 31 53	TWA27	12 07 33	-39 32 54
TWA07	10 42 30	-33 40 17	TWA12	11 21 06	-38 45 16	TWA25	12 15 31	-39 48 42
TWA28	11 02 10	-34 30 36	TWA05	11 31 55	-34 36 27	TWA10	12 35 04	-41 36 39

Table 2. Proper motions and trigonometric parallaxes for three of our targets.

	<i>TWA22</i>	<i>TWA27</i>	<i>TWA28</i>
$\mu_{\alpha} \cos \delta$ (mas/yr)	-154.9 ± 1.8	-57.5 ± 0.4	-62.1 ± 0.5
μ_{δ} (mas/yr)	-27.4 ± 1.8	-22.6 ± 0.4	-12.8 ± 0.5
π (mas)	53.1 ± 0.8	19.1 ± 0.4	17.7 ± 0.5
d (pc)	18.8 ± 0.3	52.4 ± 1.1	56.4 ± 1.6

Until now observations are completed for TWA22, TWA27(2M1207A) and TWA28 (SSSPM1102) and the preliminary results are presented in Table 2.

3. Conclusions

Our results confirm the planetary nature of the sub-stellar companion 2M1207b (Ducourant *et al.* 2007). In this case the proper motion and trigonometric parallax are consistent with those from the two other recently published studies (Gizis *et al.* 2007, Biller and Close 2007). In the case of TWA28 (SSSPM1102), our results reinforce the Scholz hypothesis (Scholz *et al.* 2005) that this object is a sub-stellar companion of the eponymous T Tauri TW Hya. For TWA22, the late spectral-type ($\approx M7$) from the grating spectrometer at Siding Spring Observatory (Song *et al.* 2007), a close binary companion from VLT AO ($\rho \approx 0.1$ arcsec, $\Delta(k) \approx 0.4$ mag, Chauvin *et al.* 2007), and the small trigonometric distance (18.8 pc, this work) will make TWA22 the closest, young, low-mass, brown dwarf binary system known to date.

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