

BINARY STARS IN LOOSE ASSOCIATIONS: Towards a calibration of PMS models

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ABSTRACT: Precise determinations of dynamical masses of pre-main-sequence (PMS) stars are necessary to calibrate PMS stellar evolutionary models, whose predictions are in disagreement with measurements for masses below 1.2 Msun. Binary stars in young, nearby loose associations are particularly good candidates, since all members share a common age. We will present the result of VLBI observations that, combined with infrared relative astrometry, are directed to determine the orbital motion of the pair ABDorBa/Bb. The study of this binary, along with other two stars of the same association, will constitute a benchmark for testing PMS models of low-mass stars.

1. INTRODUCTION: BINARY STARS IN THE AB DORADUS MOVING GROUP

An improvement of the calibration of PMS evolutionary tracks should necessarily come from the precise determination of new dynamical mass of PMS stars. Among the star candidates to improve this statistics, binaries in nearby young moving groups (loose associations of coeval, co-moving stars) are of special interest, primarily because all members share a common age. The ABDor moving group (ABDor-MG) appears as the best suited association to study binary systems. This choice is well supported by its distance to the Sun (mean distance of 30 pc, the nearest moving group), reasonable well known age (50-70 Myr; Janson et al. 2007; Guirado et al. 2011), and presence of radio emission among its active members, so that radio interferometric techniques can be applied.

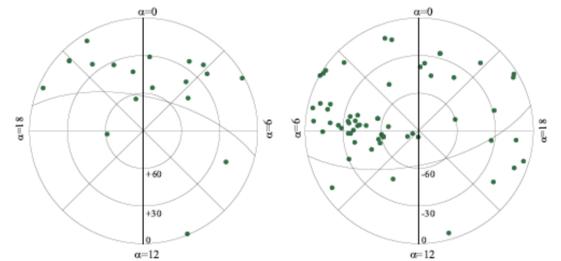


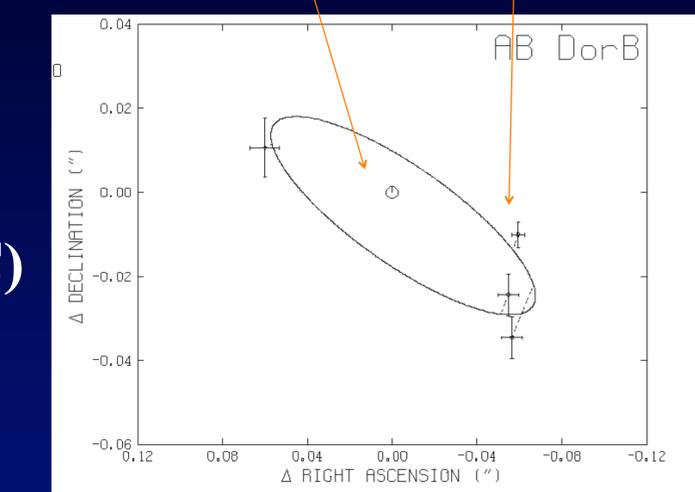
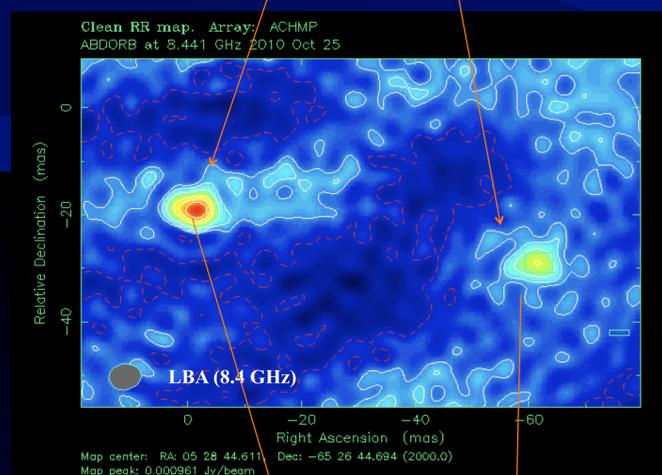
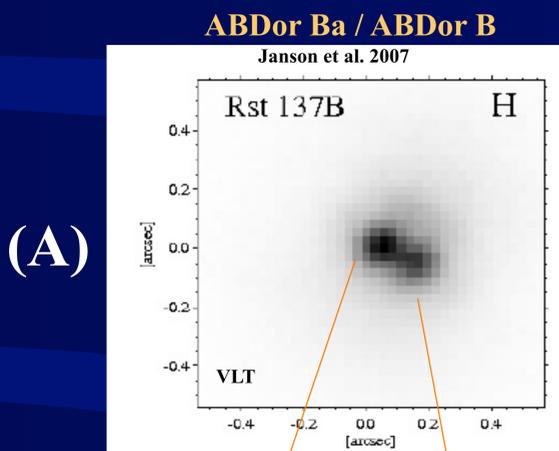
Figure 7. Celestial polar projections of the AB Dor Association. Left: Northern Hemisphere. Right: Southern Hemisphere.

Torres et al. 2008

2. LBA OBSERVATIONS OF THE PAIR ABDorBa / Bb

ABDorB (=Rst137B) is, a close binary (ABDorBa / ABDorBb; Close et al. 2005; Janson et al. 2007; Fig. A). We have observed this star with the Australian LBA array at 8.4 GHz. A phase-referenced map around the position of ABDorBa is shown in Fig. B. The weak knot 60 milliarcseconds westward ABDorBa can be readily associated to ABDorBb, the companion discovered via IR-observations. The detection of both members of the pair facilitates the monitoring of the relative orbital motion through subsequent maps using radio techniques.

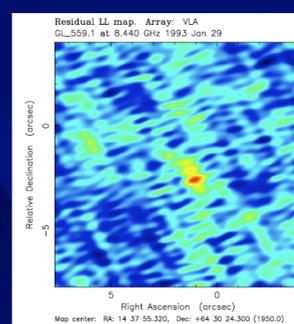
We have combined two epochs of LBA observations (Guirado et al. 2009) and two published IR relative positions of ABDorBa/Bb to get a first estimate of the orbital parameters. With the present data, the best-fit orbit (Fig. C) corresponds to a period of 1.1 yr and a semimajor axis of 0.068". The sum of the masses is 0.08 +/- 0.04 Msun, compatible with the model-dependent estimates of Janson et al. 2007. Further monitoring of this pair should improved our present measurement.



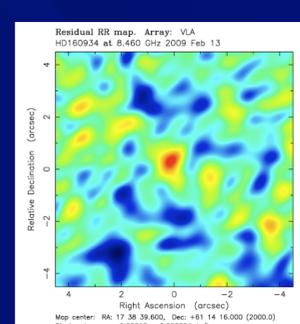
3. MORE IR / RADIO BINARIES MEMBERS OF THE ABDORADUS MOVING GROUP

We have scheduled for the next months both EVN (European VLBI Network) and AstraLux observations of two new binary systems that belong to the ABDoradus moving group: EK Dra and HD160934. The combination of both types of observations is a very efficient tool to determine the dynamical masses of the components of each of the systems. These measurements, along with those of ABDorBa/Bb should provide precise calibration points for testing PMS models of low-mass stars.

HD 160934
EVN + ASTRALUX



EK Dra
EVN + ASTRALUX



EK Dra (Hormuth 2007)