The Planetary System WG

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TOPICS

(1) Which phase of the GAIA development program are we in?

(2) Reasons

(3) Purpose and Objectives

(4) Tools

(1) Phase of GAIA development program:

- Definition phase: 2002 --- 2004-5

(2) Reasons:

• Scientific: Possibly, distributions of orbital parameters similar to Double and Multiple stars but different formation and evolution physics (→binary vs planetary frequency);

• Specific to GAIA: besides full astrometry, the Data Base will contain spectroscopy and multi-band photometry.

• High visibility: EP is a very hot topic these days and carries a significant impact factor within various funding agencies (..see, e.g., The Eddington mission..)

→ Field: Lynga 7 0.5'x0.5' (close to the gal. plane)

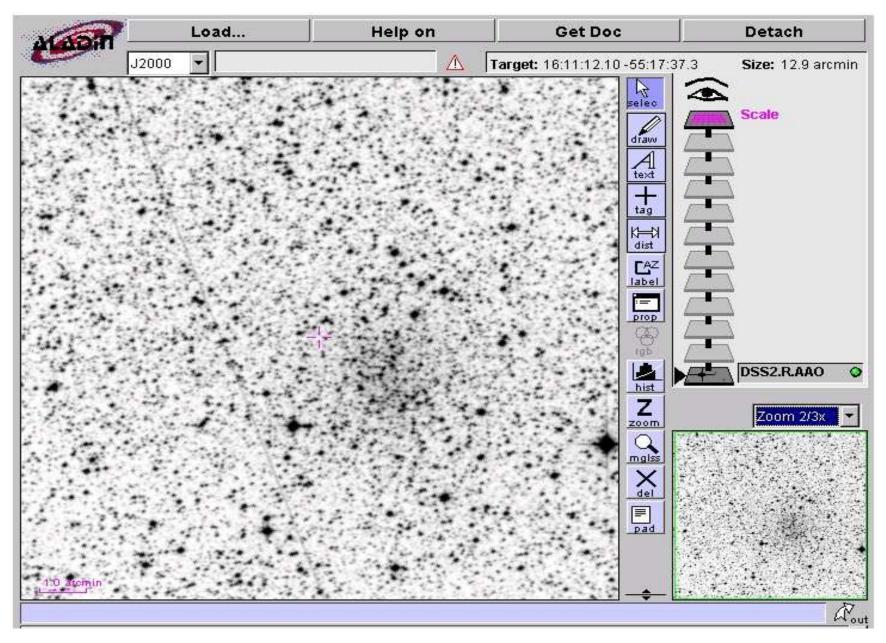Model: Padova Galaxy model (Bertelli et al, A&A, 301, 381)

No of stars: 34599 (V<20)

Ages: 0.5 - 10 Gyr

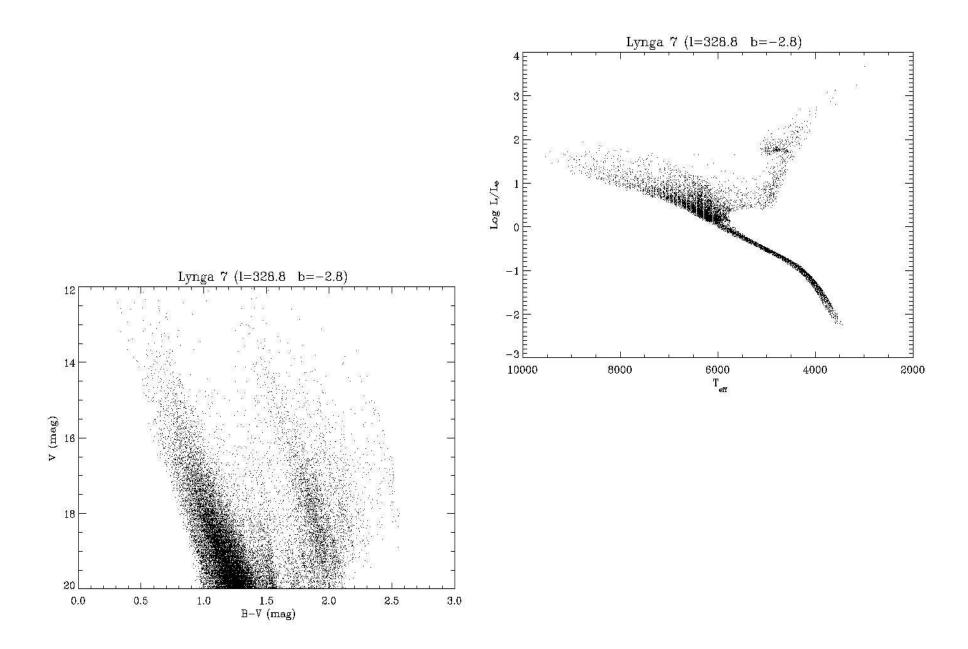Mass: 0.2< M/Mo < 2.8   (A0- M5V)

Distance: < 18 kpc

Extinction: yes   (0.7 mag/kpc)

(Simulation of the astrometric signatures in the Lynga 7 field by A. Spagna & M.G. Lattanzi. Synthetic catalog from G.P. Bertelli)

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Lynga 7 (l=328.8 b=−2.8)

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SYNTHETIC BINARIES

- 50% fraction of binaries

- Mass-ratio (q=M2/M1) and logP(days) distribution from

  Duquennoy & Mayor, 1991, A&A, 248, 485 "Multiplicity among solar type stars in the solar neighbourhood"

- eccentricity(*) = 0

- semi-major axis "a" from Kepler (III law)

- Delta_mag from mass-to-luminosity ratio

- inclination 0<i<90

- Astrometric binary-definition: rho=a*cos(i) / d < 0.1 " (or delta_mag>4) and 1 month < P < 15 years

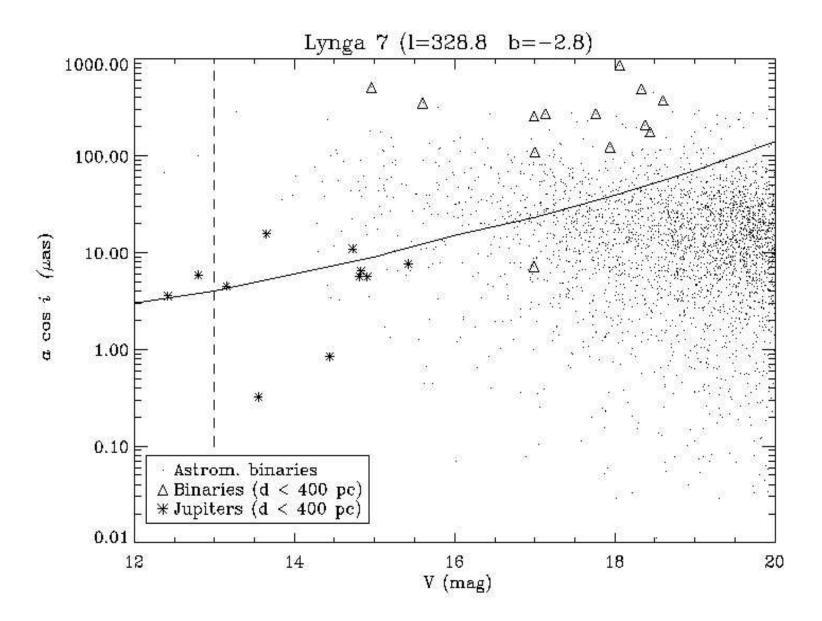 --> 4200 astrometric binaries out of 17200 binaries.

  14 astrometric binaries within 400 pc (all M dwarf in the solar neighborhood !!!)

(*)*Note: for non-zero eccentricity the photocenter separation "rho" will slightly decrease while its dispersion will increase.*

SYNTHETIC PLANETS

Mass = 1 Jupiter (1/1000 M_{Sun})

Semi-major axis range: 0<a<5 AU

Fraction of stars with planet: 100% (to help statistics!)

Periods: from Kepler's law

Selected systems: 11 with distance < 400 pc   and 1 mese < P < 15 anni   and

4350<Teff<6500 (F5-K5 dwarf and some subgiants).

Lynga 7 (l=328.8 b=−2.8)

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(3) Purpose and Objectives:

• <u>Influence the hardware design and development</u> (e.g., measurement of bright stars);
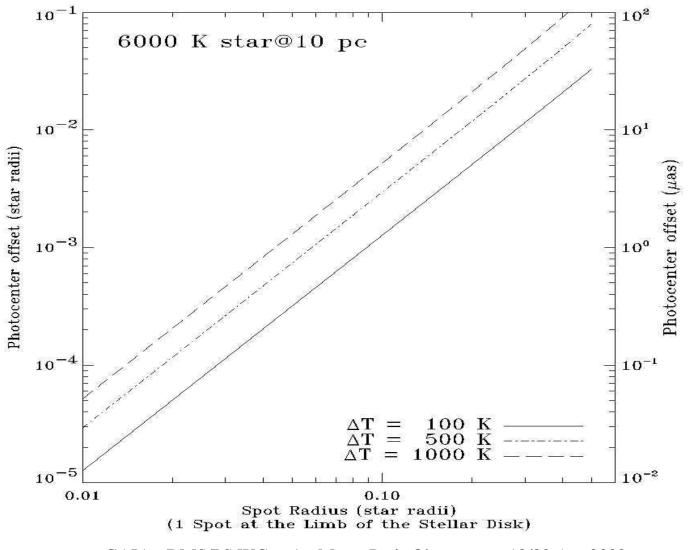
—>Variable gain implemented on chip or in the proximity electronics would allow saturation to occur at G~10.4 mag (and possibly 10.0 mag) ←

• <u>Refine the characterization of GAIA's capabilities</u> (one or more planets, astrophysical noise, dynamical noise, blind search and orbit reconstruction,..)

• <u>Gauge the impact factor of GAIA for the science of extrasolar planets</u> (identify the "big" questions, is GAIA addressing any of those? Compare GAIA to ongoing and planned ground-based and space-borne initiatives);

• <u>Demonstrate the ability to tackle the data and apply them to the science case;</u>

• <u>Detailed report to ESA.</u>

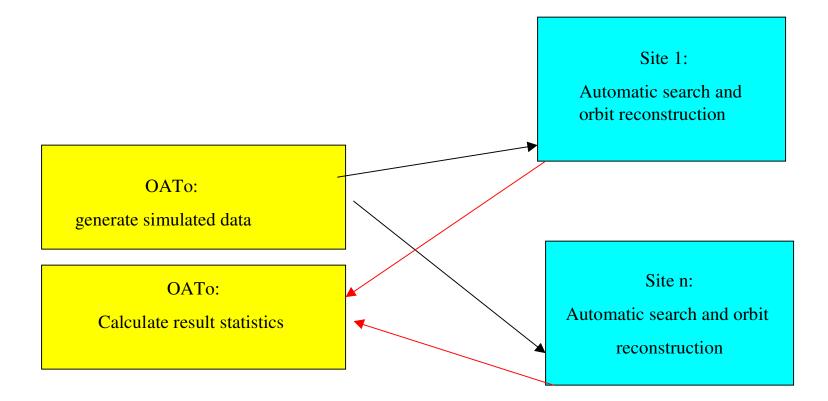GAIA - DMS/PS WGs - 1st Mtg - Paris Observatory 19/20 Apr 2002

(4) Tools

•<u>Organization</u>: do we have a team which is up to the task? Efficient communication means; keep track of theoretical developments; maintain a DB of the groud-based and space-born initiatives as they materialize and analize potential --> to contain: program name, PI, start date, duration, primary goals;....

•<u>Simulations</u> : End-to-end simulations; realistic error model; realistic model of the observed systems; automatic detection schemes (with progressive use of the different data as they become available within the GAIA data base)

•<u>Publication plan:</u> to focus activities and For example, start with a campaign on double-blind-tests)

Example: double-blind-test set up

OATo:

generate simulated data

OATo:

Calculate result statistics

Site 1:

Automatic search and orbit reconstruction

Site n:

Automatic search and orbit reconstruction

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END

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