A Finding List for $\Delta\mu$ Binaries derived from a Comparison of HIPPARCOS Proper Motions with Long-term Averaged Data

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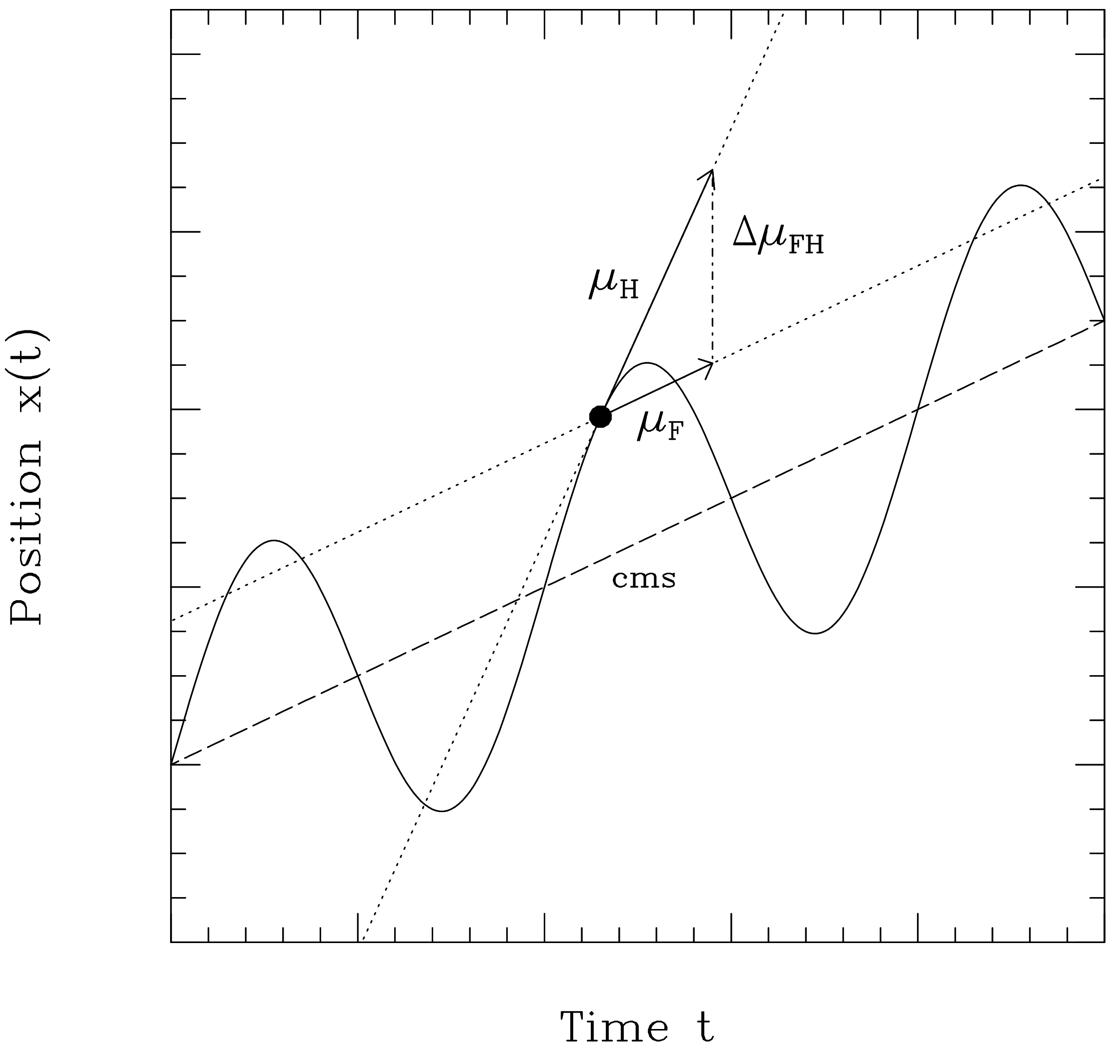
The comparison of quasi-instantaneously measured HIPPARCOS proper motions with long-term averaged proper motions, derived from ground-based data, allows the identification of many stellar objects as $\Delta\mu$ *binaries (Wielen et al., 1999, A&A 346, 675). We have used this method to find* $\Delta\mu$ *binaries among the fundamental stars, among the GC stars, and among the Tycho-2 stars. A finding list for about 7000* $\Delta\mu$ *binaries is given under the URL*

http://www.ari.uni-heidelberg.de/dmubin.

This information on the probable duplicity of the listed objects can be used for planning specific observing programs, for improving our knowledge of binary statistics, or for avoiding the use of these binaries in some astrophysical calibrations or as astrometric reference stars.

Definition of a $\Delta\mu$-binary



Wavy motion of the photo-center of an astrometric binary (solid curve) around the linear motion of its center-of mass (dashed line). Two instantaneous positions and proper motions are indicated (filled dots; arrows). The linear predictions based on the instantaneous values are shown as dotted lines.

Principle

For the detection of double stars we investigate statistically the following proper motion differences and their corresponding mean errors:

$$
\begin{aligned}
\Delta\mu_{FH} &= \mu_F - \mu_H \ , \\
\Delta\mu_{0F} &= \mu_0 - \mu_F \ , \\
\Delta\mu_{0H} &= \mu_0 - \mu_H \ , \\
\Delta\mu_{0GCH} &= \mu_{0,GC} - \mu_H \ , \\
\Delta\mu_{TH} &= \mu_{Tycho2} - \mu_H \ .
\end{aligned}
$$

For example the test parameter F_{0H} is defined by

$$F_{0H}^2 = \left(\frac{\Delta\mu_{0H,\psi}}{\varepsilon_{\Delta\mu,0H,\psi}}\right)^2 + \left(\frac{\Delta\mu_{0H,\overline{\psi}}}{\varepsilon_{\Delta\mu,0H,\overline{\psi}}}\right)^2 \ ,$$

where the subscripts ψ and $\overline{\psi} = \psi \pm 90°$ indicate that proper motion differences $\Delta\mu_{0H}$ and corresponding mean errors $\varepsilon_{\Delta\mu,0H}$ are referred to the principal axes of the local error ellipse.

Objects are $\Delta\mu$ binaries if

$$F > 3.44,$$

which corresponds the same level of significance as the two-sided 3σ -criterion for a one-dimensional normal distribution.

The method was applied to the Hipparcos-stars in:

Catalogue	number of stars
FK5, Pt. I	1535
FK5, Pt. II	3117
FK Sup Stars	995
General Catalogue (GC)	33,342
Tycho 2	about 2.5 Mio.

μ_0: Additional proper motion derived from two mean catalogue-positions

F-values: are derived by comparing a catalogue proper motion with that in another catalogues or with μ_0. The following F-values were used:

Designation	First proper motion	Second proper motion
F(FH)	FK5	Hipparcos
F(0F)	μ_0 from Hipp. and FK5	FK5
F(0H)	μ_0 from Hipp. and FK5	Hipparcos
F(0GCH)	μ_0 from Hipp. and GC	Hipparcos
F(T2H)	Tycho 2	Hipparcos

Number of tested stars: about 120,000 Hipparcos stars

Number of stars with significant $\Delta\mu$:

about 7000, including known double stars.

Examples of 4 $\Delta\mu$ binaries extracted from our Internet finding list. The significant F(T2H) value for Kapteyn's star may also be caused by its high foreshortening effect.

HIP-No.	F(FH)	F(0F)	F(0H)	F(0GCH)	F(T2H)	Cat.	Name
11767	6.18	2.11	7.32	5.08	—	FK5:	Polaris
58001	19.78	1.18	22.68	19.85	5.81	FK5:	γ UMa
24168	—	—	—	2.88	8.62	GC	Kapteyn
73934	—	—	—	—-	11.99	Tycho 2	