Candidate Common Velocity Stars from the AGK3 confirmed with Radial Velocity Measurements

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1. A preliminary selection based on proper motion

Two sets of CPM stars extracted from the AGK3 :

1. 326 pairs with $T = \rho/\mu < 1000$ years; 1.3 % optical expected.

2. 113 pairs with $1000 < T < 3500$ years; 40 % optical expected.

2. The radial velocity program

267 stars measured with Coravel :

- Set 1 : 90 stars; both components measured for 41 pairs.
- Set 2 : 177 stars; both components measured for 79 pairs.

Several SB were found and followed during about 15 years.

3. Selection of the physical wide binaries

The difference $\Delta V_R = V_1 - V_2$ obtained with $\sigma_{\Delta V} < 0.8$ km/s for

- 36 pairs from set 1
- 68 pairs from set 2

The distribution of ΔV_R is plotted in Fig. 1

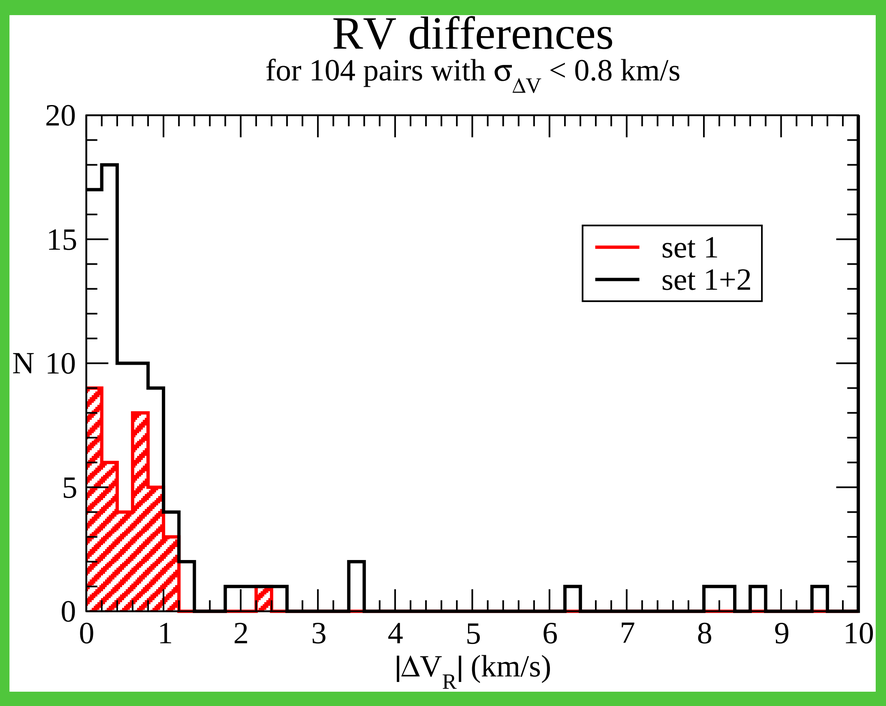

Fig 1:

Distribution of the radial velocity differences of the CPM pairs with ΔV_R more accurate than 0.8 km/s.

The physical pairs seem to have $|\Delta V_R| < 1.5$ km/s. For comparison, the maximum velocity difference for a bounded system is :

$$\Delta V_{parabolic} = \sqrt{2G\frac{\mathcal{M}_1 + \mathcal{M}_2}{r}}$$

For solar-mass stars with separation r = 1000 AU, $\Delta V_{parabolic}$ = 1.9 km/s. The 1.5 km/s limit is then rather conservative.

Proportion of optical pairs

- Only 1 pair in set 1 is beyond the 1.5 km/s limit, with ΔV_R = 2.33 km/s.
- In set 2, 33 pairs among 68 are beyond this limit ⇒ 49 ± 12 % of optical pairs (40 % expected)

Our expectations are confirmed.

4. Distribution of separations

70 confirmed wide binaries ($\sigma_{\Delta V} < 0.8$ km/s , $|\Delta V| < 1.5$ km/s)

- Hipparcos parallaxes better than 25 % for 55 binaries
- spectroscopic parallaxes have been calculated for 10 binaries

⇒ Apparent separations, $s = \rho/\varpi$, for 65 wide binaries (Fig 2).

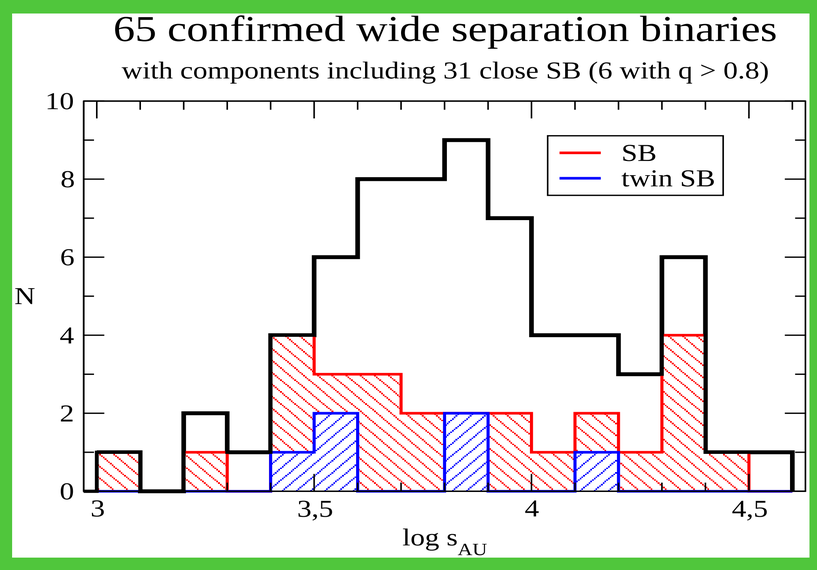

Fig 2 : Distribution of apparent separations for the physical wide binaries. The systems having a SB component are counted separately, as well as that including twin SB (SB with q near 1).

The distribution of log *s* is rising from 1000 to 5000 AU since it is affected by selection effects : in this range of separations, several pairs were not separated on the photographic plates used in the preparation of AGK3.

5. The spectroscopic binaries

31 of the 130 components of wide binaries in Fig 2 are SB (24 %).

24 SB with P < 10 years ⇒ 18 % (instead of 15 % for solar-type stars)

Are close binaries more frequent among some wide binaries than among others ? We count 4 wide binaries with both components SB , when 3.7 are expected ⇒ the answer is "**no**"

Is the frequency of close binaries depending on the separation of the wide binaries ? It comes from Fig 2 that the answer is "**no**", for all SB and also for "twins" (SB with q>0.8)

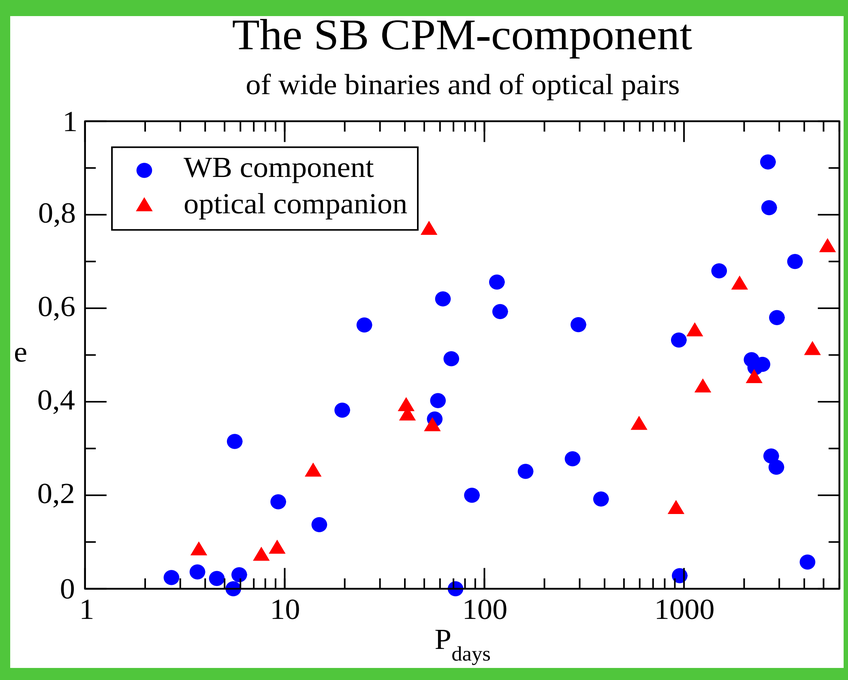

Fig 3 :

The period-eccentricity diagram of all the SB found in the program. The circles refer to the components of physical wide binaries, and the triangles to those of optical pairs.

SB properties

The SB of the program with computed orbital elements are presented in Fig 3. The positions of members of wide binaries in the P-e diagram don't look different from those of the other stars.

⇒ **SB in wide binaries look similar to "single" SB**