

CID binaries: from SDSS to Gaia

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Unresolved binaries

Wielen (1996) suggested two ways of unveiling unresolved binaries

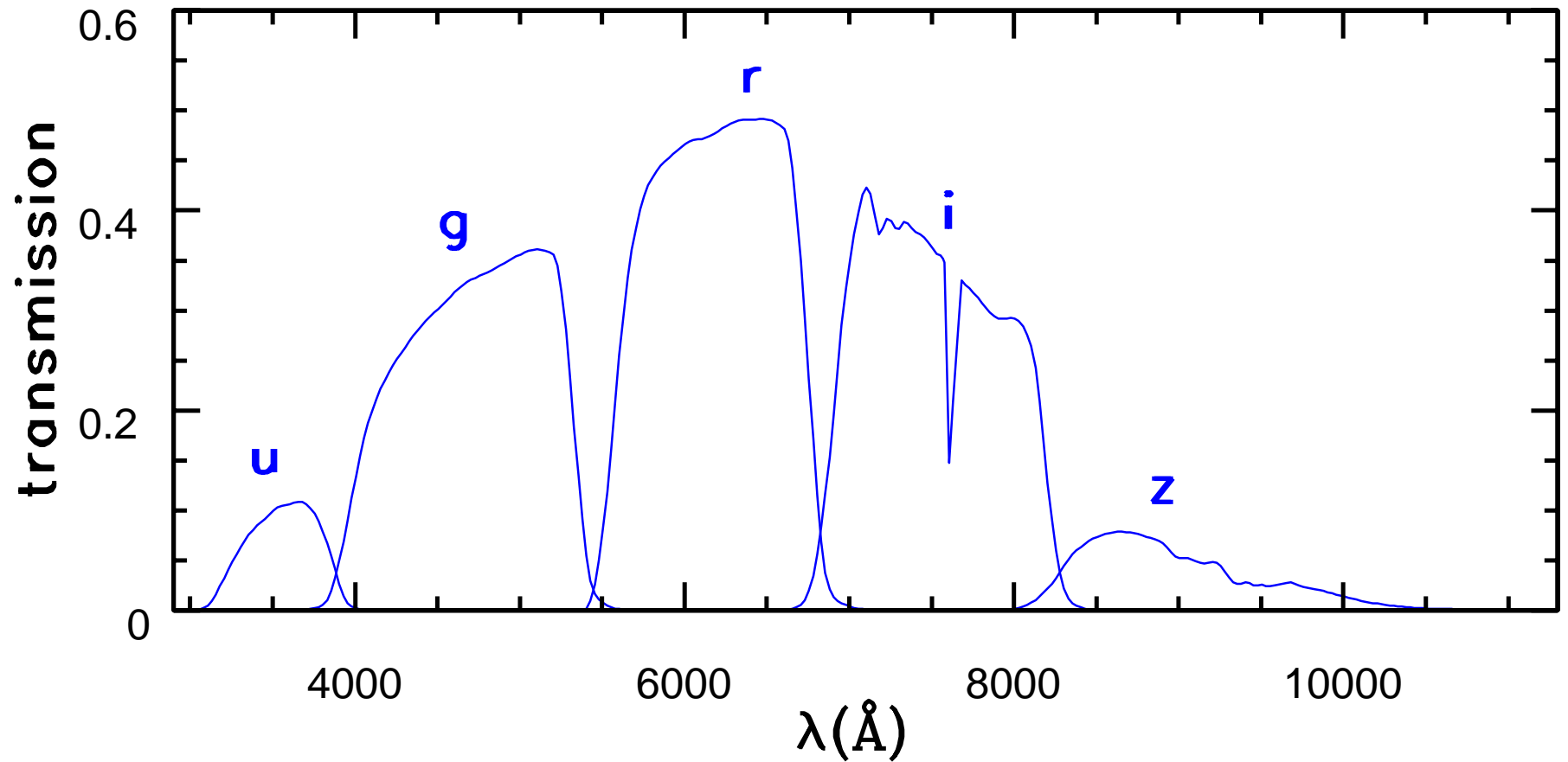
- Variability-Induced Movers
- Color-Induced Displacement binaries

VIM require several observation of the position of the photocenter and the total brightness of the source.

CID binaries rely on the color difference of the components and the subsequent shift of the photocenter depending on the adopted filter. They can be detected instantaneously

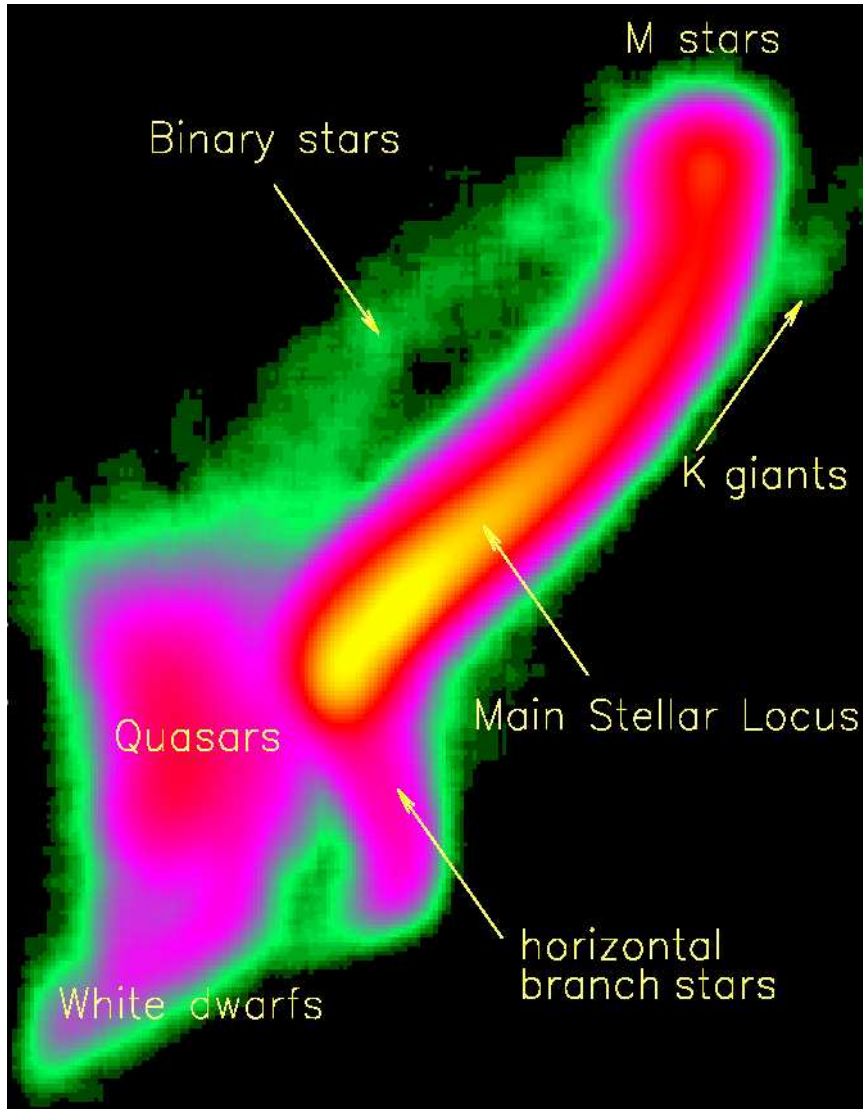
Hipparcos only detected some VIM.

SDSS Multi-band photometry



Fukugita et al. (1996), Gunn et al. (1998)

Photometric detection



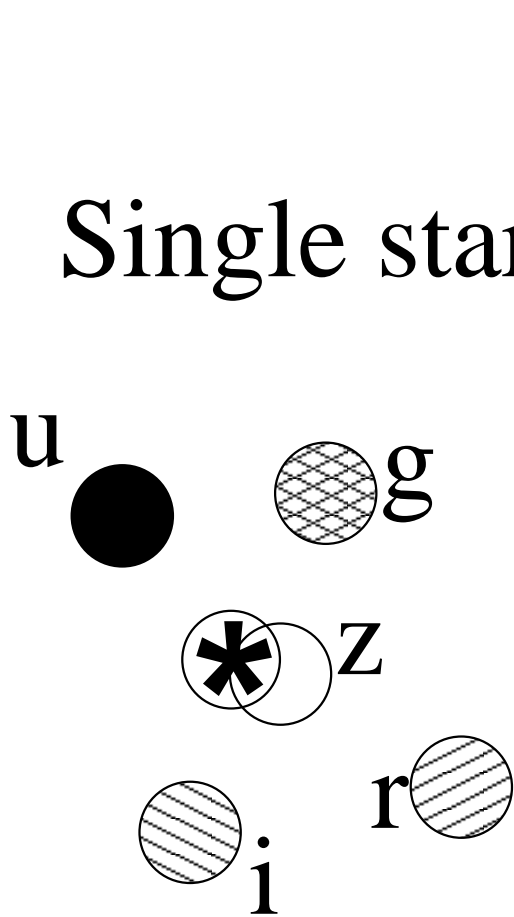
u, g, r color-color diagram.

Smolčić et al. (2004): white dwarf and M dwarf bridge w/ 880 bin. among 1.99M stars.

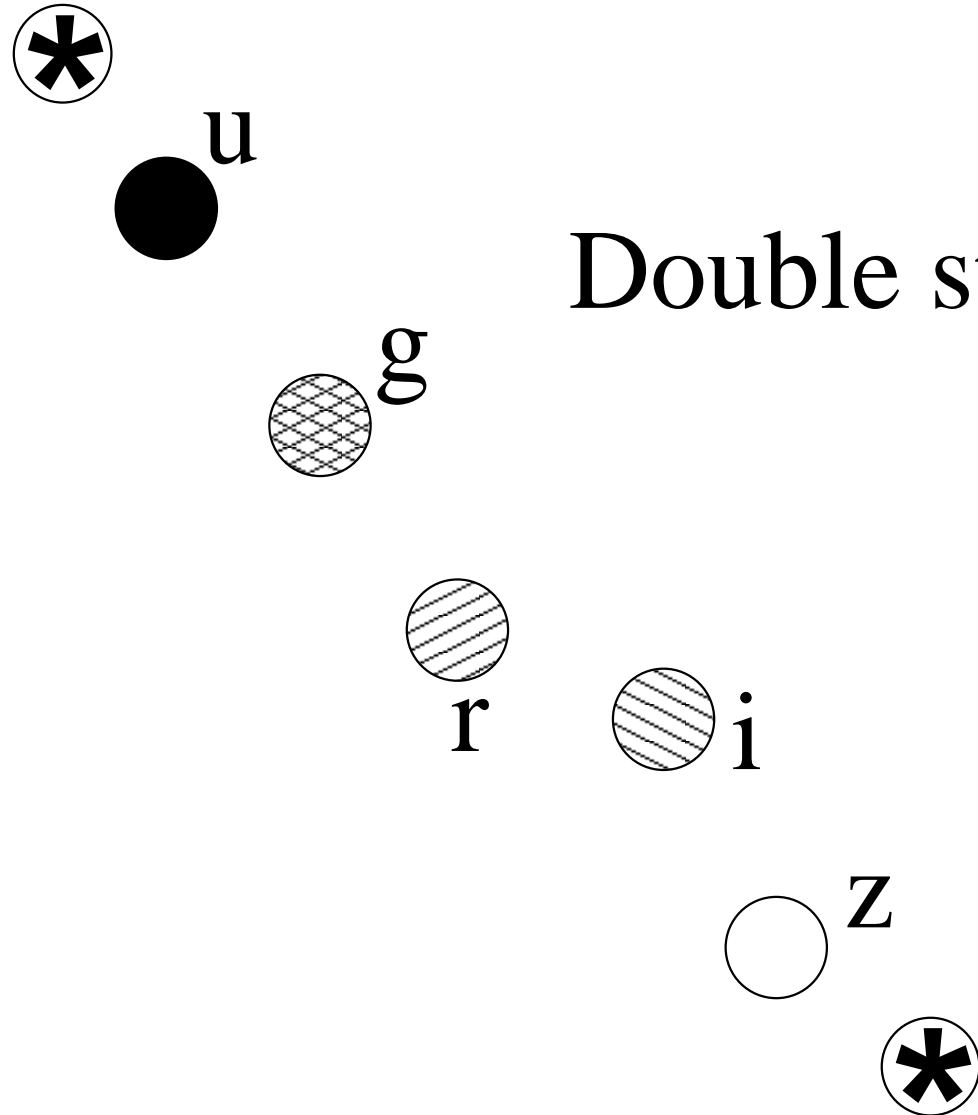
Method limited to color outliers only.

Multi-band astrometry

Single star



Double star

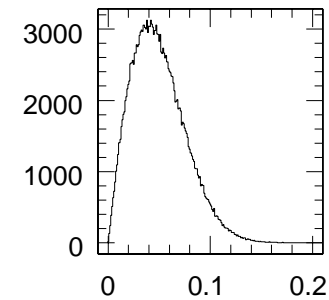
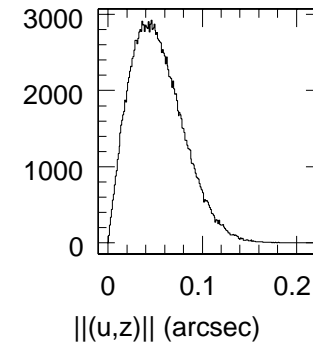
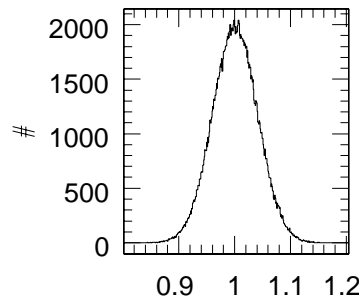
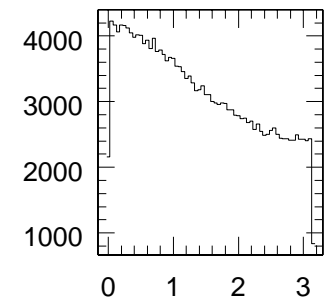
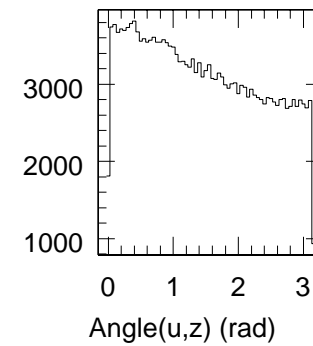
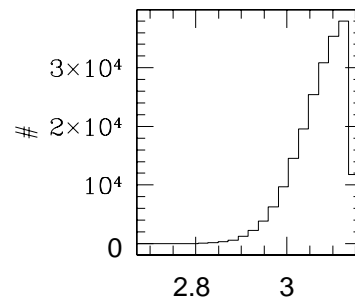
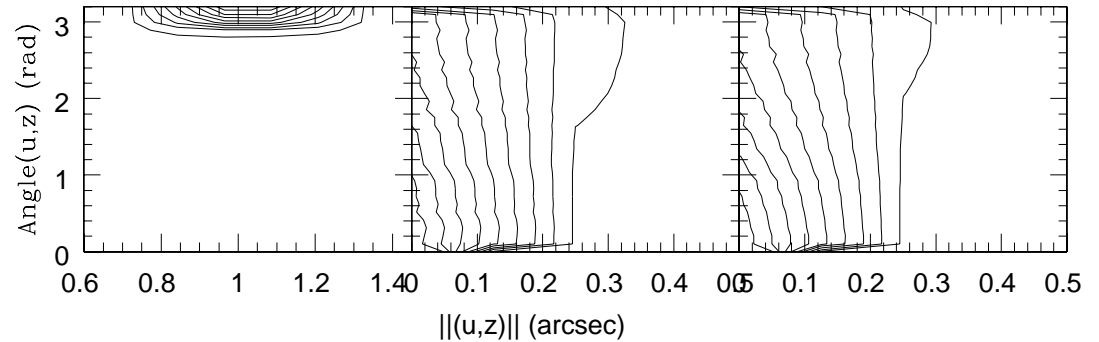


Simulated $\|(u, z)\|$

With

- $\sigma_{\alpha,u} = 36$ mas,
- $\sigma_{\delta,u} = 39$ mas,
- $\sigma_{\alpha,z} = 20$ mas,
- $\sigma_{\delta,z} = 22$ mas,
- $\rho = 0.17$,

no detection below
10 mas

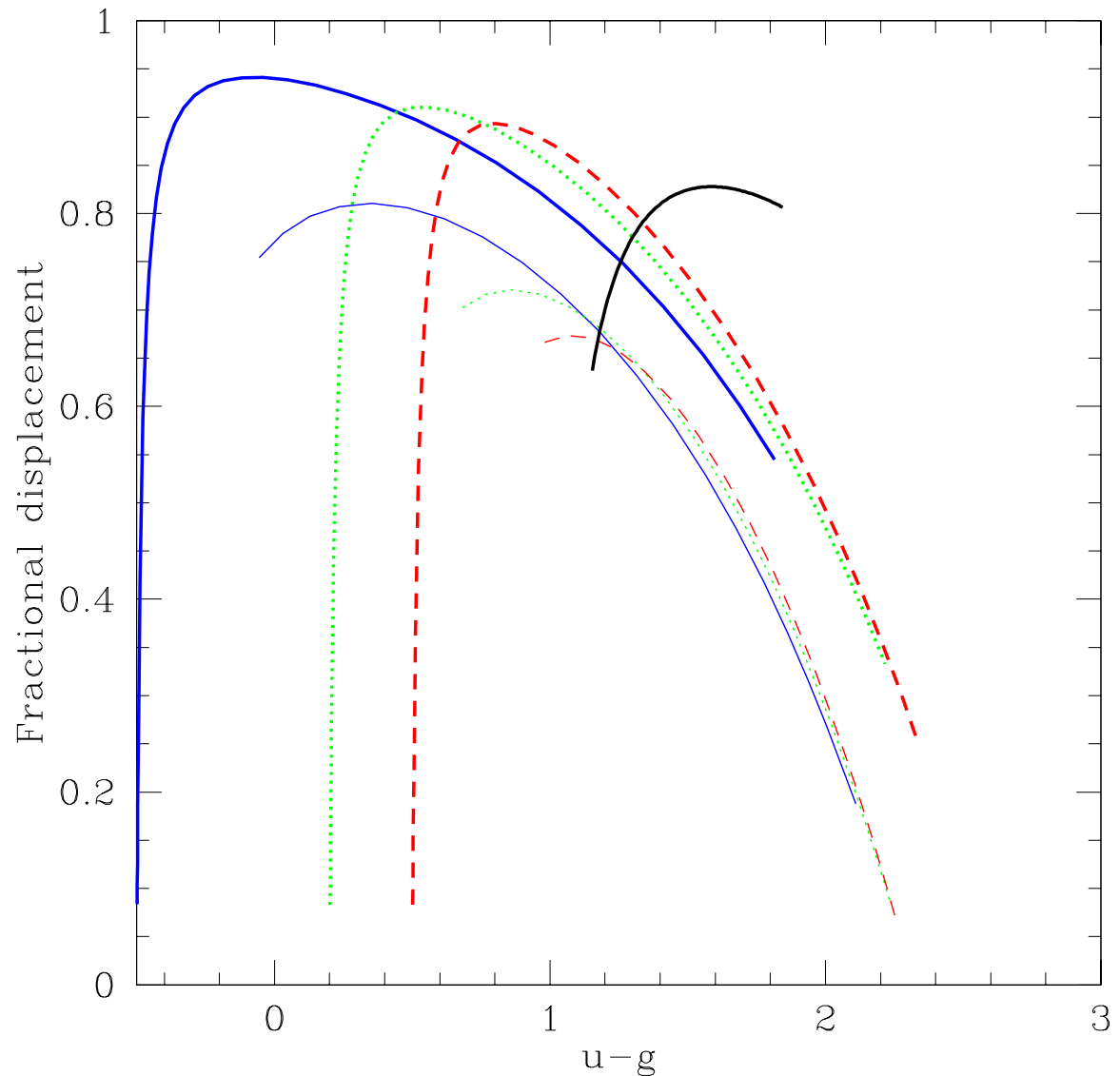


$$\|(u, z)\| / \|A, B\|$$

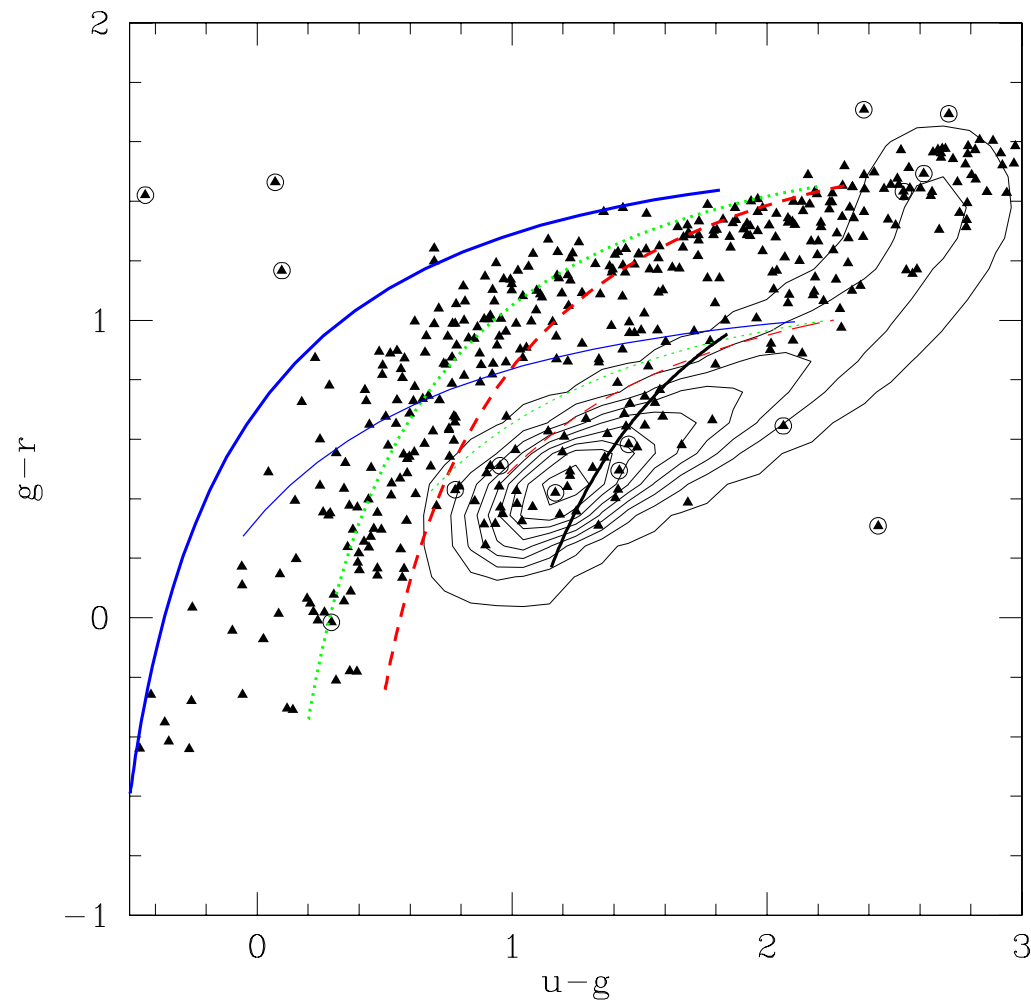
Combinations

- WD+M dwarf,
- WD+K7V,
- A0V+K5III.

A0V+K5III: rather similar colors but the displacement is always quite large.

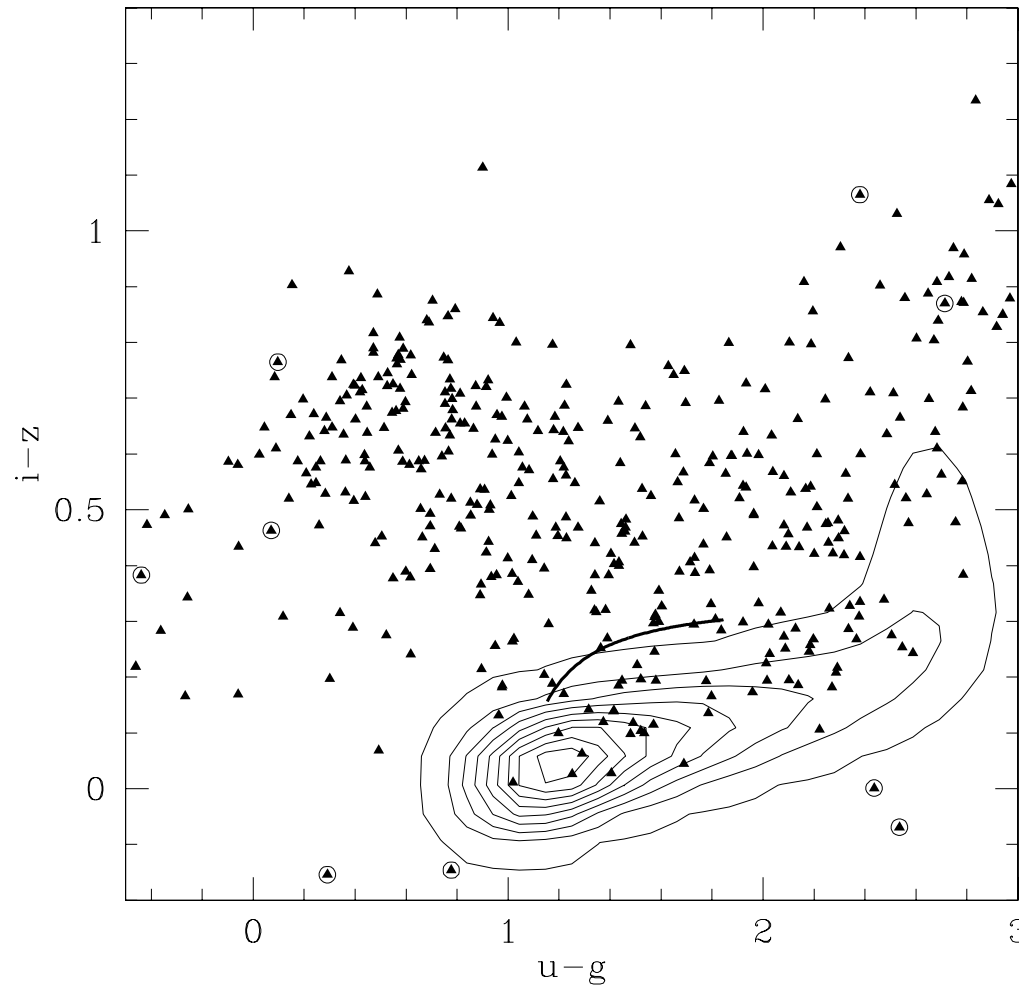


Color-color diagram (DR1)



Results of Smolčić et al. (2004) confirmed. Quasars?

No quasar contamination



Detection of binaries even inside the stellar locus.

SDSS vs. Gaia

SDSS	Gaia
Large σ_{astrom}	small σ_{astrom}
one shot	tens of observations
2D data	1D measurements

- One shot \Rightarrow binary nature *on the fly*
- Several data \Rightarrow Binary modeling (GAIA-AF-02)

Rely upon a very accurate calibration of the chromaticity effects.

Conclusions

- Wielen is proven to be right: CID binaries do exist!
- Good complement to the photometric outlier method.
- Much higher precision of Gaia wrt SDSS
but projection of the separation.
- *On the fly* but will need to wait for the calibration.