Study of open cluster NGC 5617 in Gaia era

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Abstract. Identification of member stars in open clusters is still an open question. Thanks to Gaia
DR2 data base, which improves our statistics regarding true members in clusters to understand
cluster properties much better way. In this paper, we identify the cluster members using proper
motion and colour magnitude diagram for NGC 5617. In addition to this, we have determined
more precise fundamental parameters as well.

Keywords. Open clusters and associations: individual (NGC 5617), Colour-magnitude diagram,
Astrometry

1. Introduction

NGC 5617 (Cl426-605) ($\alpha_{2000} = 14^h 29^m 48^s$, $\delta_{2000} = -604300$; $l = 314.67$, $b = -0.10$)
is located in the fourth galactic quadrant of Milky Way Galaxy. The value of reddening
$E(B-V) = 0.53$ and distance of 1.8 Kpc have been estimated by Haug (1978) based
on photographic-photoelectric data base. CCD UBV photometry has been reported by
Kjeldsen & Frandsen (1991), who got a smaller reddening $E(B-V) = 0.48 \pm 0.02$, a
larger distance of 2.05 ± 0.2 Kpc and an age of 70 Myr. This object is an intermediate age
open cluster (8.2×10^7 years) containing red giants and blue struggler stars (Ahumada
& Lapasset 2007) in its surroundings, which membership of the cluster still in doubt. In
this paper, our main focus is to improve our knowledge about likely members which will
be much helpful to understand the cluster properties.

2. Data Used

We have used GAIA DR2 (Gaia Collaboration *et al.* 2018) for the astrometric analysis
of NGC 5617. This data consist of five parametric astrometric solution-positions on the
sky (α, δ), parallaxes and $(\mu_\alpha cos\delta, \mu\delta)$ with a limiting magnitude of $G = 21$ mag. The
uncertainties in the respective proper motion components are up to 0.06 mas yr^{-1} (for
$G \leqslant 15$ mag), 0.2 mas yr^{-1} (for $G \sim 17$ mag) and 1.2 mas yr^{-1} (for $G \sim 20$ mag).

3. Mean proper motion and decontamination of field stars

PMs $\mu_\alpha cos\delta$ and μ_δ are plotted as vector point diagram (VPD) in the bottom panels in
Fig 1 (a). In this figure top panels shows that the corresponding G versus $(G_{BP} - G_{RP})$
colour magnitude diagrams. The left panel shows all the stars, while the middle and right
panel show the probable cluster members and field region stars. A circle of 0.5 mas yr^{-1}
around the cluster center defines our membership criteria, which is a compromise between
loosing cluster members with poor PMs and inclusion of non member stars. This method
of member selection has been described by Bisht *et al.* (2019) for two open clusters
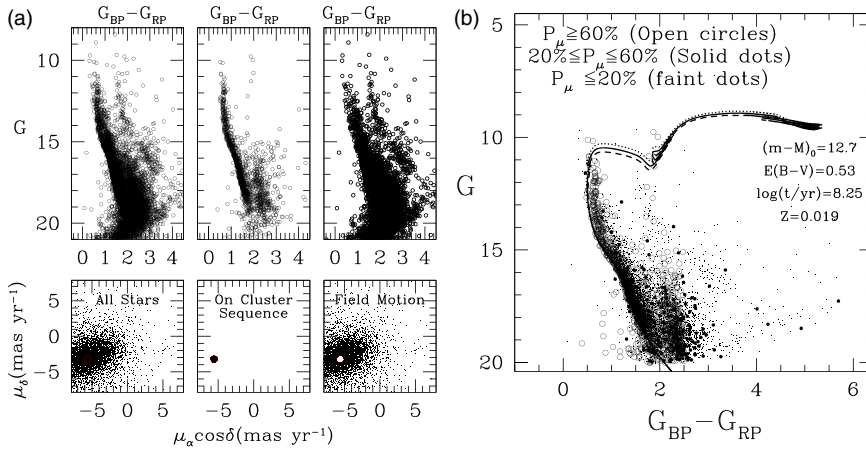Berkeley 24 and Czernik 27.

Figure 1. a : (Bottom panels) Proper-motion vector point diagram (VPD). (Top panels) G versus $(G_{BP} - G_{RP})$ colour magnitude diagrams. (Left) The entire sample. (Center) Stars in VPDs within circle of 0.5 mas/yr of the cluster mean. (Right) Background/foreground field stars in the direction of these clusters. All plots show only stars with PM σ smaller than 0.5 mas/yr in each coordinate. **b**: G versus $(G_{BP} - G_{RP})$ cleaned colour-magnitude diagram. Open circles, solid dots and faint dots indicates most likely members, low probable members and non members respectively. The estimated value of distance modulus, reddening, age and metallicity also shown in this figure. Dotted,solid and dashed lines are the theoretical isochrones of log(age) = 8.20, 8.25 and 8.20 as taken from Marigo *et al.* (2017).

4. Concluding remarks

We have removed non members from the main sequence of NGC 5617 using high precision gaia DR2 proper motion data. In Fig 1(b), Open circles are considered as most likely members with membership probability higher than 60%, solid dots are low probable members with probability in between 20% to 60%. Faint dots are confirmed as non member stars with probability below than 20%. Age and distance have been estimated as 180 ± 20 Myr and 1.63 ± 0.3 kpc by fitting the solar metallicity isochrones of Marigo *et al.* (2017) to $(G, G_{BP} - G_{RP})$ cleaned colour magnitude diagram. Our analysis is much reliable because this work has been done using confirmed member stars only.

Acknowledgments

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