



Detailed Analyses of Binary OCs

Seval Taşdemir, Deniz Cennet Çınar

Binary and Multiple Stars in the Era of Big Sky Surveys KOPAL2024, 9-13 September 2024

Detailed Anal

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Purpose and Perspective of the Stud

The aim of this study is to conduct a comprehensive photometric and are of the close binary open clusters (CBOCs) CWNU2666 and HSC224 Hunt & Reffert (2023). This research focuses on accurately identifying a the member stars of these two clusters, which are closely aligned in both space via the *Gaio* DR3 photometric and astrometric data.

By achieving a clear separation in positional and color space, the study s the fundamental astrophysical and astrometric parameters of each clust expected to contribute to a better understanding of the clusters' form stellar evolution of the binary open clusters.

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Astrometric and Photometric Data

Fine photometric and astrometric analyses of HSCC 224 and CWNU 266 the Gaia DR3 catalogue (DR3, Gaia Collaboration et al. 2023). Astrometr data were generated based on the equatorial coordinates provided by Hi 2023). ((a. 6.) = 1186 44m 05s 3347906 & = -110.54*21*783347).

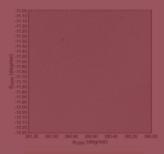


Figure 1: Identification chart of clusters.

Table 1: Fundamental parameters of CWNU 266 and HSC 224

Parameter	CWNU 2666	
Astrometric Parameters		
$(\alpha, \delta)_{\rm J2000}$ (Decimal)	(281.02,-11.90)	(280.23
$(l,b)_{\rm J2000}$ (Decimal)	(21.49,-03.79)	
Cluster members $(P \ge 0.5)$	106	
$\mu_{\alpha}\cos\delta$ (mas yr ⁻¹)	0.646 ± 0.155	
$\mu_{\delta} \; (\text{mas yr}^{-1})$	-0.769 ± 0.124	-0.728
	0.537 ± 0.006	0.530
	1863 ± 102	1857
kmeans		
Astrophysical Parameters		
		0.807
$A_{\rm G}$ (mag)	1.816 ± 0.047	1.503
[Fe/H] (dex)	0.010 ± 0.05	
Age (Myr)	160 ± 15	140
$G - M_{\rm G} \text{ (mag)}$	13.192 ± 0.051	12.857
	1885 ± 44	



Astrometric and Photometric Data

The photometric and astrometric analyses of HSCC 224 and CWNU 266 utilized data from the Gaia DR3 catalogue (DR3, Gaia Collaboration et al. 2023). Astrometric and photometric data were generated based on the equatorial coordinates provided by Hunt & Reffert (2023) ($\langle \alpha, \delta \rangle$) = (18h 44m 05s.3347906, δ = -11o 54' 21".783347).

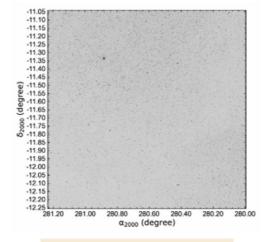
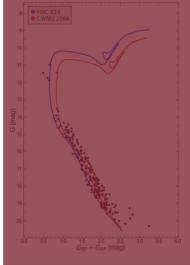


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Parameter	CWNU 2666	HSC 224
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$(\alpha, \delta)_{\rm J2000}$ (Decimal)	(281.02,-11.90)	(280.23,-11.80)
$(l,b)_{J2000}$ (Decimal)	(21.49, -03.79)	(21.23, -03.05)
Cluster members $(P \ge 0.5)$	106	146
$\mu_{\alpha} \cos \delta \ (\text{mas yr}^{-1})$	0.646 ± 0.155	0.665 ± 0.131
$\mu_{\delta} \; (\text{mas yr}^{-1})$	-0.769 ± 0.124	-0.728 ± 0.107
ϖ (mas)	0.537 ± 0.006	0.530 ± 0.005
d_{∞} (pc)	1863 ± 102	1857 ± 169
kmeans	25	34
Astrophysical Parameters		
$E(G_{\rm BP}-G_{\rm RP}) \ ({\rm mag})$	0.975 ± 0.025	0.807 ± 0.016
$A_{\rm G}~({ m mag})$	1.816 ± 0.047	1.503 ± 0.030
[Fe/H] (dex)	0.010 ± 0.05	0.010 ± 0.05
Age (Myr)	160 ± 15	140 ± 15
$G-M_{ m G}~({ m mag})$	13.192 ± 0.051	12.857 ± 0.034
$d_{ m iso}~(m pc)$	1885 ± 44	1866 ± 29





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Refferences





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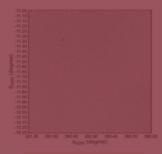
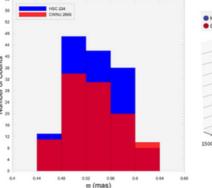


Figure 1: Identification chart of clusters.

Table 1: Fundamental parameters of CWNU 266 and HSC 224

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$\mu_{\alpha} \cos \delta \text{ (mas yr}^{-1}\text{)}$		
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⊘ Analyses



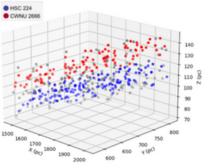


Figure 2: Gaia DR3-based trigonometric parallax histogram constructed from the most likely member stars of HSC 224 and CWNU 266.

Figure 3: The 3D distribution of most likely stars of HSC 224 (Blue), and CWNU 2666 (Red). Also, grey circles represent the stars which are out of the limit radii of clusters.

- In this study, a spatial separation was performed by considering the central coordinates of the binary open clusters.
- The limit radii of the clusters was determined taking into account the CMD and VPD as 24 arcmin.
- Taking into account the the results of the photometric completeness limit the membership probability analysis and the limiting radius we identified 106 and 146 members for the cluster CWNU 2666 and HSC 224, respectively with probabilities (P ≥ 0.5).
- We obtained the fundamental astrophysics parameters (see also table 1) by using the isochrone fitting method.

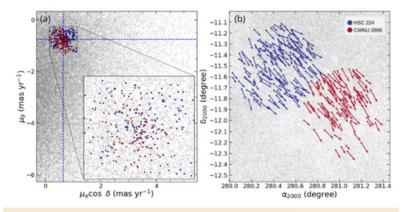
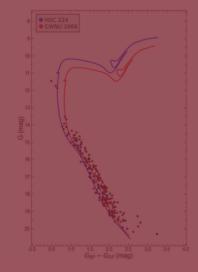


Figure 4: Vector Point Diagram (a) and proper-motion velocity vectors (b) of HSCC 224 and CWNU 2666. In panel (a), the magnified boxes reveal regions with a high concentration of member stars in the VPDs, and mean proper-motion values are indicated by the intersection of blue dashed lines.





Colour-magnitude diagram for the studied cluster HSC 224 and CWNU 2666, Different colour show the ip of stars (0.5 > P) with cluster. The best solution of fitted isochrones (41 Gyr and 67 Gyr) are inferred as the blulines, respectively.

Conclusion and Future Works

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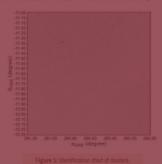


Table 1: Fundamental parameters of CWNU 266 and HSC 224

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Astrometric Parameters		
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$(l,b)_{J2000}$ (Decimal)	(21.49,-03.79)	
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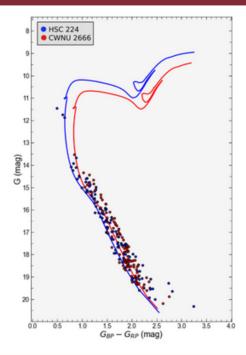


Figure 5: Colour-magnitude diagram for the studied cluster HSC 224 and CWNU 2666. Different colour show the membership of stars (0.5 > P) with cluster. The best solution of fitted isochrones (41 Gyr and 67 Gyr) are inferred as the blue and green lines, respectively.

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Conclusion and Future Works

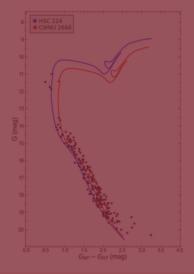
Drawing from the literature, we identified and validated that CWNU 2666 and HSC 224 form a physical binary cluster by analyzing their positions in the 2D celestial coordinate system, the 3D Cartesian coordinate system, proper motion, parallax, and CMD.

For future work, SED analyses will be performed for the most likely member stars of each cluster and will be compared with the model atmosphere parameters in the spectral studies in the literature. In addition, the total masses of the clusters will be calculated and a comparison will be made. These analyses aim to provide a perspective on the previous interactions and formation of the clusters with each other.









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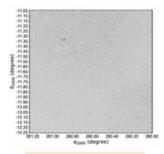


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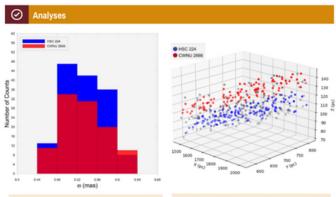


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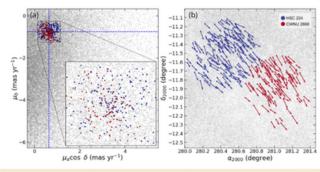


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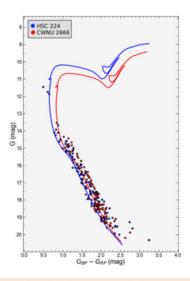


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