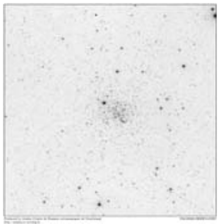
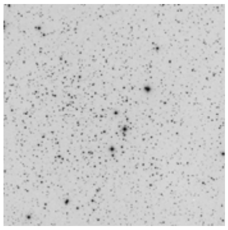


Studies on the Corona of Open Clusters



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ABSTRACT

High quality proper motions on an extended area of a selection of Open Clusters (OCs) will let us study their coronas with unprecedented accuracy. We are in the process of obtaining astrometry with the Meridian Circles of San Fernando CMASF at El Leoncito (Argentina) and the CTA at La Palma of an area few times the known radius (from Webda) of a selection of OCs. We will make use of Strömgren wide-field photometry to complement their characterization.

We have already analysed the old open cluster M67, deriving properties for 2738 stars fainter and, in a wider area, than any previous precise survey in the cluster region. With new data from the CMASF we have covered an area of about 2°x1.4° and down to 17 magnitude in r'. Proper motions are then used to determine the membership probabilities of stars in the region, applying parametric and non-parametric approaches to cluster/field segregation. Adding photometric criteria, we obtained a preliminary list of 665 probable member stars, up to a distance 0.96° from the cluster centre.

These are preliminary results on our work that will lead us to the most complete study of its structure, dynamics and mass segregation up to date. We have already obtained proper motions for NGC1817, NGC 2264 and NGC2509 that are now being processed.

1. Automatic Meridian Circles Observations

Círculo de Tránsitos Automático (CTA) (La Palma)
Sky coverage: -30º < δ < + 50º

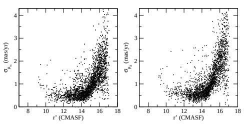
9 < r' < 17

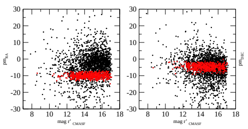
Círculo Meridiano San Fernando (CMASF) (El Leoncito, Argentina)
Sky coverage: -50º < δ < +30º

2. New Proper Motions Studies: M67 case

1. First epoch data have been taken from plates POSSI (1951.9) measured with two different machines: APM (median σ_α = 0".27, σ_δ = 0".31) and USNO-A.2 (median σ_α = 0".25, σ_δ = 0".29) catalogues, with averaged positions when the star is present in both catalogues.
2. Second epoch is taken from CMC14 (2001 for this zone) The median internal errors at r'_{CMASF} = 15 mag are σ_α = 0".037and σ_δ = 0".032.
3. Third epoch positions: CMASF at El Leoncito (2010). The median internal errors at r'_{CMASF} = 14.5 mag are σ_α = 0.050" and σ_δ = 0.060"

Fi… or magnitude trends in proper motions we have plotted (se… members as red circles.





Proper motions for 2738 stars. 665 cluster members in red.

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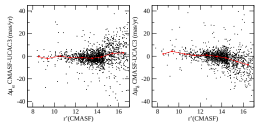
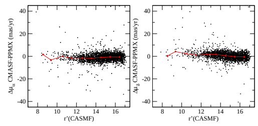


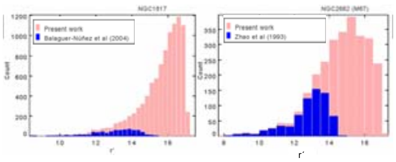
UCAC3 Zacharias et al. (2010) USNO+Hip+2MASS+POSS+others
1-10 mas/yr 1569 stars in common

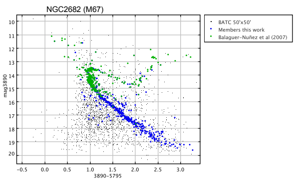


PPMXL Röser et al. (2010) USNO-B1+2MASS
4-10 mas/yr 2737 stars in common

We compare our absolute proper motions with those of the latest general catalogues' releases: UCAC3 (Zacharias et al. 2010), top left. We can see that for magnitude r' fainter than 13.5 UCAC3 proper motions show a clear trend with magnitude (as happened with UCAC2 release for J_{2MASS} fainter than 12). The use of proper motion data from UCAC3 catalogue should be carefully performed to avoid systematics. No trend is visible in the comparison with PPMXL (Roeser et al. 2010), top right.

Two OCs comparison with high accuracy proper motions from previous results:
NGC1817 (Balaguer-Núñez et al 2004),
NGC2682 (M67, Zhao et al 1993)





Our data reaches 3 mag fainter than previous high accuracy results.

4. Membership, key on the Corona studies

To be able to disentangle the structure, dynamics and mass segregation of OCs is necessary to improve our knowledge of their coronas. Precise membership information is fundamental to that aim. From new deeper and wider astrometric studies on a selection of OCs, we derive properties of the stars fainter, and in a wider area, than any previous precise survey in the clusters' regions. Proper motions are then used to determine the membership probabilities of the stars, applying parametric and non-parametric approaches to cluster/field segregation and adding photometric and spectral criteria when possible. In the case of M67, we use the BATC photometry (Fan et al. 1996), as can be seen in the colour-magnitude diagram above.

List of Open Clusters Observations

Cluster Name	Distance	Age	E(B-V)	Z	Area	Obs.
NGC2682 (M67)	900	9.82	0.04	476	90'	CMASF
NGC1817	1972	8.612	0.334	-446.8	95'	CTA
NGC 2264	667	6.954	0.051	25.6	115'	CTA/ CMASF
NGC 2509	912	9.9	0.15		35'	CTA
Ruprecht 32	5346	7.08	0.5	-53.5	30'	CTA
NGC 6405	487	7.97	0.144	-6.6	90'	CTA
King 25	1450	8.8	1.36		30'	CTA
NGC 6819	2360	9.174	0.238	348.1	30'	CTA
Bochum 6	2500	7	0.71	-15,1	60'	CTA
NGC 1893	3280	7.027	0.581	-96.2	65'	CTA
Teutsch 10	2600	7.5	1.01		35'	CTA/ CMASF
NGC 2355	2200	8.85	0.12	450	45'	CTA/ CMASF
NGC 2112	850	9.301	0.63	-185.6	108'	CTA
Haffner 8	1182	9.15	0.03	27.7	30'	CMASF
Pismis 3	1394	9.027	1.3	12.2	90'	CMASF
Berkeley 44	1800	9.11	1.4	105.3	30'	CTA
NGC 3680	938	9.077	0.066	273	30'	CMASF
NGC 6231	1243	6.84	0.439	25.7	90'	CMASF
Blanco 1	269	7.796	0.01	-264.3	210'	CMASF
Teutsch 51	2900	8.9	1.01		30'	CTA / CMASF
NGC 6704	2974	7.863	0.717	-115.1	30'	CMASF
NGC 6694	1600	7.931	0.589	-81.3	50'	CTA
NGC 6705	1877	8.302	0.426	-90.9	30'	CTA / CMASF
NGC 6633	376	8.629	0.182	54.5	90'	CTA / CMASF
IC4665	352	7.634	0.174	103.4	210'	CTA / CMASF
Ruprecht 134	550	9.05	0.15	-2.1		CTA / CMASF
NGC1980	550	6.67	0.05	-184.5	75'	CTA / CMASF
NGC 6530	1330	6.867	0.333	-30.9	90'	CTA / CMASF
NGC 2477	1222	8.848	0.279	-124.3	90'	CTA / CMASF
NGC 2658	2021	9.152	0.043	213.7	45'	CTA / CMASF
NGC 2244	1445	6.896	0.463	-52.2	90'	CTA
Trumpler 24	1138	6.919	0.418	29.7	210'	CMASF
IC 4756	484	8.699	0.192	44.2	115'	CTA
NGC 6802	1124	8.87	0.848	18	30'	CTA
NGC 6583	2040	9	0.51	-90	30'	CTA
Collinder 421	950	9.06	0.1	42.1	90'	CTA

With proper motions already derived
All observations finished Observations in progress
Gaia - ESO Survey clusters