1 Title: Open Star Clusters: the path from molecular clouds to the MW disc population

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1.1 Abstract:(10 lines max)

Open star clusters (OCs) play a major role in studies of formation and evolution of stars and the Milky Way. Accurate parallaxes and proper motions provided by the Gaia mission will bring us into a new domain of cluster research. However, Gaia will give inadequate information on radial velocities and chemistry. In order to fully exploit the potential of Gaia and OCs, we hence propose a large public spectroscopic survey of a representative sample of OCs and cluster members, using FLAMES. The main objective is the measurement of accurate and homogeneous radial velocities and elemental abundances. The spectroscopic dataset along with information from Gaia will represent a revolution in cluster astrophysics. We will ultimately be able to: understand how clusters form; evolve, dissolve, and populate the Milky Way; calibrate complex physics that affect stellar evolution; measure the Galactic metallicity gradient at different ages with unprecedented accuracy, thereby setting constraints on models of disc formation. The survey products will have a high legacy value.

2 Description of the survey:

2.1 Scientific rationale: (2 pages)

The promise of open clusters. The study of the formation and evolution of open star clusters (OCs) and their stellar populations represents a backbone of research in modern astrophysics, with a strong impact on our understanding of key open issues, from the star formation (SF) process, to the assembly and evolution of the Milky Way (MW), and galaxies in general.
OCs are dynamically bound groups of stars that formed from the same giant molecular cloud, having a similar age and bulk chemical composition. The OC family includes loose SF regions with as few as $\sim$ 10 stars, up to super star clusters with 10^5-10^6 members. OCs in the MW trace different thin disc components, covering a broad age interval, from $\sim$ 1 Myr to several Gyr, and spanning a metallicity range from $\sim$ 1/3 to twice solar (e.g., Friel 1995, ARA&A, 33, 381). Most stars in our Galaxy, including the Sun itself, were born in clusters (e.g. Lada & Lada, 2003, ARA&A 41, 57; Portegies Zwart et al. 2010, ARA&A 48, 431). Hence, if we wish to understand how stars form, we need to understand how clusters form. A variety of internal and external mechanisms cause 90% of the newly born clusters to dissolve within 100 Myr. OCs are thus the dominant source of field stars. Furthermore, stellar populations in OCs cover stars of all masses and evolutionary stages. Each cluster is a snapshot of stellar evolution. Linking together observations of many OCs at different ages and chemical compositions reveals the story of stellar evolution, to be compared with the same story told by theoretical models. Much of stellar, and ultimately galactic, astrophysics hinges on these crucial comparisons between cluster observations and the predictions of the models.
The contribution of the Gaia Mission. Recent large-scale surveys have contributed significantly to cluster astrophysics (e.g., 2MASS, DENIS, Spitzer, Chandra, SDSS), but in the next few years a revolution is arriving. The cornerstone ESA Gaia mission will bring us in a new domain of cluster research. Gaia will be sensitive to stars down to G=20; it will measure distances for *individual* stars in OCs with a precision better than 1% for clusters closer than $\sim$ 1kpc and better than 10% for almost the entire OC family. Higher accuracies are expected for proper motions [1], yielding a precision in *individual* tangential velocities (V_t) of the order of $0.2 - 0.3$ km/s for low mass stars in clusters up to $\sim$ 1.5 kpc, and up to larger distances for bright O/B stars. This would allow resolving both peculiar velocities and internal dispersions, which are typically of the order of 0.8-3 km/s (Meibom et al. 2002, A&A 386, 187; Furesz et al. 2008, ApJ 676, 1106). Gaia will also provide good photometric information, helping to characterize cluster members. Crucially Gaia has limited spectroscopic capability, hence missing a vital third kinematic dimension and having poor chemical discrimination. Not only is the limiting distance for radial velocity (RV) measurements smaller than for photometry and astrometry (only stars brighter than V=17 will have a spectroscopic observation), but the expected accuracy (1 km/s at best) is far below that expected for V_t. Abundance determinations will be possible only for stars brighter than V= 12.
Towards a revolution in cluster science: Gaia plus FLAMES spectroscopy. In this Letter of Intent we combine the expertise of many leading scientists in cluster research to propose a large-scale FLAMES survey of clusters, mainly aimed mainly at obtaining accurate and homogeneous information on RVs and chemistry, which is not provided by Gaia. This will prepare us for the "onslaught" of Gaia data and yield major breakthroughs in our comprehension of the three major issues discussed below. Investigation of the three themes implies surveying statistically significant sample of members of OCs on different time- and spatial scales, from very young clusters to the oldest ones, from the smallest scale of the internal structure of nearby clusters to longer MW disc scales. A large and homogeneous spectroscopic data set such as this has never been acquired before; independently on Gaia, it will have strong impact on a broad range of important issues (see Sect. 5.2). Finally, in emphasizing the MW's main stellar component – the thin disc–, the proposed survey is entirely complementary to the other survey proposed by the GCDS[2] consortium.
1. The evolution of OCs and associations: from birth to disruption. Cluster origin theories range from highly dynamic models (Bonnell et al. 2003, MNRAS 343, 413) to quasi equilibrium and/or slow contraction scenarios (Tan et al. 2006, ApJ 641, L121). The two scenarios lead to different initial cluster structure and kinematics. For example, shallow or absent velocity gradients are expected if clusters form in a quasi-equilibrium

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[1] `http://www.rssd.esa.int/index.php?project=GAIA\&page=Science$_$Performance`
[2] `http://camd08.ast.cam.ac.uk/Greatwiki/GreatCds/`

state, while strong gradients should be present if clusters form in sub-virial conditions (e.g., Proszkow et al. 2009, ApJ 697, 1020). Also, depending on several factors such as initial conditions themselves, SF efficiency, tidal interaction with the Galaxy, clusters can undergo infant mortality on very short timescales ($\leq 10-30$ Myr -e.g., Fall 2006, ApJ 652, 1129) or longer term dissolution (de Grijs & Parmentier 2007, A&A 7, 155). In order to understand cluster evolution and to put constraints on those parameters which essentially determine whether the cluster will disrupt into the field or not, realistic simulations are needed. While progress has been made during the past years in the development of these (e.g., Tasker et al. 2008, MNRAS 390, 1267; Capuzzo-Dolcetta 2010, MSAIS 14, 210), the vital missing element is a large body of observations to be compared with these models. Gaia will produce most of the required data (distances, positions, $\mathrm{V_t}$) for a large number of nearby clusters, with the required accuracy, but not the radial component of the velocity. Full exploitation of these data thus requires commensurately precise RVs to complete the 6D phase space, to get complete kinematics, and information on the energy and angular momentum distributions for different groups of stars. GIRAFFE spectroscopy will indeed allow us to derive RVs with a precision of $\simeq 0.3$ km/s (e.g Jackson & Jeffries, 2010, MNRAS, 407, 465), with even better precision for key subsamples observed with UVES. Repeated observations will identify close binary systems, which have a vast impact on the dynamical evolution of clusters.

2. The evolution of stars in clusters: from birth to death. Gaia distance measurements will finally make fully accessible the **unique potential** of OCs to empirically resolve the Hertzsprung-Russell diagram (HRD) and to put tight constraints on the so far still quite limited calibrations of stellar evolutionary models for Pop. I stars, from the pre-main sequence (PMS) phase up to the latest evolutionary stages. Indeed, input physics (opacities, EOS, treatment of convection, mixing, rotation, magnetic fields, He abundances) that significantly influence the stellar magnitudes, lifetimes and burning-phase duration, all still need to be calibrated (e.g., Naylor 2009, MNRAS 399, 432; Soderblom 2010, ARA&A 48, 581). Only once the models are appropriately adjusted to represent the data as obtained for a wide range of OCs of different ages and compositions, reliable stellar masses and ages can be determined, which is vital for virtually all branches of stellar and galactic astrophysics. Individual distances and photometry provided by Gaia for several tens of nearby OCs and for large samples of members, covering wide ranges of spectral-types and masses, will yield exquisitely precise observed colour magnitude diagrams (CMDs). To turn them into equally precise HRDs we need to correct for reddening, to identify binaries, to measure rotation, to accurately measure effective temperature (for faint stars for which accuracy in stellar parameters provided by Gaia is not enough), and to detect disturbances (accretion, shells, nebulous lines, etc.) which can perturb the position of a star in the HRD. Overall metallicity and abundances are also most critical to testing models. Spectroscopy is clearly essential here.

3. The population and evolution of the Milky Way thin disc. Key questions are how clusters populate the MW thin disc and what they tell us about its formation and evolution. To answer the first question, we need the data for many OCs at a wide range of Galactocentric radii ($\mathrm{R_{GC}}$), and with a large range of ages, where the very young clusters trace the areas of SF, and older clusters trace the dispersion. The survival rates of OCs as a function of age can be used to trace the history of field star populations (e.g., de Grijs 2010, RSPTA 368, 693). OCs of different ages and $\mathrm{R_{GC}}$ also reveal information on the abundance distribution in the thin disc, the radial gradient in particular, and on its evolution with time (e.g., Randich 2005, ESO Messenger 121, 18; Bragaglia & Tosi 2006, AJ 131, 1544). This is a key input to models of formation and evolution of the disc. It constrains the SF efficiency as a function of radial distance, the initial mass function at the time of formation of the disc, the co-rotation resonance, the nature of in-fall from the halo and the role of possible mergers (e.g., Magrini et al. 2009, A&A 494, 95). The gradient at different ages is also essential for assessing the radial streaming of gas (e.g. Schönrich & Binney 2009, MNRAS 399, 1145), the influences by the bulge, and, with the advances in theory, the recent history of our Galaxy's spiral pattern.

Current estimates of the gradient suffer from low statistics, lack of homogeneity, of samples at key positions/ages, and of orbit determinations (e.g., Magrini, Randich et al. 2010, A&A in press, arXiv1008.3158). Key new information provided by Gaia are accurate distances from the Sun, allowing us to push down the uncertainties in Galactocentric radii, and proper motions. New and homogeneous spectroscopy is instead crucial for accurate (internal accuracy ≤ 0.05 dex) abundances of several elements (Fe, C, N, O, Mg, Ca, Ti, Si, Na, Ni, Mn, Ba, La, Ce, Eu) and the RVs, needed for orbit determination. We recall that different elements are produced by different nucleosynthesis sites; thus deriving abundances of all these elements is fundamental in order to put constraints on previous generations of polluters and to reconstruct the chemical evolution of the disc.

3 Observing strategy, including instruments to be used: (1 page)

Sample. The sample was selected as to best address the three themes described in Sect. 2.1: it includes clusters in all phases of evolution (with exception of the embedded one, not observable with optical spectroscopy) and covers a large range of environments (e.g., metallicity, positions in the disc) and characteristics (e.g., richness). Suitable clusters were carefully selected from an analysis of the Dias et al. (2002, A&A 389, 871 -2010 version) and Kharchenko et al. (2005, A&A 440, 403) catalogues, along with WEBDA database[3] and the results of a monitoring programme carried out by the Geneva group. To optimize the scientific return of the survey only clusters with available photometry and membership information have been selected. Also, we have searched the ESO Archive, in order not to duplicate existing observations which could be easily integrated in our sample.
We have subdivided the clusters in three classes, based on their evolutionary stage: *a.* young (or pre-main sequence) clusters and associations with ages greater than ∼ 1 Myr up to ∼ 100 Myr; *b.* mature OCs with ages between ∼ 100 and 500 Myr; *c.* OCs older than 0.5 Gyr.
We have then set a completeness distance (D_{comp}), defined as the distance up to which Gaia will provide V_t with a precision of 0.3 km/s for M-type stars. This is comparable to the accuracy we will get from Giraffe spectroscopy and is high enough to test models of cluster formation and evolution (e.g., Offner et al. 2010, ApJ 704, L124). D_{comp} is 1500 pc for young clusters and 700 pc for clusters in classes *b.* and *c.*, where M dwarfs are fainter. The limiting spectral-type is based on the requirement to sample the full cluster population down to the lowest mass, with exception of the substellar regime.

For each cluster class, our sample then includes *all* suitable (see above) clusters with $D \leq D_{comp}$ and observable from Paranal. Within each cluster, all known members down to the M dwarf regime will be observed. This sample will allow addressing both theme 1. and, with a subset of clusters, theme 2.; for this the primary selection is that a Gaia distance precision (per star) of better than ∼ 1% is expected. To this sample we add: *i)* a minority of young massive clusters up to larger distances. These clusters permit the study of SF formation and dynamics in locations dominated by very massive stars, as well as the determination of abundances in young distant clusters, which is needed to study the evolution of the gradient; *ii)* OCs in classes *b.* and *c.* up to large Galactocentric radii (R_{GC}), allowing us to address theme 3. by means of abundance determination in giant stars. OC selection here is optimized as to well cover the metallicity-age-R_{GC}-position parameter space. Limiting distance from the Sun is set by the faintest stars observable with UVES ($V \sim 16.5$) and is of the order of 15 kpc. We have already carried out FLAMES observations of distant OCs (Randich et al. 2005) without problems in fiber allocation. Final number of clusters in each class is given in the second column of Table 1. Overall the sample will include 110 clusters.

Strategy. For all clusters we will employ FLAMES with Giraffe to target faint cluster members, while UVES fibers will be fed with brighter or key objects, to be used for accurate abundance determination or for which better precision in RV is required. Six Giraffe set-ups will be employed (HR03/05A/06/14A/15N/21). More specifically, HR03/05A/06/14A contain a large number of spectral features to be used to derive RVs and characteristics (e.g., temperature, gravity, wind) of early-type stars; HR15N/21 are instead the most commonly used gratings for late-type stars; they access a large enough number of lines to derive RVs, as well as to retrieve key information on the star characteristics (e.g., temperature, Li, accretion rates, chromospheric activity, rotation). As to UVES, CD3 grating is most suitable both for early-type stars in young clusters and late-type members of old OCs.

Table 1: Synthesis of survey strategy

Class	number of clusters	GIRAFFE			UVES			Av. # 1hr OBs per cluster
		targets	mag.	set-up	targets	mag.	set-up	
a.	30	F-M	≤ 19	HR15N/21	(B)G-K	≤ 16	CD3 (520/580)	20
a.	10	O-B	≤ 15	HR03/05A/06/14A	B, G/K supergiants	≤ 14	CD3 (520)	12
b.	20	B-M	≤ 19	HR15N/21	B-K,WDs	≤ 16.5	CD3 (520/580)	20
c.	50	A-K	≤ 19	HR15N/21	G/K giants	≤ 16.5	CD3 (580)	12

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[3] `http://www.univie.ac.at.at/webda`

4 Estimated observing time:

Sample cluster diameters vary from a few arcmin to a few deg, while number of members varies from a few tens to more than a thousand. Thus, the number of pointings/fields per cluster will significantly change for different targets.

Exposure times per cluster field obviously depend on typical magnitudes and colours of Giraffe and UVES targets. We aim to get a S/N greater than $\sim 20-30$ for Giraffe spectra, which would allow deriving RV with the requested accuracy, as well as measuring absorption and emission lines needed for a full target characterization (Jackson & Jeffries, 2010). A S/N greater than 60-80 is instead needed for accurate abundance determination from UVES spectra (e.g., Biazzo, Randich, & Palla, 2010, A&A in press, arXiv1010.1658). According to the most recent version of the Giraffe and FLAMES+UVES ETCs and our own experience, this implies typical integration times of 3 and 6 hrs for the faintest Giraffe (V=19) and UVES (V=16.5) targets, respectively.

The total number of 1 hr OB per cluster will depend on the number of pointings per cluster, number of exposures per pointing, possible combinations of Giraffe and UVES targets, and overheads (~ 12 min/OB). Average estimates of the final number of 1hr OBs per cluster are given in Table 1 in Sect. 3. Those estimates already take into account that at least two repeated exposures of the same field will be acquired to identify binaries.

Overall, we will observe 110 clusters for a total observing time of 1720 hrs, or ~ 200 nights. The observations will be distributed over three years.

Period	Instrument	Time (h)	Mean RA	Moon	Seeing	Transparency
P88	FLAMES	280	07	n	1.2	clear
P89	FLAMES	280	18	n	1.2	clear
P90	FLAMES	280	07	n	1.2	clear
P91	FLAMES	280	18	n	1.2	clear
P92	FLAMES	300	07	n	1.2	clear
P93	FLAMES	300	18	n	1.2	clear

5 Data management plan:

5.1 Description of the responsibilities within the team: (1 page)

The PI of this LoI has been PI of several previous FLAMES programmes on both young and old clusters (for a total of 120 hrs); all these programmes were succesfull and have produced a significant number of publications. Most of the team members have large experience with FLAMES observations and data analysis of open and globular clusters, as well as extragalactic resolved populations. The team includes experts in all areas touched upon by this proposal, from the technicalities of the pipelines for data reduction, to N-body simulations. We have all the required software for data analysis in hand and are not attempting anything new: all the techniques are indeed well tested, including sky subtraction and correction for telluric lines. Thus, our team has the necessary expertise to efficiently carry out the proposed survey and for a timely delivery of data products.

We have identified a number of critical areas in the Data Management and will set up appropriate work-packages (WPs) and responsibilities as follows:

• coordination and interaction with ESO –this will be main responsibility of the PI of the LoI (S. Randich -INAF/Arcetri);
• Virtual Observatory (VO) –WP coordinator: E. Solano (CAB/INTA-CSIC); participation: E. Paunzen (Vienna), C. Soubiran (Bordeaux). The WP includes: Development of a VO archive for the FLAMES data (in coordination with ESO) and of VO services for high-level data products (i.e. catalogues) as well as ancillary data; Management of theoretical models in the VO framework; Identification of ancillary data in VO archives and services. Links to the WEBDA database will also be created.
• final sample selection and characterization –WP coordinator: U. Heiter (Uppsala, S.); participation: all CoIs of the LoI;
• observational strategy and preparation of the observations –WP coordinator: G. Micela (INAF/Palermo); participation: groups at Vilnius, SIM/U, LAOG, Palermo, Padova, Bologna, Arcetri, Alicante;
• data reduction and quality control –WP coordinator: A. Bragaglia (INAF/Bologna); participation: groups at Leicester, Keele, Arcetri, Bologna, Catania;
• RV analysis –WP coordinator: R. Jeffries (Keele, UK); participation: groups at Keele, Napoli, Catania, Padova, Bruxelles;
• stellar parameters (including rotation) and abundance analysis of cool stars –WP coordinator: R. Smiljanic (ESO); participation: groups at Keele, Arcetri, Bologna, Catania, Napoli, Vilnius, CAB/INTA-CSIC;
• analysis of early-type stars –WP coordinator: R. Blomme (Royal Obs. Bruxelles); participation: groups at Lieges, Alicante, IAC, Hertfordshire;
• theoretical models, including stellar evolutionary tracks, N-body simulations, Galactic evolution –WP coordinator: A. Vallenari (INAF/Padova); participation: Padova (stellar evolution), F. Palla (Arcetri) -PMS evolution, L. Magrini (Arcetri) and D. Romano (Bologna) -chemical evolution, R. Capuzzo-Dolcetta (Univ. Roma) -N-body simulations, A. Herrero (IAC) -massive stars;
• development of statistical tools for data analysis –WP coordinator: E. Alfaro (IAA Granada); participation: group at UB;
• Link to Gaia –WP coordinator: F. van Leeuwen (Cambridge); participation: groups at ESA/ESTEC, MSSL, UB, Catania, Bologna, Padova, Torino;
• Complementary data (e.g., wide field photometry, X-rays, Spitzer, NIR, etc.) –WP coordinator: J. Drew (Univ. of Hertfordshire); participation: groups at Palermo, LAOG, Geneva, Catania, CAB/INTA-CSIC, Graz.

5.2 Description of data products and justification of their legacy value: (1 page)

Data products. The survey will yield Giraffe/UVES spectra at [at least] two different epochs. Whereas raw data will automatically be public, we will make available enhanced data products using VO standards.
Within 18 months from the observations: we will provide **i.** reduced, wavelength calibrated 1D spectra; **ii.** radial velocities, both for individual stars and average values for the clusters.
Within 24 months from the observations: we will provide enhanced data products, including **iii.** equivalent widths (EWs) of spectral lines used for the abundance analysis; **iv.** stellar parameters (effective temperature, surface gravity, microturbulence, extinction when applicable, rotation); **v.** final abundances, both for individual stars and average cluster values; **vi.** EWs of emission lines (when present) and measurements of chromospheric activity or accretion rate.
In the longer term: we will provide stellar ages and masses for the sample clusters/stars.
Legacy value. One of the three main goals of the proposed survey -the calibration of stellar models- also has the highest legacy value, as it will impact upon a number of fundamental issues. A few examples are: the shape of the initial mass function and its universality; the timescale of SF and SF histories; a much improved basis for field star age determination; the 'initial mass' to 'final mass' relation for white dwarfs. The calibration of HRDs as derived from MW OCs, along with multi-band photometry, will also provide stellar fiducials (e.g., Brasseur et al. 2010, AJ, in press) and will represent precious input to population synthesis models, which, in turn, are used to interpret the properties of unresolved stellar populations in distant galaxies.
Our survey will provide the first homogeneous set of RVs, abundances, rotational velocities, and stellar characteristics for such a large sample of clusters and cluster members. This will represent a **standalone unique dataset** that will allow addressing a variety of outstanding topics, including:
- evolution and effect of environment on accretion and protoplanetary discs of pre-main sequence (PMS) stars (e.g., Storzer & Hollenbach 1999, ApJ 515, 669; Sicilia-Aguilar et al. 2009, AIPC 1094, 225);
- 'chemical tagging' of young clusters: constraints on triggered SF scenarios (e.g., Cunha et al. 1998, ApJ 493, 195; Biazzo et. al. 2010, A&A, in press);
- lithium ages for young clusters; comparison with isochronal ages and further constraints on PMS models; implications for SF histories (e.g., Jeffries & Oliveira 2005, MNRAS 358, 13; Palla et al. 2007, ApJ 659, L41);
- time evolution of stellar angular momentum and magnetic activity from the early evolutionary phases up to the oldest ages (e.g., Barnes & Kim, 2010, ApJ 721, 675);
- variable stars and binaries: OCs allow probing the dependence of variability properties on age and chemical composition. Detection and characterization of binaries, and in particular eclipsing binaries, will allow putting independent constraints on stellar models;
- synergy with Corot/Kepler data: our sample will include a few Corot/Kepler target clusters (those visible from Paranal). Coupling spectroscopic and asteroseismology of red clump stars in OCs will put strong constraint on the age and metallicity leading to a stringent seismic modeling of the star;
- The high precision and homogeneity of the proposed survey will allow pinning down the signature of diffusion (Lind et al. 2008, A&A 490, 777), which is crucial not only for stellar astrophysics, but also for the interpretation of observed abundance distributions from stars of different type (e.g., main sequence stars w.r.t giants);
- constraints on internal mixing processes at work in stars in different evolutionary phases as traced by light elements (Li, CNO –e.g., Charbonnel & Talon, 2010, IAUS268, 365; Smiljanic et al. 2009, A&A 502);
- characterization of massive stars: correlations between rotation and abundances; mass loss, wind parameters, construction of the Galactic wind-momentum luminosity relation;
- 'Chemical tagging' of clusters and constraints on population/origin (Bland-Hawthorn 2002, ARA&A 40, 497);
- Use of cluster space velocities to trace the local velocity field and to investigate the Galactic rotation curve (e.g., Frinchaboy et al. 2008, AJ 136, 118).

As a final remark, we stress that a change of paradigm for Globular Clusters has only been possible when high precision, homogeneous data have been collected for large samples of stars and clusters (Carretta et al. 2009, A&A 505, 117). Even if we now think that OCs are rather simple objects, this should be proved by means of similarly thorough investigations. With this survey we would build a sample of clusters that would be **THE** reference for all the above studies and many others. There is no such database now, and this is exactly what a public survey could and should provide.

6 Other remarks, if any: (1 page max)

The proposed spectroscopic survey is part of the activities of the GREAT working group on Open Clusters and Young Associations coordinated by A. Lanzafame, A. Vallenari, and S. Randich[4]. Future complementary activities might include an optical spectroscopic survey of clusters in the Northern hemisphere as well as photometric and spectroscopic surveys in the near-IR. In this respect, we point out that the VISTA VVV survey should have completed its multi-band pass of the expanded GLIMPSE strip by the time this proposed survey gets underway. This will improve on 2MASS/DENIS-based target selection. Optical digital/photometric coverage via VPHAS+ ($|b| < 5$) should be accomplished over 2012-2014. This will be useful mainly for source-by-source reddening, and, in many cases, complete reddening law determinations.

We stress that, considering available instrumentation in the Southern hemisphere, FLAMES on VLT is the most suitable one to to perform an efficient high resolution survey of clusters. Viceversa observations of clusters (w.r.t. field stars) allow making the best use of the instrument capabilities, with a very high efficiency in fiber allocation. As mentioned in Sect. 3, several observations of OCs are already present in the ESO Archive. We have considered those observations in the build-up of our sample and will make use of them whenever possible. However, the available spectra alone would not allow constructing the large homogeneous dataset requested here. The sample proposed in this survey will instead represent a step change in terms of data homogeneity and quality, coverage of the cluster parameter space, sampling of the stellar populations within each cluster.

We also mention that future planned surveys with LAMOST and HERMES will most likely include a large number of OCs and will start soon. Paraphrasing the conclusions of the ESO workshop on 'Wide-field Spectroscopic Surveys' (2009, ESO Messenger 136, 64), we stress that *'a large survey of OCs carried out with FLAMES could place the European cluster community in a favourable situation before instruments with massive multiplexing go into operation at other observatories....Similarly, ground based Gaia preparatory surveys would go a long way toward generating the data required to complement Gaia if the surveys begin soon.'*

As a final, related remark, we note that the final Gaia catalogue will be available only after 2020. However intermediate releases are planned and will be done. These will already provide basic astrometry (positions, parallaxes, proper motions) and photometry and would be available about within the same time scale as the products of this survey.

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[4] `http://camd08.ast.cam.ac.uk/Greatwiki/WGB1OpenClusterYoungAssociation`