LAMOST Open Clusters Survey: Current Status and Perspective

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Introduction about LAMOST Survey

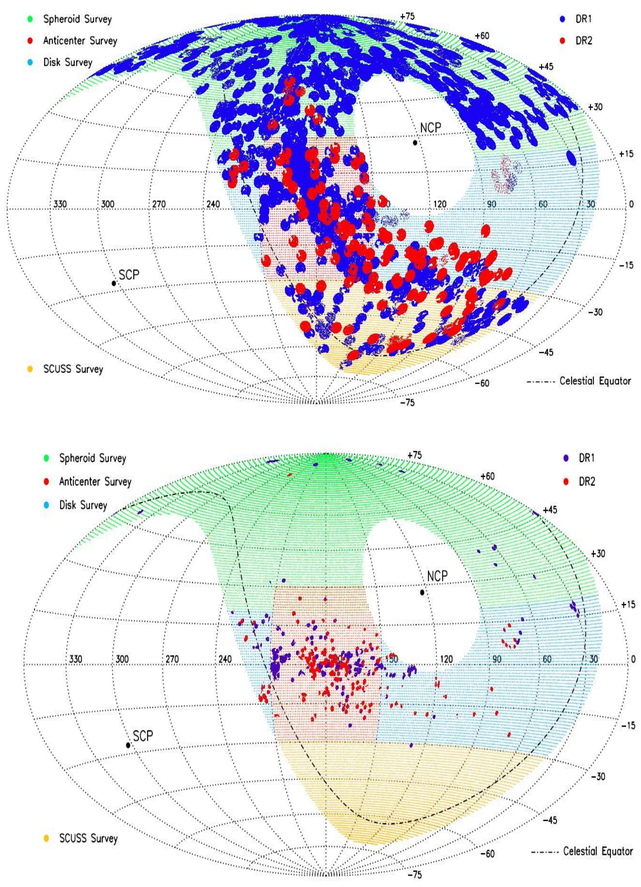
LAMOST (Large Sky Area Multi-Object fiber Spectroscopic Telescope, also known as GuoShouJing Telescope) is a Chinese national scientific research facility operated by National Astronomical Observatories, Chinese Academy of Sciences (NAOC) (Deng 2014). LAMOST Pilot survey started from 2011 October, and end in 2012 June, obtained more than 700,000 spectra. The regular survey has operated since 2012 September and has obtained about 2 million spectra as of 2013 June. These spectra have been released as Data Release 1(DR1) catalog.

1. LAMOST disk open clusters survey project

Open clusters (OCs) have long been used to trace the structure and evolution of the Galactic disk. Since open clusters possess of relatively large age span whilst the cluster ages can be relatively accurately dated and one can see them to a large distance, their [Fe/H] values serve as an excellent tracer of the abundance gradient along the Galactic disk as well as many other important disk properties, such as the age-metallicity relation (AMR), abundance gradient evolution, disk age, and so on. During the past years, there is the increased amount of data available for the Milky Way galaxy, such as the multiple bands of photometric: SDSS, 2MASS, WISE, UKIDSS et al.; radial velocity survey: SEGUE, APOGEE, LAMOST et al.; proper motion data will soon be provided by GAIA.

Problems still existed: data from various sources, need to combining different kinds of data, with different completeness, Focus on Kinematics and Memberships.

We have proposed a low Galactic latitude disk survey plan concentrating on open clusters (Chen, Hou et al. 2012). One of the primary science objectives of the LAMOST disk survey is to investigate the structure of the thin/thick disks of the Galaxy, including the chemical abundance as a function of position within the disk and the extinction in the disk. In the main survey, we expect to cover more than 400 open clusters in the low Galactic latitude region, and obtain stellar radial velocities as well as abundance information for stars as faint as r=16m in the cluster fields. This will be the largest spectroscopic data sets for studying the properties of Galactic open clusters, as well as the structure, dynamics, and evolution of the disk as probed by open clusters.



2. Current Status in the DR1+DR2

The left upper figure shows the whole Milky Way survey regions till June 2014. Circles represent the LAMOST FOV and plate positions. Red circles are For DR2 data, blues are DR1 data. In total, LAMOST has obtained more than 3M stellar spectra with well determined parameters.

In the left lower figure, we show the positions of open clusters that has been observed by at least one of the LAMOST plates. Due to the site conditions, both location and clear night distribution, most of the observed clusters are in the Galactic Anti-center region. Based on the Kharchenko (2013) open cluster catalogue, we found that in the range of $-10^\circ \leq \mathrm{DEC} \leq +70^\circ$, there are about 500 clusters could be reach by LAMOST. We cross match the LAMOST data in a FOV of 2 square degree with the Kharchenko et al. (2013) open clusters catalogue and found that in DR1+DR2 about 450 open clusters regions have been observed by LAMOST. For about 300 Ocs region, there are more than 500 member stars have been observed. But for a large part of cluster regions, only few member stars be observed.

3. Future prospective for LAMOST spectral data in OC regions

Those data have provide good basis for the further study of the cluster properties since for the stars in the clusters regions, LAMOST has provide the basic stellar parameters, such as radial velocity, metallicity, logg and effective temperature. The most challenging problem is to confirm whether the stars in the cluster regions belong to the cluster member. We find that the velocity distribution function alone is not enough to separate the member stars from field stars. We are trying to combine the multiband photometric data with spectral data to best determine the probability of a star belong to cluster member by using Baysian methods. We expected that within the next 3yrs data added, we can obtain spectral data for 400 open clusters, with well define parameters.

Reference:

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