

# SONG China project

## – participating in the global network

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**Abstract.** SONG (Stellar Observations Network Goup) is a low-cost ground based international collaboration aimed at two cutting edge problems in contemporary astrophysics in the time-domain: 1) Direct diagnostics of the internal structure of stars and 2) looking for and studying extra solar planets, possibly in the habitable zone. The general plan is to set up a network of 1 m telescopes uniformly distributed in geographic latitude (in both hemispheres). China joined the collaboration (initiated by Danish astronomers) at the very beginning. In addition to SONG's original plan (<http://song.phys.au.dk>), the Chinese team proposed a parallel photometry subnet work in the northern hemisphere, namely 50BiN (50 cm Binocular Network, previously known as mini-SONG), to enable a large field photometric capability for the network, therefore maximising the potential of the network platform. The network will be able to produce nearly continuous time series observations of a number of selected objects with high resolution spectroscopy (SONG) and accurate photometry (50BiN), and to produce ultra-high accuracy photometry in dense field to look for micro-lensing events caused by planetary systems. This project has great synergy with Chinese Astronomical activities in Antarctica (Dome A), and other similar networks (e.g. LCOGT). The plan and current status of the project are overviewed in this poster.

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### 1. The Chinese SONG node

SONG, as an international program with well defined science goals, is designed to operate as a single instrument on its mission (for details on science and instrumentations of SONG see [song.phys.au.dk](http://song.phys.au.dk)). Unlike previous global stellar observation networks, the telescopes and instruments of each SONG node follow the same design, even if not manufactured by the same company. The Chinese SONG node takes the same parameters as the prototype node in Denmark (now being commissioned at Tenerife, Spain); some of the original drawings were also accepted. The 1 m telescope and the spectrograph have been redesigned applying the same standard as the prototype, and are fabricated at NIAOT.

The site for the Chinese node is a key to realize the expected performance of the network. The other proposed sites in the northern hemisphere subnet all have very good quality. None of the existing optical sites in China (mostly near the eastern coast line) meet the requirements of SONG, therefore a search for a reasonably good site for the SONG node in west China is crucial. Suggested by the site survey team, we selected a number of radio sites with existing infrastructure that can host the node 3 years ago

when we started the project. The radio observatory in Delingha has been selected for our project. The site quality in terms of supporting infrastructure, general weather pattern, optical observational condition (seeing, sky background, extinction) are optimal among all the candidate sites in west China.

The main components of the Chinese SONG node and corresponding current status are listed below:

- (a) Site: Delingha with geographic coordinate of N37.378027, E97.732326. Qualification started 2009, foundation and observational buildings construction started Aug 2012;
- (b) 1 m SONG telescope: Factory assembled August 2012, site installation will be in the end of April 2013;
- (c) High resolution Spectrograph: in fabrication;
- (d) Lucky-image camera system: in fabrication;
- (e) Software systems (data pipelines, networking and operations): being developed.

## 2. 50BiN subnet of SONG

50BiN is a Chinese initiative that originated from common research interests of the whole stellar physics community in the country. China will fund the system as an add-on project of Chinese participation of SONG. We are obliged to consider any suggestions and contributions to 50BiN in terms of scientific provisions. Any type of participation in the program will be highly appreciated. Given the condition that 50BiN is going to share the infrastructure and network of SONG, a number of science goals matching all the goals of the SONG can be pre-defined.

The plan is to have a small photometry telescope installed at every SONG node site in the north, so that photometry for a selection of objects can be followed in the same long time based line and duty cycle as SONG.

Just like SONG, a long time-baseline high duty cycle photometry of large FOV will be offered by 50BiN, which facilitates researche in the following areas:

Primary science goals:

- (a) Photometry of a sample of open clusters, determining basic physical parameters when measured in a uniform way;
- (b) Time domain study of variable objects in selected clusters: long time base-line, high cadence and high duty cycle, high precision photometric observations.
  - A complete survey of stellar variability along the main sequence (e.g. Cep, Scu & Dor) in selected open clusters;
  - A complete survey of small and large amplitude red variables along the RGBs of selected open clusters;
  - A complete survey of eclipsing binaries in selected clusters, including looking for the transit of exoplanet systems;
  - Looking for flare type variabilities in selected clusters; Stellar rotation and spot activities.
- (c) Time domain study of selected field areas.

The first node, the prototype of 50BiN, is contributed by the CWNU. It is a binocular equatorial mount system. Two parallel camera systems will be used so that simultaneous photometry in two channels will be realized. The FOV is 20 arcmin and is suited for most galactic open clusters. The prototype will be in commissioned by the end of 2012. We wish to find more partners for future, both domestic or international. We have started negotiations with host institutes of the SONG network, hopefully to complete the network within the next 2–3 years.

For further details on the project, please see <http://song.bao.ac.cn>.