NEWSLETTER
Vol. Nº 0
March 2025

Stellar Observations Network Group

This is the first newsletter send to the SONG community to inform on the project status, development and results. The aim is to sent out a SONG newsletter a few times per year.

The SONG 2024 Science Meeting was held in September 2024 where many interesting results were presented. At the meeting the new structure of the scientific use of SONG was also presented.

1. General information and news

1.1. The 2024 SONG Science Workshop

The 2024 SONG Science Workshop has held in Tenerife and organized by IAC in La Laguna. More than 50 members of the SONG community participated in the workshop located at the IAC-TEC. The very well organised and succesful workship was sponsered by the ULL and IAC. See the workshop web page here: https://meetings.iac.es/song24/

The next SONG Science Workshop will be held in the USA and hosted by the New Mexico State University in 2026. More information later.

1.2. New team of science coordinators

Mikkel Nørup Lund has been appointed the new Science Coordinator with Frank Grundahl as a temporary deputy.
We would like to thank Sergio Símon-Días for his high level of commitment and invaluable efforts and thoughts both acting as Science Coordinator but also in the long process before. Muchas gracias Sergio!

1.3. Solar observations working group in SODA

A new working group (WG) focusing on solar observations with SONG has recently been formed. This WG will be chaired by Rafael A. Garcia with Marian M. Gonzalez as deputy. f you are interested in joining this working group, this is now possible via SODA ("My Account" -> "Working Groups"). The newly formed working group will soon call for a startup discussion on possible activities, so if you are interested, please take the time to sign up. If you cannot see the "Working Groups" tab, but would like to join, please contact the Science Coordinator for having this access enabled. Contact information and the ability to join this WG via SODA can be found here.

2. Node's Reports

2.1. Aarhus University – AU (central node)

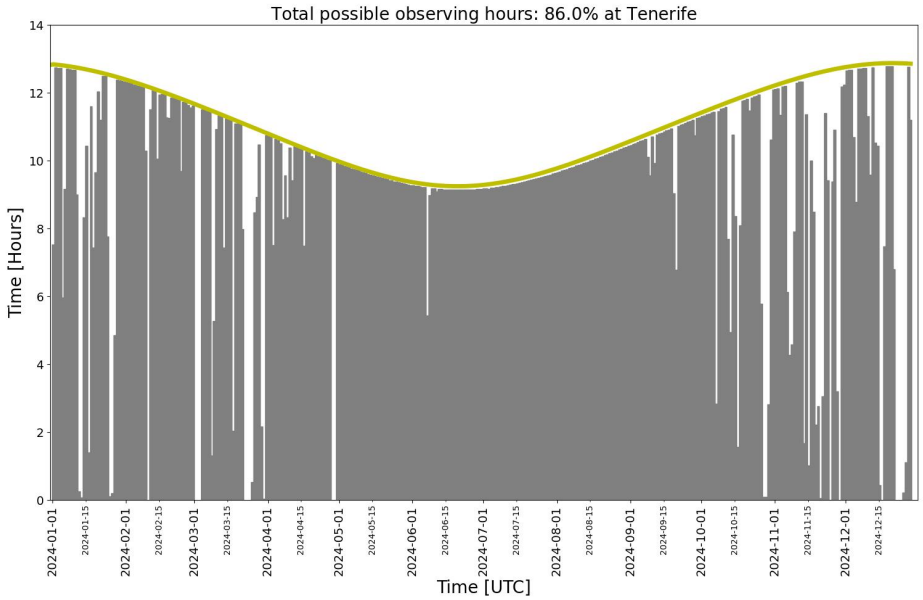
The staff was expanded in September 2024 by a systems developer / system administrator, Jakob Lysgaard Rørsted, who is responsible for the astrophysical IT infrastructure in Aarhus.

In late summer and early fall 2024, we had numerous issues related to the data archive – including a full week of downtime in mid-September. To ensure stable operations, the SONG data was moved to a new storage system and general maintenance has been performed on all machines and systems. Since the completion of this work in late October, we have not had any significant downtime or issues.

The central IT department at Aarhus University, where many of our (virtual) servers are hosted, had experienced a severe outage in late January 2025. The problems were quicky resolved but some servers did not fully recover – including the server hosting the central SONG/SODA database. Following intensive recovery work, the machine is now fully operational again.

2.2. Teide Observatory – OT

During the Christmas period in 2024 a power failure occurred that seems to have caused a network switch to fail. This unit was replaced but the power issue continued. This was temporary fixed by moving the dome power to a different power circuit. The fix is expected to cause minor issues with the dome until a proper fix has been implemented. A weather statistics plot for 2024 is shown below. The plot shows the possible daily (nightly) observing hours where the weather conditions is not preventing observations. The Teide Observatory is clearly a world class observatory in terms of weather conditions. Very impressive!

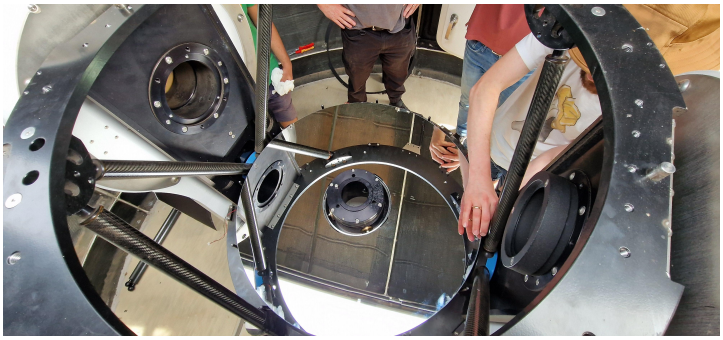


Weather statistics for 2024 at the Teide Observatory in Tenerife. Gray shows the daily possible observing hours. The yellow line is the length of each night.

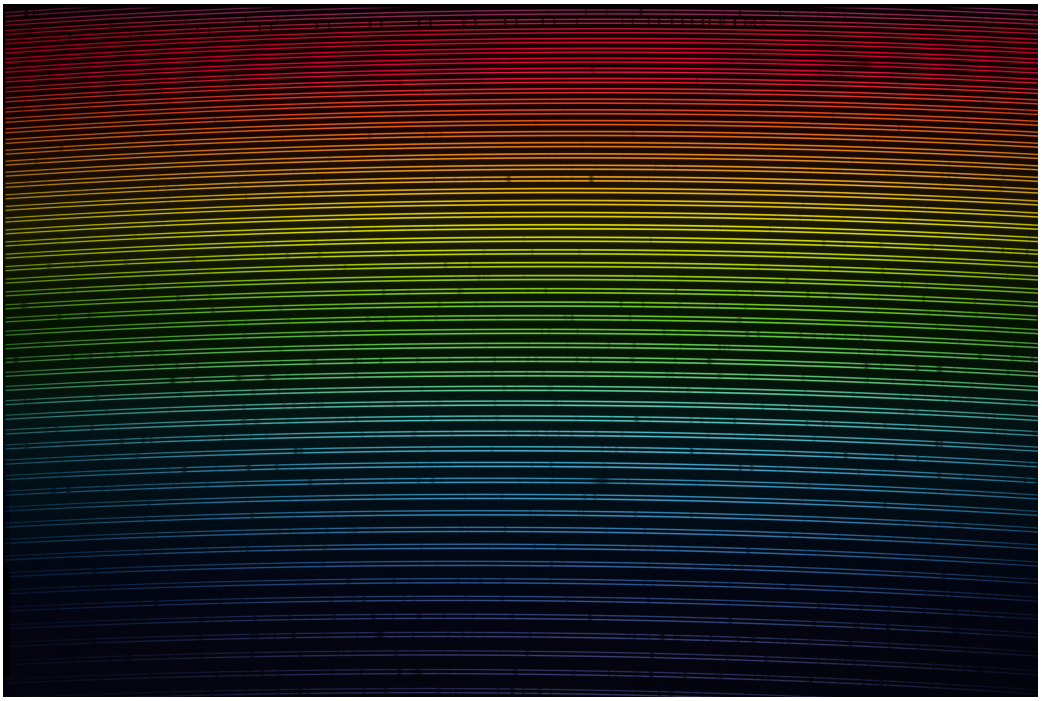
2.3. Mt. Kent Observatory - MKO

A dedicated work trip was cunducted in February 2025 where the primary mirror of the SONG telescope 2 (T2) was succesfully re-installed after it was send for re-aluminization in mid 2024. The SONG detector, a Kepler 4040 from FingerLakes was replaced with a QHY 600 Pro CMOS similar to the one being used at Tenerife since January 2024. A new weather station was partially installed and the trip included an extensive system check and regular maintenance.

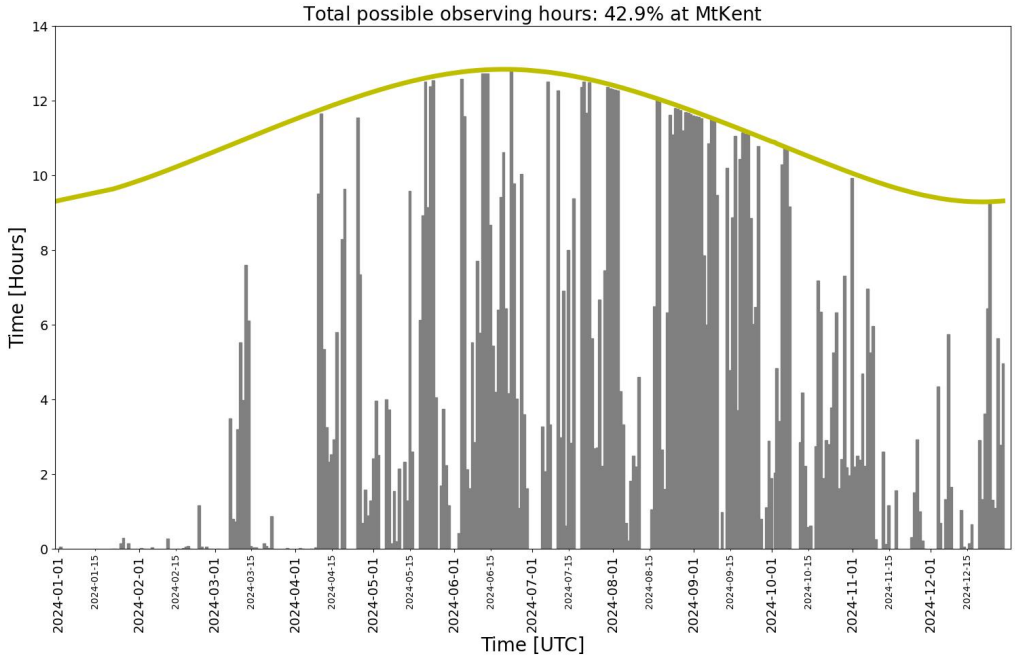
A big thanks to the local team and especially Duncan Wright for helping the Danish team with the on-site work during the trip.



The Primary mirror of SONG T2 being re-installed 2025. Credit: Mads Fredslund Andersen



First light with the new QHY detector and re-alunimized primary mirror on T2. Light from Procyon observed with both telescopes (T1 and T2) are seen on the above spectrum.



Weather statistics for 2024 at the Mt. Kent Observatory, Australia. Gray shows the possible daily observing hours. The yellow line is the length of each night.

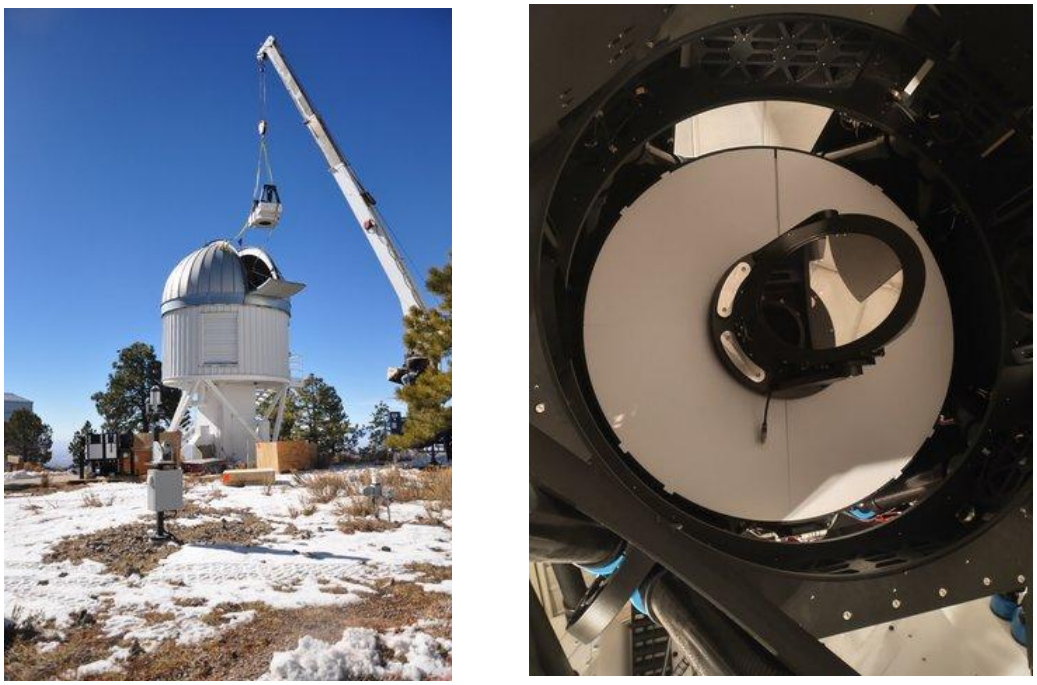
2.4. Lenghu - LO

The SONG telescope and spectrograph has been moved from the Delingha Observatory to the newly build Lenghu Observatory. Read paper in *Nature* on the Lenghu Observatory here. More site condition information can be found here.

The detector (QHY600 Pro) and fiber connection have been successfully tested in Beijing. The NIAOT spectrograph team has made necessary hardware modifications for the new detector, and will help with the installation after the Chinese New Year holiday.

2.5. Apache Point - APO

The main effort in the last four months has been the assembly and alignment of the spectrograph in a lab at the New Mexico State University. The schedule is to start taking the aligned spectrograph to the observatory in April/May for reconstruction. This summer will involve integration of the fiber and calibration system with the already-installed telescope.



The telescope at APO – a 1m Alt/Az PlaneWave CDK1000 telescope system – was installed on the 17th of January 2024. Credit: Jason Jackiewicz

3. Observational programs in SONG

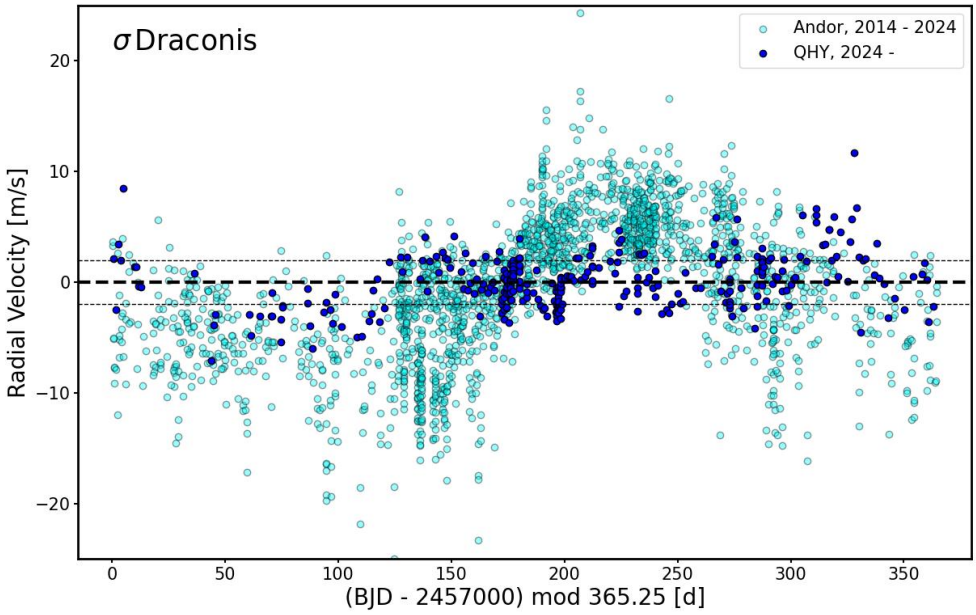
At OT high cadence observations started in early 2024 with observations of the subgiant 35 Dra (being observed contemporaneously by TESS) for asteroseismic analysis, continuing as the main priority until early May 2024. A week of observations was then dedicated at OT to observations of the fast-rotating A-type pulsator Zeta Vir for Doppler imaging of high-degree non-radial pulsations. From mid-May to mid-June observations were obtained for one of SONG's primary targets mu Her, also contemporaneously with TESS. From mid-June to late September, we observed beta Aql from both OT and Mt. Kent, overlapping also with TESS during its sector 81. Observations of the O-type star lam Ori started in early September and continued until late November, completing at the start of the period the night together with beta Aql, and from late September with a continuation of observations of 35 Dra. From late November a two-week campaign was run at OT on the EB system gam Per.

Following a close-down at OT from late December 2024 to early January 2025, high-cadence observations were started on tet UMa for asteroseismic analysis and these are expected to continue until April 2025.

4. Operations, Instrument and Data processing and archive

4.1. New detctor at the Hertszprung SONG telescope

In January 2024 the original CCD detector, from Andor, used for the the spectrograph at Teide was replaced with a new CMOS system from QHY (model QHY600). Our motivation for this was to see if the 'one-year-problem' could be removed – for stars with long time series data we observed a re-curring 1-year pattern in the measured radial velocities. After many experiments with independent data reductions and software we concluded that the likely culprit was a charge-transfer-inefficiency problem for the Andor detector. Presently we have collected data for one year and can conclude that indeed the 1-year pattern is now gone. The new QHY detector has pixels of 3.76μm (13.5μm for Andor) and provides a much better sampling of the instrumental profile – for the most narrow slit this has led to a slight increase in the resolution from 115.000 to 125.000.



The figure shows radial velocities for σDra modulus one year. The cyan coloured symbols are from the old Andor CCD and the dark blue are from the new QHY detector. Credit: Frank Grundahl

Overall the improved sampling has resulted in a slight improvement in the radial velocities for our radial-velocity standard stars.

As part of the work to exchange the detector we have developed a new spectral extraction package, which we call *songpipe*. It is based on the PyReduce package by Piskunov, Wehrhahn & Marquart (A&A 646, A32, 2021) and is used for the data from OT and MKO.

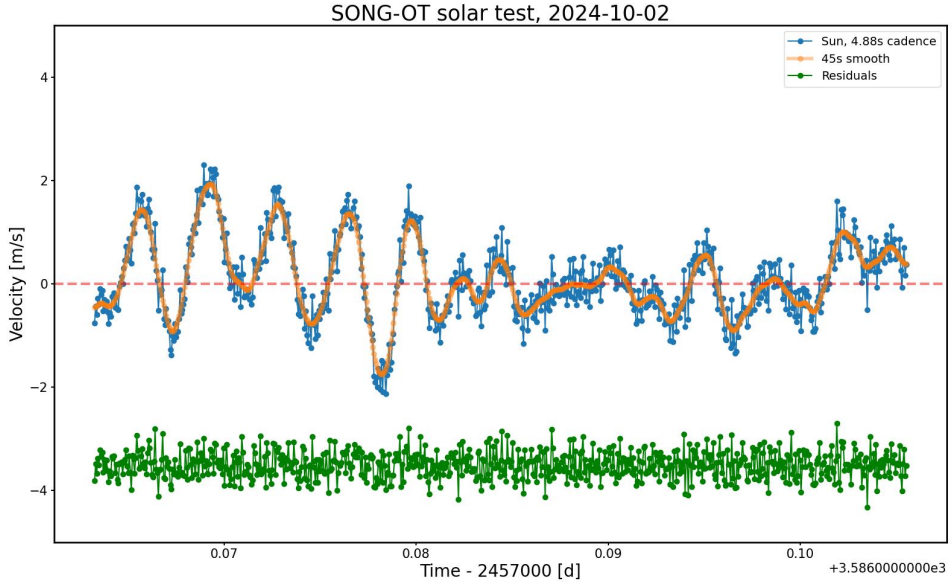
The Iodine radial velocities are determined using the *pyodine* software package which can be found here.

5. Scientific highlights

5.1. Solar observations with the new QHY detector at OT

In October 2024, we carried out a 1-hour test of solar observations using an optical fiber and solar-tracking platform. The setup holds the tip of a 400µm fiber directed towards the Sun and sends light to the spectrograph resulting in a completely filled slit. This is the ideal situation with no moving parts in the spectrograph and a very stable slit illumination. Our goal with these observations was to test the improvement for the Solar RVs provided by the new QHY detector.

The figure below shows the radial velocities obtained for 750 spectra obtained with a cadence of 4.88s and 2s. exposures using the same iodine cell that we use during the nightly observations. We obtained very good RV precision of 26cm/s – roughly 2 times better than for solar observations with the Andor CCD.



The figure shows the radial velocities from a one hour observing campaign on the Sun from 2024 using the new QHY 600 Pro detector. The blue points are the observations and the orange line a smoothed curve which subtracted from the observations gives the residuals in green. Credit: Frank Grundahl

The beautiful southern sky above the Mt. Kent Observatory, Southern Queensland, Australia on 2025-02-14. Credit: Mads Fredslund Andersen

If you have any comments, inputs or suggestions to the future SONG newsletter(s) please feel free to send an e-mail to:

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Links

Official SONG project web page (needs to be updated):
song.au.dk

Unofficial technical operations web pages:
song.phys.au.dk

SONG data archive, Working Groups and user input web page:
soda.phys.au.dk

Note: The above three web pages might be merged into one in the future.

Node information web pages:
Teide Observatory common weather page: cww.ot-admin.net
Mt. Kent Observatory weather page: astroweb.unisq.edu.au/site/weather.php
Lenghu Observatory web page: lenghu.china-vo.org
Apache Point Observatory web page: apo.nmsu.edu
NMSU (APO) SONG project wiki page: astronomy.nmsu.edu/song-wiki/start

Institutional web pages:
Aarhus University, au.dk
Instituto de Astrofísica de Canarias, iac.es
National Astronomical Observatories China: nao.cas.cn
University of Southern Queensland, unisq.edu.au
New Mexico State University, nmsu.edu