From the Director:

Dear OSO Astro Newsletter readers,

It has been an eventful return from summer holidays at the observatory with the installation of the new radome for the 20 m telescope (see page 3). Together with the already installed new 3mm receiver, a new 2.5 GHz wide spectrometer and the completion next year of a 4mm receiver, the 20m telescope is becoming a greatly enhanced instrument. Looking forward to the new year, Spring 2015 will see the submission of a new proposal to VR for OSO operations funding. This proposal will highlight OSO's continuing contributions toward providing equipment and data/user support to the largest international telescopes (ALMA and SKA) and also in developing instruments for potential future space projects. The other telescopes with OSO involvement (20 m, 25 m, APEX, LOFAR, VLBI) will continue to provide complementary very low/very high angular resolution observations, important for respectively preparing and following-up observations with the large interferometer array projects. Beyond astronomy OSO is also a geoscience facility and we look forward to the installation of the Wallenberg foundation (KAW) funded twin telescope system for geodetic VLBI and the development of our other geophysics/aeronomy instruments. We welcome input from the community in forming our new operations proposal for the coming years; one specific mechanism for this input is via our call for astronomy instrumentation proposals (page 5).

Sincerely,

John Conway
Call for Proposals

Proposals are invited for observations with the APEX telescope, the Onsala Space Observatory 20 m telescope, and the Swedish LOFAR station in stand-alone mode in the observing period April - August 2015

**Deadline for proposals:** 15th October 2014.

Proposals are also invited for the European VLBI Network (EVN). See details and deadline below;

APEX is a 12 m diameter submillimetre telescope in Chile. The available facility receivers are the Swedish Heterodyne Facility Instrument covering a wide frequency range (211-500 GHz), the LABOCA bolometer array camera (345 GHz) and the ArTeMiS bolometer array (850 GHz). (There are also PI instruments).

The **Onsala 20 m** diameter telescope in Sweden is equipped with receivers for 18-50 GHz and 85-116 GHz.

The **Swedish LOFAR** station at Onsala Space Observatory is an array of antennas for the frequency bands 10-90 MHz and 110-240 MHz. It is part of the International LOFAR Telescope (ILT), but is offered here in stand-alone mode.

For more information: see [http://www.chalmers.se/rss/oso-en/observations/proposals](http://www.chalmers.se/rss/oso-en/observations/proposals)

The **EVN** is a collaboration of the major radio astronomical institutes in Europe (including OSO), Asia and South Africa and performs high angular resolution observations of cosmic radio sources.


Support at OSO

The National Facility offers a wide variety of support to Swedish astronomers. For example, we host one of the European ALMA regional centers, supporting ALMA users throughout the Nordic region. We also offer support in several other areas.

**Data Reduction:** We support the reduction of all types of radio/(sub-)mm interferometric and single-dish observations. We welcome visitors who need reduction support and offer them the use of our National Facility Computing Infrastructure (NaFCI) for reduction of large data sets.

**Student projects:** We also specifically encourage visits by students who want to learn how to reduce and analyse their radio/(sub-)mm observations.

**Specialized Courses:** National Facility support staff will be able to assist with specialised lectures on for example interferometry, radio/(sub-)mm data analysis and/or the use of National Facility instruments.

**Workshop/School support:** Similarly, we can assist in planning and lecturing at schools or workshops, when these include topics related to National Facility activities and instruments. This includes but is not limited to, for example, radio/(sub-)mm interferometry and single dish observing and analysis, ALMA, APEX, LOFAR, SKA.

**Seminars:** National facility staff are also available for scientific and technical seminars on the aforementioned instruments.

**More Information:** For more information, please contact Wouter Vlemmings, Head of Astronomy User Support ([wouter.vlemmings@chalmers.se](mailto:wouter.vlemmings@chalmers.se)).
News Items

The new radome for the OSO 20 m telescope

During August and September the OSO 20 m telescope is being treated to a newly renovated home. The old radome surrounding the 20 m telescope was installed in 1975, almost 40 years ago. It was finally decided last year that it had deteriorated to the extent that the installation of a new one was unavoidable. Over the years, money has been saved up for this essential maintenance, and Chalmers management are additionally providing 25% of the required funding. The radome is being exchanged by replacing a top cap consisting of 50 panels in one go (see Picture), while the remaining 570 panels are changed one by one. Installation started on 11th August, and the new radome is expected to be finished this week. This will provide the 20 m telescope with a radome having similar radio wave transmission properties as the original one and, of course, protect the telescope for decades to come.

Band 5 receivers for ALMA and early deployment on APEX in 2015

Onsala Space Observatory, through its Group for Advanced Receiver Development, is presently executing a contract from ESO to build 67 (plus spares) Band 5 (162 - 211 GHz) receivers for ALMA. The receivers are to be delivered in 2017. This full-production project follows the successful delivery of six pre-production receivers to ESO as part of an earlier project. It is not likely that Band 5 receivers will be available on ALMA before 2017/2018. In the meantime, together with ESO, it has been agreed to install a Band 5 pre-production cartridge including optics on APEX in early 2015. This instrument will provide a unique capability at these frequencies in the southern hemisphere which will both provide exciting results in their own right and help prepare projects for Band 5 on ALMA when it comes.

The main science drivers of the Band 5 receiver are:

1. Observations of the H_2O 3(1,3)-2(2,0) transition at 183 GHz. Water vapour is widespread in the interstellar medium (ISM), as became very clear from the Herschel observations. The 183 GHz line is an important tracer of star forming activity especially when water is evaporated from grain mantles heated by the radiation from the newly born stars. It is a unique molecular diagnostic of warm gas and energetic processes (like molecular outflows) taking place during the formation of stars. Under certain physical conditions the transition can become a strong maser. The 183 GHz water line is essentially the only low-energy (~200 K) water
line that can be accessed by ground based telescopes, albeit then only at high altitude sites like the APEX Chajnantor site, at an altitude of 5100 m.

(2) Increasing the z-coverage for highly redshifted CO lines (CO 2-1 out to $z < 0.4$ instead of $z < 0.08$), by extending the observable frequencies to a lower range.

(3) Other molecular lines than water present in the frequency band of the receiver are, for instance, several low-energy rotational transitions (from HCN, NH2+, HCO+, CS). They form a very good compliment to lines accessible by the higher-frequency APEX receivers in a multitude of astronomical objects (e.g., circumstellar envelopes, molecular clouds, galaxies).

The receiver is expected to be offered to the community in a special call for proposals early next year. We anticipate that the APEX observations will provide very useful scientific results that later on can be studied in even greater detail by ALMA.

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**ALMA interferometry school at Dark in Copenhagen**

On August 13-21 the Dark Cosmology Center in cooperation with the Nordic ALMA node at OSO organised the school “Introduction to sub-mm interferometry and science with ALMA”. The course gave an introduction to interferometric observations, data reduction, and analysis with a focus on ALMA observations. Lectures on theory of interferometry were complemented by practical exercises and science presentations. A total of 17 master students, PhD students, and postdocs from all nordic countries participated. The course was held in a relaxed atmosphere, allowing for abundant opportunities for questions and discussions during and in-between lectures.
SKA Science Conference and Science Prioritisation

The 'Advancing Astrophysics with the Square Kilometre Array' conference held from June 8-13 in Giardini Naxos, Italy, brought together 250 scientists from across the world. They presented a broad range of science topics, including cosmology, cosmic magnetism, pulsars, star and planet formation and exobiology. The science discussed at the meeting will be presented in the new SKA Science book in Spring 2015 and at least 10 Swedish astronomers are contributing authors.

In the meantime, an international Science Review Panel and the SKA Science Team are evaluating which science topics the detailed design of SKA phase 1 should be optimised toward and deciding on the ‘first light’ instrumentation (initial receiver bands, etc). Based on this, the Science Review panel will provide advice to the SKA Director-General and will review potential options for SKA1 re-baselining. More information on the process (and other SKA information) is available in the monthly bulletins for the SKA office (https://www.skatelescope.org/skao-monthly-bulletin/).

Call for Instrumentation Proposals

As part of the preparation process for the next OSO operations proposal to be submitted to VR in Spring 2015 we request from the Swedish astronomical community proposals for future instrumentation priorities for the 20 m, 25 m, APEX and single-station LOFAR telescopes.

Instrumentation is broadly defined as receivers, backends and specialised data processing. The proposal (half to one page) should contain a short description of the instrumentation and its scientific uses; to be eligible for consideration the instrumentation should have broad use within the community and not be of the form of a specialised experiment.

These proposals will be used as one input in defining, within our submitted VR proposal, the list of priorities amongst future development options (i.e. more frequency coverage, wider spectrometer bandwidth, multi-pixel versus single pixel receivers etc on the different telescopes).

Proposals should be sent to john.conway@chalmers.se

The deadline is 1st December.
Science Highlights

We would like to introduce you to a few of the recent science highlights produced using the instruments at, and supported by, Onsala Space Observatory. We especially welcome short contributions by you, the users of our telescopes, so please do not hesitate to contact us if you have results you would like to share in future newsletters.

EVN Deep Radio Observations of SN2014J

In a recent publication in the *Astrophysical Journal*, an international team of researchers including astronomers at the Department of Astronomy at Stockholm University, used deep EVN observations to constrain the progenitor system and environment around the Type Ia supernova SN2014J. They combined EVN and eMERLIN observations to obtain the most sensitive radio studies of a Type Ia SN ever. Modelling of the radio emission sets upper limits on the progenitor mass-loss rate and the density around the SN. The models are consistent with a double-degenerate scenario involving two white-dwarf stars as the progenitor system to SN2014J. The full results can be found in Pérez-Torres et al. 2014, ApJ 792, 38.

Isotope ratios in AGB CSEs with APEX and the OSO 20m

Sofia Ramstedt at Uppsala University and Hans Olofsson at Chalmers used the APEX telescope in Chile and the OSO 20m telescope to determine the $^{12}$CO/$^{13}$CO ratios in a large sample of M-type, S-type, and carbon AGB stars. The study comprises the largest sample of stars ever studied, allowing for a statistical analysis of the evolution of stars on the AGB. They find that the $^{12}$CO/$^{13}$CO abundance ratio changes with the different chemical types, consistent with stellar evolution models where the spectral types constitute an evolutionary sequence. Surprisingly they do not find a correlation between the $^{12}$CO/$^{13}$CO abundance ratio and the mass-loss rate. This indicates that the mass loss does not increase with age along the AGB, contrary to what was

High-resolution imaging of radio supernovae and diffuse emission in M82 with LOFAR

An international collaboration of researchers led by astronomers at Chalmers have used the SKA precursor LOFAR telescope to obtain radio continuum images of the nearby starburst galaxy M82 at 118MHz and 154MHz. The image resolution (0.2") and sensitivity (0.15mJy/beam) achieved at 154MHz is a new record for science images at low frequencies, and was possible only using the full international LOFAR network, including the station in Onsala. The images reveal 16 compact sources, many of which have been observed also at higher frequencies and classified as radio supernovae. The compact objects are embedded in a diffuse radio emission. The full results are presented in Varenius et. al 2014, submitted to A&A. Further studies of the free-free absorption effects on the compact sources and the diffuse emission will constrain the structure of the absorbing medium to better understand the physics of star formation in the core of M82.

News on SKA/LOFAR

Newsletter:

If you are interested in more specific SKA and LOFAR related news, register for the SKA/LOFAR newsletter via our webpage:

http://www.chalmers.se/rss/oso-en/observations/ska-lofar-mailing-list