SALT NEWSLETTER

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Southern African Large Telescope,
Sutherland, South Africa

TOPICS

Contributors to this issue: Encarni Romero Colmenero, Steve Crawford, Rudi & Stephanie Kuhn, Rosalind Skelton, Daniel Staab, Petri Väisänen, Thea Koen (editor).

LETTER FROM HEAD OF ASTRO OPS

Dear SALT community -

The big news of the past few months at SALT is a completed HRS pipeline. HRS users are now receiving wavelength calibrated, extracted, and order-stitched spectra as part of the automatic daily data delivery after each observing night. The pipeline is being run for past observations as well. For more details please read the information further down in this Newsletter. I sincerely wish to thank all those involved in the effort, in particular Steve Crawford, Alexei Kniazev, and Rudi Kuhn.

We are currently in the latter half of the SALT Semester 2016-2, which has been going well with expected weather losses and no major technical difficulties.

There is change in our plan for the rest of the semester – and it is to the PI's advantage. March had originally been set aside for a technical shutdown period, but we recently decided to delay the largest piece of work planned, concerning the tracker, to be combined with the installation of the RSS guider in September 2017 most likely. Thus, *the shutdown in March will only be one week* (8.3. – 15.3.). This will hopefully mean happier PIs due to higher observation completeness statistics. For reference, the final statistics of the last semester showed 82% and 55% completeness for P1 and P2 respectively, and 99% completeness for triggered P0 blocks.

The Phase-1 proposals of 2017-1 are being assessed by the TACs at the time of writing. The number of proposals submitted was higher than over the past several semesters, perhaps reflecting new interest due to the new era of the active alignment system. Further quantitative analysis has confirmed that SALT has been totally seeing limited down to intrinsic 1.0" zenith seeing conditions (corresponding to 1.2" image quality on the detector at SALT airmass) since April 2016.

The last months have seen many new SALT data publications. In fact, 2017 has started with a record paper rate. Please see a list of the new papers in this Newsletter, with some analysis on which data is currently being published. We welcome science highlights or news from PIs, one such contribution is included in this Newsletter, and others at http://www.salt.ac.za/news/
Finally, we wish to remind the SALT community of the conference, "SALT among the constellations of very large telescopes", in Poland in June. Further details below.

As always, never hesitate to contact salthelp@salt.ac.za with any questions you have.

Petri Väisänen
Head of SALT Astronomy Operations

HRS PIPELINE

Since the New Year, two versions of HRS pipeline products are distributed automatically every day to PIs, one based on PyHRS (Crawford et al. 2016[1]) and the other on MIDAS (Kniazev et al. 2016ab[2]). There are slight complementary differences in the approaches, and PIs should feel free to use either or both of the results. The PyHRS pipeline is available also as a set of downloadable programs to be installed and run by the PIs themselves. Further documentation about how the pipelines work, what is included and what the various data products are in the respective versions, is available at https://github.com/saltastro/pyhrs and http://www.saao.ac.za/~akniazev/pub/HRS_MIDAS/.

Note that that neither pipeline currently includes the High Stability (HS) mode, though HS data can be reduced with the PyHRS package by the PIs themselves.

The radial velocity accuracy of the automatic pipeline products is <300 m/s for the LR, MR, HR modes using the default calibrations (i.e. nothing extra requested by the PIs, and the arcs and RV standards *not* taken in the same night necessarily). Better accuracies might well be achieved with more involved calibrations and analysis methods.

What about data taken previously? Currently, all data from the beginning of 2016-2 are reduced and available. Most of 2016-1 has also been run, and parts of 2015-2. To get access to those products, merely use the "Request data" button of the relevant observed block on the Web Manager page of your program. Older data-sets can in principle be run as well, but we ask PIs needing specific dates to request them from *salthelp*, so that we can prioritise past

[1] http://adsabs.harvard.edu/abs/2016SPIE.9908E..2LC
[2] http://adsabs.harvard.edu/abs/2016MNRAS.459.3068K
http://adsabs.harvard.edu/abs/2016arXiv161200292K

sets. Please note, however, that due to limited resources we cannot promise immediate response. Also, pre-2015 data-sets become increasingly difficult to reduce.

Though the bulk of the HRS pipeline development is now done, we still anticipate many tweaks to enhance the quality of the products. It is extremely important to get feedback from users, especially those experienced with Echelle data reductions and analysis. So, please, do send feedback and criticism!

Future developments will be available at http://astronomers.salt.ac.za/hrs-pipeline/

RESULTS FROM THE SALT SURVEY

In November 2017, we conducted a survey of SALT users about how they currently used the telescope and how they plan to use it in the future. We received 46 responses representing all of the different scientific areas of research and at least one response from each partner. This included responses from students, post-docs, researchers, professors, and even a few from the private sector.

One hour of uncharged SALT time was up for grabs for a lucky participant in the SALT survey, and the winner was: Dr. J.O.E. Jacob – IUCAA, India. Congratulations!

SALT Observing Modes By Interest

- RSS Longslit
- HRS low/medium/high resolution
- RSS Multi-object spectroscopy
- RSS NIR arm (still to be installed)
- RSS high speed spectroscopy
- RSS Fabry Perot Medium Resolution
- RSS Fabry Perot High Resolution
- HRShigh stability mode
- SALTICAM Imaging
- RSS Fabry Perot Tunable Filter / low resolution
- RSS Linear spectrapolarimetry
- SALTICAM Frame Transfer
- SALTICAM Slotmode
- RSS All-stokes spectrapolarimetry
- RSS Circular spectrapolarimetry
- Berkeley Visible Image Tube camera (BVIT)
- RSS diffuse object polarimetry

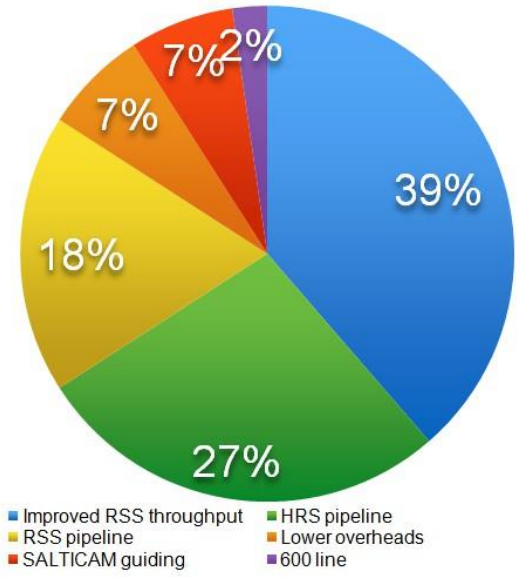
SALT users were most interested in the workhorse modes of the instruments: RSS longslit and multi-object mode, as well as HRS. Our users are also excited about the capabilities of NIR spectroscopy with the upcoming addition of the RSS NIR arm. Next are the Fabry-Pérot modes followed by the more niche modes of high speed measurements and polarimetry.

While almost all users have downloaded their observations, only a third have published their data so far. The main road blocks to date have been a lack of time/resources, still collecting a

sufficient sample, and lack of pipelines. If problems still remain with your observations, please contact salthelp@salt.ac.za for further help.

As to future priorities (see pie chart), the top priority for many users was improved RSS throughput, followed by better pipelines for RSS and HRS, and lower acquisition times. In terms of future development, users were most interested in IFUs or new high throughput spectrographs, and they were most interested in supporting future observations with SKA and LSST.

In terms of comments left by the participants, pipelines were the most outstanding issues. With the release of the HRS pipeline, hopefully this will alleviate the problem. SALT PhD and post-doc bursaries were encouraged. It was suggested that TACs should allocate more time to the most productive users. The importance of training and education was mentioned, and we hope that the recent SALT data reduction workshop has helped. We look forward to repeating such endeavours in the future.



A presentation with more of the details of the survey is available at: http://pysalt.salt.ac.za/talks/salt_survey.pdf

FABRY-PÉROT

We are very pleased to announce that, at long last, the RSS Fabry-Pérot system is finally working well in both its LR and dual-etalon HR modes. For more information, please read on:

A circular polarizer was attached to the HR etalon at the beginning of January to remove the infamous internal reflections that hindered dual-etalon HR observations. This was successful, albeit with a higher cost (~30% throughput) than expected, and it enabled the dual-etalon mode re-commissioning to continue. Excellent data were taken for two commissioning targets at the end of January and dual-etalon HR mode has started science observations.

After the successful commissioning of the dual-etalon HR mode, the LR etalon developed some serious controller instabilities for a couple of weeks, rendering the entire Fabry-Pérot system

unreliable and unusable. We are happy to report that this problem has been attributed to a new tracker motor vibration (which also affected the primary mirror) that has since been corrected. Thus LR has also started regular science observations.

As for the MR etalon, after an extensive investigation by Ted Williams and Ockert Strydom, it was found to have some disconnected optical components in addition to its damaged coatings, and it will therefore require extensive repairs before it can be returned to the telescope. A repair plan has been drafted and submitted to the SALT BEC and, if approved, the MR etalon could be back on the telescope in a year or two.

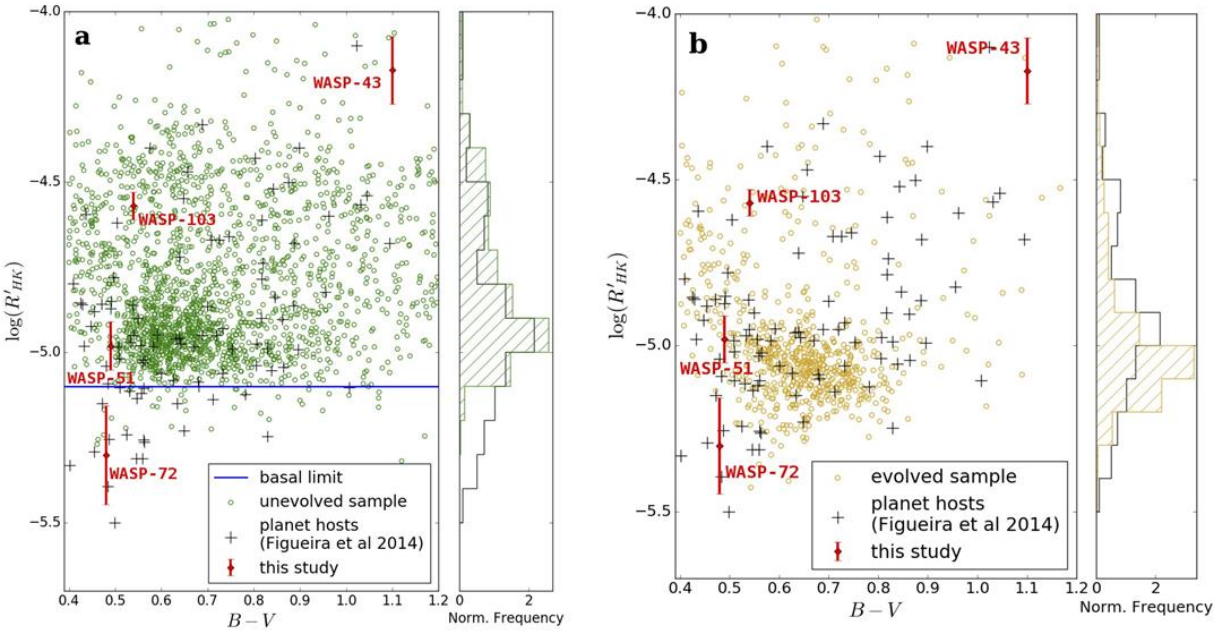
DATA REDUCTION WORKSHOP

A workshop on SALT data reduction was held at SAAO in Cape Town at the beginning of February. More than 30 SALT users gathered together to work on a large variety of data under the guidance of Steve Crawford and SALT Astronomy team. While the workshop was aimed particularly at those with SALT data already in hand, to help them make the most of their data, we also introduced some newcomers to the telescope and its data products. A smaller group visited the telescopes up in Sutherland for a night, where they witnessed the beauty of the Karoo sky first hand, before coming back to Cape Town to delve into the data analysis. The talk slides can be accessed at: http://pysalt.salt.ac.za/meetings/salt_workshop/.Thanks so much to everyone who joined in, to those who supported and helped organise the workshop and to those

who shared their expertise with other SALT users. We are certain that having dedicated three days to your SALT data will pay off for the participants, and look forward to seeing some superb results! A massive thank you to Rosalind Skelton for organising the workshop.

SCIENCE HIGHLIGHT

SALT observations of the chromospheric activity of transiting planet hosts: mass-loss and star–planet interactions.



Staab et al. calibrated the RSS to measure the widely-used Ca II H&K S-index diagnostic of stellar activity, applying this to four hot Jupiter host stars. WASP-43 is anomalously active and WASP-103 appears more active than expected for the system age: star-planet interactions may enhance their Ca II H&K core emission. The activity levels of WASP-51/HAT-P-30 and WASP-72 are anomalously low, with the latter falling below the basal envelope for both main sequence and evolved stars. This can be attributed to circumstellar absorption due to planetary mass loss, though absorption in the ISM may contribute. A quarter of known short period planet hosts exhibit anomalously low activity levels, including systems with hot Jupiters and low mass companions.

Read the full article: **http://mnras.oxfordjournals.org/content/466/1/738**

SALT SCIENCE WORKSHOP IN POLAND

There is some space still left, if interested please register as soon as possible: https://salt2017.camk.edu.pl/index.html

SALT SOCIAL MEDIA

In case you missed our last edition, we thought we'd include our social media details again: SALT is active on facebook and twitter. So be sure to “like” and “follow” us to keep your finger on the pulse of what we’re getting up to:

The official facebook account is www.facebook.com/SATelescope
The official account for twitter is @SALT_Astro

We’re always looking for additional contributions for the News page on the SALT website. Whether it’s a press release, quick article on astronomy & SALT or even a fun fact you’d like to share, please contact Thea Koen at thea@salt.ac.za.

IN OTHER NEWS

Enrico Kotze, one of the authors of the TRAPPIST-1 Nature paper which discovered a system with 7 earth-mass planets, is an SAAO PhD student and has filled in as a SALT operator.

Quest magazine had an edition on SALT and astronomy in South Africa. It can be found online at: http://www.assaf.org.za/files/Quest/Quest%20124%20ELECTRONIC.pdf.

MEET THE TEAM: DR RUDI KUHN

It all started with a small boy having a big dream

Dr Rudi Kuhn was only five years old when his dad taught him the names of the planets in our solar system, which at the time still included Pluto before it was demoted to a dwarf planet. From that moment, his fascination with the mysteries of space took root. After saving his pocket money for two years, Kuhn bought his first telescope at the age of eight. This telescope is still in his office today.

After a short career in the IT industry, he chose to follow his passion

When Kuhn shared his intention of becoming an astronomer with a high school career counsellor in the late 1990s, he was quickly discouraged from pursuing this dream, the reason being a lack of job opportunities. “It was the era when the only respectable careers involved becoming either a doctor, accountant or teacher,” explains Kuhn. He consequently qualified as an IT technician and travelled to England to work there, like so many school leavers at the time.

But Kuhn’s passion for astronomy never went away. During his time in England, he did some research to explore his options and came across the National Astrophysics and Space Science Programme (NASSP) offered at the University of Cape Town (UCT). Upon returning to South Africa, Kuhn was faced with a life-altering decision: on the same day, he received a job offer for a respectable position in IT, as well as his letter of acceptance from UCT. Although he was

aware of the sacrifices involved in returning to university, Kuhn chose to follow his childhood dream – and he has not looked back since.

Becoming an astronomer is a long but very rewarding journey

It took twelve years in total to complete his studies and qualify as an astronomer. “It was a tough journey. I now know that ‘imposter syndrome’ is a very real thing,” says Kuhn with a laugh. “There were numerous times during my PhD when I felt I wasn’t good enough to make it.” But in the end his perseverance and dedication paid off.

It also turns out that Kuhn’s IT skills were not wasted. “A significant part of working in astronomy is reducing and interpreting the massive amounts of data we receive from the telescopes when we do observations,” explains Kuhn. This requires programming skills, which means that in the end his experience in IT is proving very valuable in his job as an astronomer.

Being involved in building a telescope from scratch was a definite highlight

One of the highlights during Kuhn’s studies was helping to build the KELT-South telescope in Sutherland as part of his PhD. KELT stands for Kilodegree Extremely Little Telescope and its main purpose is to look for transiting exoplanets. “I have a keen interest in the different instruments used in telescopes, such as the camera and spectrograph,” explains Kuhn. “Being physically involved in the process of building a telescope was therefore an amazing experience.”

To infinity and beyond…

So what is so inspiring about astronomy? “The sheer size and scope of the universe,” says Kuhn excitedly. “The ‘Hubble Ultra Deep Field’ image taken by the Hubble Space Telescope is one of my favourite images of space,” he explains. The image shows about 10 000 galaxies, each containing up to hundreds of billions of stars, covering billions of light years. And the best part? “This is just a small sample – there are up to 100 billion galaxies in the observable universe alone. Who knows what we might discover in future?”

SALT SCIENCE PAPERS

Refereed SALT papers published after the previous SALT update sent in late October are listed below. The rate of papers in 2017 so far has been high, and we at SALT Operations are very excited to see the data we gather published. We were also interested to see which data PIs are

currently publishing: for example, the thirteen 2017 papers below come from a range of proposals all the way from the 2011-2 semester (one such data set) to an observation from the 2016-1 just half a year ago, with the median in semester 2014-2. The papers below represent data from RSS, HRS, and Salticam, with the RSS long-slit mode the largest contributor with 80%, as is typical. The papers below include SALT time contributed by 7 different SALT Partners.

We encourage SALT users to inform us of any papers making use of SALT data, and to double check the list here after publication: http://astronomers.salt.ac.za/data/publications/ Also, please adhere to the Acknowledgements policy found under the link.

- Cartier, R., Sullivan, M., Firth, R.E., et al. 2017, "Early observations of the nearby Type Ia supernova SN 2015F", MNRAS, 464, 4476 http://adsabs.harvard.edu/abs/2017MNRAS.464.4476C
- Dutta, R., Srianand, R., Gupta, N., et al., 2017, "H I 21-cm absorption survey of quasar-galaxy pairs: distribution of cold gas around z < 0.4 galaxies", MNRAS, 465, 588 http://adsabs.harvard.edu/abs/2017MNRAS.465..588D
- Fuchs, J.T., Dunlap, B.H., Dennihy, E., et al., 2016, "The magnetic cataclysmic variable LSQ1725-64", MNRAS, 462, 2382 http://adsabs.harvard.edu/abs/2016MNRAS.462.2382F
- Godoy-Rivera, D., Stanek, K.Z., Kochanek, C.S., et al. 2017, "The unexpected, long-lasting, UV rebrightening of the superluminous supernova ASASSN-15lh", MNRAS, 466, 1428 http://adsabs.harvard.edu/abs/2017MNRAS.466.1428G
- Hardy, L.K., McAllister, M.J., Dhillon, V.S., et al. 2017, "Hunting for eclipses: high-speed observations of cataclysmic variables", MNRAS, 465, 4968 http://adsabs.harvard.edu/abs/2017MNRAS.465.4968H
- Koen, C., Miszalski, B., Väisänen, P. & Koen, T., 2017, "Optical spectra of ultracool dwarfs with the Southern African Large Telescope", MNRAS, 465, 4723 http://adsabs.harvard.edu/abs/2017MNRAS.465.4723K
- Kraan-Korteweg, R., Cluver, M.E., Bilicki, M., et al. 2017, "Discovery of a supercluster in the Zone of Avoidance in Vela", MNRAS, 466, 29 http://adsabs.harvard.edu/abs/2017MNRAS.466L..29K
- Lipunov, V.M., Kornilov, V., Gorbovskoy, E. et al. 2017, "First gravitational-wave burst GW150914: MASTER optical follow-up observations", MNRAS, 465, 3656 http://adsabs.harvard.edu/abs/2017MNRAS.465.3656L

- Macfarlane, S.A., Woudt, P.A., Groot, P.J., et al. 2017, "The OmegaWhite survey for short-period variable stars - III: follow-up photometric and spectroscopic observations", MNRAS, 465, 434 http://adsabs.harvard.edu/abs/2017MNRAS.465..434M
- Monageng, I.M., McBride, V.A., Coe, M.J., Steele, I.A. & Reig, P., 2017, "On the relationship between circumstellar disc size and X-ray outbursts in Be/X-ray binaries", MNRAS, 464, 572 http://adsabs.harvard.edu/abs/2017MNRAS.464..572M
- Negrello, M., Amber, S., Amvrosiadis, A., et al., 2017, "The Herschel-ATLAS: a sample of 500 μm-selected lensed galaxies over 600 deg^2", MNRAS, 465, 3558 http://adsabs.harvard.edu/abs/2017MNRAS.465.3558N
- Proshina, I.S., Kniazev, A.Y. & Sil'chenko, O.K., 2016, "Counter-rotating gas disk in the S0 galaxy IC 560", AstL, 42, 783 http://adsabs.harvard.edu/abs/2016AstL...42..783P
- Rajoelimanana, A.F., Charles, P.A., Meintjes, P.J., "Orbital and superorbital monitoring of the Be/X-ray binary A0538-66: constraints on the system parameters", MNRAS, 464, 4133 http://adsabs.harvard.edu/abs/2017MNRAS.464.4133R
- Shara, M.M., Crawford, S.M., Vanbeveren, D., et al. 2017, "The spin rates of O stars in WR + O binaries - I. Motivation, methodology, and first results from SALT", MNRAS, 464, 2066 http://adsabs.harvard.edu/abs/2017MNRAS.464.2066S
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- Su, T., Marriage, T.A., Asboth, V., et al., 2017, "On the redshift distribution and physical properties of ACT-selected DSFGs", MNRAS, 464, 968 http://adsabs.harvard.edu/abs/2017MNRAS.464..968S
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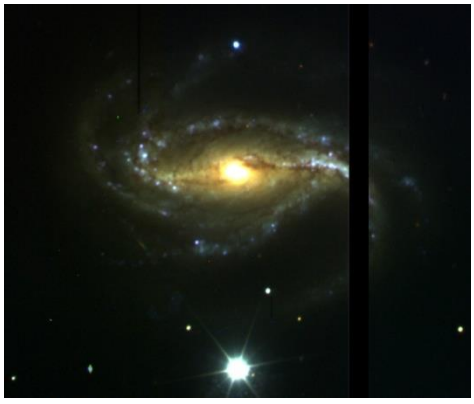
- Ward, J.L., Oliveira, J.M., van Loon, J.Th. & Sewilo, M., 2017, "K- band integral field spectroscopy and optical spectroscopy of massive young stellar objects in the Small Magellanic Cloud", MNRAS, 464, 1512 http://adsabs.harvard.edu/abs/2017MNRAS.464.1512W



Salticam acquisition image for a SALT spectral observation. SN 2016gkg is the white-blue spot above the yellow galaxy nucleus, at the tip of the spiral arm. Dr. Saurabh Jha at Rutgers classified it as a type-II Supernova. The science paper can be found above: Tartaglia et al 2017.