Monday, November 6

Week 45 of 2023

November 2023						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

December 2023						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

- Home
- Moon
- Work
- UA Holidays
- NOAO
- Siri Suggestions
- ADASS 2023 Calendar
- Telescopes

7AM

8AM

7:30AM MORNING COFFEE
Where
POSTER ROOM (Catalina/Tucson rooms)
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?
level=level3]

9AM

8:30AM ADASS Welcome

8:45AM C101: Europes revolutionary sky surveyors: Gaia and Euclid

9:00AM INVITED I101: ESASky: Unveiling the Universe through Multi-Wavelength

9:30AM C102: Multi-wavelength archival research: where are the

10AM

9:45AM C103: Lessons Learned from a Multi-wavelength Time Do-

10:00AM COFFEE BUFFET
Where
POSTER ROOM (Catalina/Tucson rooms)
[https://union.arizona.edu/in-

10:15AM FOCUS DEMO F102: Navigating ESA HST and JWST

11AM

11:00AM C104: Non-negative matrix factorization approach to sky

11:15AM C105: 3D visualisation of radio data in scientific archive

11:30AM C201: Remote observations with DISCOS and the Sardinia

11:45AM C202: Automation of VLASS Quick Look Image Quality As-

Noon

12:00PM LUNCH BREAK

1PM

1:30PM C203: SPOT: A collaborative framework for Planetary Science

1:45PM C204: Updating science operations planning software for a

2PM

2:00PM INVITED I201: SKA Observatory software
Where

2:30PM C803: Cloud Data Processing for the Event Horizon Tele-

2:45PM C206: Open Source Software for Processing and Using Dark

3PM

3:00PM AFTERNOON BREAK
Where
POSTER ROOM (Catalina/Tucson rooms)
[https://union.arizona.edu/in-

3:15PM FOCUS DEMO F901: hypothesis - property-based test-

4PM

4:00PM BOF B801: Science Platform in the multi messenger and exascale era
Where
RINCON ROOM
[https://union.arizon-

4:00PM BOF B901: Quantifying & Mitigating Satellite Constellation Interference with SatHub
Where

4:00PM BOF B902: FITS Data Displays for Observatory Operations
Where
SANTA RITA ROOM
[https://union.arizon-

5PM

6PM

5:40PM BOF B101: Best practices in data presentation
Where
RINCON ROOM

5:40PM BOF B301: The Future of FITS and Other Standardized Astronomical Data

5:40PM BOF B601: Software and Shared Workflows for the Planetary Defense Community

6:00PM BOF

7PM

• Timed Events

7:30AM to 8:30AM MORNING COFFEE
Location: Where
POSTER ROOM (Catalina/Tucson rooms)
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?
level=level3]
Notes: Event Description

Coffee breaks will be held in the poster room.

Hot beverage service.

8:30AM to 8:45AM ADASS Welcome
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?
level=level3]
Notes: Event Description

ChatGPT welcomes ADASS
[https://pretalx.com/adass2023/talk/review/SKAVUKVV9UDU8LMXGG-PJZQFSH88MLJWC]

8:45AM to 9:00AM C101: Europes revolutionary sky surveyors: Gaia and Euclid
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?
level=level3]
Notes: Event Description

THEME: SCIENCE WITH DATA ARCHIVES: CHALLENGES IN MULTI-WAVELENGTH AND
TIME DOMAIN DATA ANALYSIS
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion]

PRETALX [https://pretalx.com/adass2023/talk/RXPCJY/]

The European Space Agency (ESA) is currently operating two revolutionary sky-mapping missions: Gaia, launched in 2013, to map more than a billion stars in our Milky Way in three dimensions to study its structure, dynamics, and evolution, and Euclid, launched mid-2023, to map billions of galaxies across the Universe in three dimensions to study the growth of structure under the influence of dark energy and dark matter. The ESAC Science Data Centre (ESDC) hosts
the science archives of both missions. Upcoming major milestones are Euclid's first "quick data release" (Q1), towards the end of 2024, and Gaia's fourth data release (DR4), not before the end of 2025. This presentation introduces both sky surveyors, their science cases, their archive systems, and their data products, which include epoch astrometry, epoch photometry, and epoch spectra in the case of Gaia, and pixel images, spectra, and catalogues in the case of Euclid. ESA is developing novel and interoperable, IVOA-compliant user interfaces to access these massive, petabyte-level data sets, including web GUIs, Python Astroquery modules, bulk-download repositories, and ESA Datalabs modules allowing users to bring their code to the data.

9:00AM to 9:30AM INVITED I101: ESASky: Unveiling the Universe through Multi-Wavelength and Time-Domain Exploration
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?
level=level3]
Notes: Event Description

THEME: SCIENCE WITH DATA ARCHIVES: CHALLENGES IN MULTI-WAVELENGTH AND
TIME DOMAIN DATA ANALYSIS
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion]

PRETALX [https://pretalx.com/adass2023/talk/HSZRRK/]

In the evolving landscape of astronomical research, a comprehensive understanding requires more than isolated observations across the electromagnetic spectrum. Today, the study of many astronomical phenomena demands an integrated approach, where multi-wavelength analysis converges with time-domain investigation. To facilitate such a holistic exploration, astronomical archives play an important role in providing access to multi-wavelength and time-domain data, enabling
astronomers to study their objects of interest effectively. However, navigating multiple archives can be time-consuming and cumbersome.

ESASky (https://sky.esa.int) is a science-driven discovery portal with the primary goal of facilitating data discovery and archival science of multi-mission, multi-wavelength and multi-messenger astronomical data. ESASky provides full access to the entire sky as observed by ESA space astronomy missions, missions from international partners such as Chandra (NASA), Suzaku (JAXA) and AKARI (JAXA), and ground-based and
space-based observatories from the major astronomical data centres of the European Southern Observatory (ESO), the Canadian Astronomy Data Center (CADC), the Mikulski Archive for Space Telescopes (MAST), the High Energy Astrophysics Science Archive Research Center (HEASARC) and
the Netherlands Institute for Radio Astronomy (ASTRON). Users can search, visualise and download all public high-quality data from these observatories, including science-ready images, spectra, catalogues, data cubes and time series data, as well as search for publications associated with sources and plan JWST observations. Additionally, the multi-messenger feature of ESASky provides access to gravitational wave events and probability maps on the sky from the LIGO-Virgo-KAGRA
collaboration and Neutrino events from the IceCube Neutrino Observatory.

Exciting new features have been added to ESASky this year to provide users with access to even more astronomical data. These include the ability to access all tables in the VizieR Catalogue Service from the Strasbourg Astronomical Data Centre (CDS) and access to all data centres registered in the Virtual Observatory (VO) Table Access Protocol (TAP) Registry. Notably, these new data centres encompass VizieR, NASA/IPAC Infrared Science Archive (IRSA), the German Astrophysical Virtual Observatory (GAVO) Data Centre, the Javalambre-Photometric Local Universe Survey (J-PLUS) and all tables within the ESA Archives (Gaia, XMM-Newton, JWST, HST, Herschel, ISO, INTEGRAL, and Legacy archives such as Hipparcos, Cos-B and CoRoT).

In this presentation, I'll highlight the numerous multi-wavelength features of ESASky and discuss the current and new developments aimed
at incorporating time-domain data, ultimately evolving ESASky into a fully-featured multi-wavelength and time-domain exploration tool.

9:30AM to 9:45AM C102: Multi-wavelength archival research: where are the obstacles and how to tackle them?
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: SCIENCE WITH DATA ARCHIVES: CHALLENGES IN MULTI-WAVELENGTH AND
TIME DOMAIN DATA ANALYSIS
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion]

pretalx [https://pretalx.com/adass2023/talk/YN9UZF/]

Multi-wavelength analysis of archival data can lead to groundbreaking discoveries. Following our ADASS tutorial in 2015, we discovered a population of intermediate-mass black holes using archival data from SDSS, Chandra, and XMM-Newton, which became a major contribution to
the field. Despite the final success, our team faced numerous quite serious issues with data formats, access, reduction and analysis tools which slowed down the project by about 1.5 years. In this presentation, I will outline the most important challenges we faced and discuss the workarounds and a path forward. Presently, in order to succeed in multi-wavelength archival research, one really needs to be an expert in observations and data reduction in every spectral domain that is used. The main obstacle is that some major space missions and most ground-based observatories do not provide science ready data in the archives or provide them only for a small fraction of all observations. Data reduction efforts require very high time and manpower investments. Even when reduced data are available, they often
do not conform to any standards (from FITS WCS representation to IVOA standards for metadata). A potential path forward is to organize a push from the funding agencies towards data providers to deliver science ready data which would comply to the FAIR principles.

9:45AM to 10:00AM C103: Lessons Learned from a Multi-wavelength Time Domain Use Case on a Science Platform
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: SCIENCE WITH DATA ARCHIVES: CHALLENGES IN MULTI-WAVELENGTH AND
TIME DOMAIN DATA ANALYSIS
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion]

pretalx [https://pretalx.com/adass2023/talk/LGZB3Y/]

We present a list of obstacles as well as possible solutions for doing multi-wavelength time domain science on large scales inside of science platforms. Relevant to this talk, science platforms are computing environments provided by archives near the data which allow fast, convenient data access and computing, which thereby increase inclusion and reproducibility in science. Our specific use case is to generate light curves from many available archives at many wavelengths for a sample of 500,000 quasars. In writing this use case, we have hit stumbling blocks at 1) determining the best data structures to store and work with time-domain data, 2) finding the best way for archives to serve large time-domain catalogs so that scientists can 3) access those catalogs, and 4) concerns about understanding the calibration of large multi-wavelength surveys. For each of these obstacles, we discuss our requirements as well as solutions we have developed to address those obstacles at scale.

10:00AM to 11:00AM COFFEE BUFFET
Location: Where
POSTER ROOM (Catalina/Tucson rooms)
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

Coffee breaks will be held in the poster room.

Continental buffet.

10:15AM to 10:45AM FOCUS DEMO F102: Navigating ESA HST and JWST Science Archives through Automated Jupyter Notebooks
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

PREV
[https://adass2023.lpl.arizona.edu/event-categories/monday-session-1]NEXT
[https://adass2023.lpl.arizona.edu/event-categories/monday-session-2]

THEME: SCIENCE WITH DATA ARCHIVES: CHALLENGES IN MULTI-WAVELENGTH AND
TIME DOMAIN DATA ANALYSIS
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion]

pretalx [https://pretalx.com/adass2023/talk/R7SQVP/]

Efficient data access and analysis are crucial in the ever-expanding realm of astrophysical research. This demonstration aims to showcase a comprehensive workflow for initiating and conducting research using the European Space Agency's (ESA) Hubble Space Telescope (HST) and

James Webb Space Telescope (JWST) Science Archives. Guidance will be provided from the User Interfaces to advanced scripting, supporting researchers when navigating the vast repositories of observations and data.

Starting from scratch, participants will learn how to execute simple searches using the available User Interfaces (https://hst.esac.esa.int/ehst, https://jwst.esac.esa.int/archive). These user-friendly applications will help users to identify the desired observations and check the associated files in the quick-look viewers for images, cubes and even their footprints, using an embedded version of ESASky. The objective of this step is to construct complex queries that target specific celestial objects, time periods, and data types, among many other filters.

A step-by-step walkthrough will highlight the direct integration of these queries into automated Jupyter Notebooks generated on-the-fly in
the User Interfaces, removing the need for manual data extraction. These notebooks will be readily equipped with essential code snippets for data retrieval, pre-processing, and initial analysis. Participants will gain insights into effectively handling and visualizing data directly within the notebooks.

The automated notebooks serve as a foundation for attendees to embark
on scientific exploration immediately, facilitating faster insights and reducing the barrier to entry for researchers new to the archives. This approach not only empowers researchers but also encourages collaborative and reproducible research practices within the astrophysical community (e.g. integrating these Notebooks into ESA Datalabs).

11:00AM to 11:15AM C104: Non-negative matrix factorization approach to sky subtraction for optical spectroscopy
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: SCIENCE WITH DATA ARCHIVES: CHALLENGES IN MULTI-WAVELENGTH AND
TIME DOMAIN DATA ANALYSIS
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion]

pretalx [https://pretalx.com/adass2023/talk/ADPJ79/]

Numerous sky background subtraction techniques have been developed,
since the first implementations of computer-based reduction of spectra. Kurtz and Mink (2000) for the first time discussed a
PCA-based method which allowed them to subtract night sky background
from multi-fiber spectroscopic observations without any additional sky observations. We hereby take this approach one step further with usage of NNMF instead of PCA and generalize it to long-slit and IFU spectra. This allows us to generate approximately 10 times as many valid eigenspectra because of non-negativity. We combine this approach with the algorithm proposed in Kelson (2003) to generate an oversampled sky
model. We apply our method to “short”-slit spectra of low-mass galaxies originating from intermediate-resolution Echelle spectrographs (ESI at Keck, MagE at Magellan, X-Shooter at the VLT) when galaxies fill the entire slit and demonstrate its efficiency even when no offset sky observations were obtained.

11:15AM to 11:30AM C105: 3D visualisation of radio data in scientific archive
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: SCIENCE WITH DATA ARCHIVES: CHALLENGES IN MULTI-WAVELENGTH AND
TIME DOMAIN DATA ANALYSIS
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion]

pretalx [https://pretalx.com/adass2023/talk/BEBPR8/]

New advances in techniques for visualisation of multi-dimensional data contribute to a more efficient scientific analysis. The large amount of data that the Square Kilometre Array Observatory (SKAO) will produce and its data size will bring new challenges for current visualisation techniques in astronomy. Remote visualisation of data sets is required in order to avoid the transfer of large data sets. This is especially critical for next-generation telescopes.

In this contribution, we will present an exploratory study on how existing software and technologies for 3D visualisation can be used in scientific archives, in a way that allows the user to customise the visualisation and interact with the data, and the viability of using them for larger data sets, as the ones coming from SKA data products. The study includes general purpose software, not being limited to astronomy software. We will also present a tool to create interactive visualisations of spectral line data, making use of the technologies selected from that aforementioned study. The aim of the tool is to be complementary to other visualisation and analysis tools, while being useful for multi-dimensional Big Data from SKAO and its precursor telescopes. The 3D models are written with the X3D standard and represent chosen iso-surfaces, which are extracted as a triangular mesh using the marching cubes algorithm. Other information, like markers and images, can be added to the model in order to improve the visualisations. We have prioritised the use of web technologies to favour interactivity in scientific archive platforms. As a result, the interactive tool allows showing and hiding objects, changing the colormap, changing the scale, adding multiple cubes and other features. Furthermore, it allows its integration in an observatory archive. The tool was created targeting radio data cubes but we are studying and expanding its functionalities to allow visualisation of cubes containing data from other wavelengths. This implementation is being integrated in a Virtual Observatory platform through SODA services.

11:30AM to 11:45AM C201: Remote observations with DISCOS and the Sardinia Radio Telescope
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: GROUND AND SPACE MISSION OPERATIONS SOFTWARE
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion--2]

pretalx [https://pretalx.com/adass2023/talk/8CXSBY/]

DISCOS is the control software of the three INAF (Italian National Institute for Astrophysics) single-dish radio telescopes. It has been developed starting from the Alma Control Software framework and its core is shared between the Sardinia Radio Telescope (SRT), the Grueff Radio Telescope in Medicina and the Noto radio telescope. DISCOS controls all the telescope subsystems, it offers the user multiple observing strategies providing a combination of textual and graphical user interfaces. In order to ease operations for the aforementioned telescopes and carry on the observations in a more efficient manner, the users are provided with a means to control the telescope remotely. We hereby describe the solutions we implemented, with particular emphasis on the remote access to the Sardinia Radio Telescope, for both observation and maintenance purposes, presenting also some ideas
for future improvements.

11:45AM to 12:00PM C202: Automation of VLASS Quick Look Image Quality Assurance
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: GROUND AND SPACE MISSION OPERATIONS SOFTWARE
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion--2]

pretalx [https://pretalx.com/adass2023/talk/PDDXAD/]

In September 2017 the Very Large Array (VLA) began the first three epochs of observations for the Very Large Array Sky Survey (VLASS). Each epoch of the survey is split into two observing cycles with 6

cycles total to be completed over 7 years. During each epoch the VLA will survey ~80% of the sky with declination > -40° in full polarization between 2-4 GHz and generate 35,500 sets of products, each covering ~1 square degree of sky. To ensure the survey meets its science goals a Quality Assurance (QA) workflow was developed whereby
each product was manually inspected before being released to the community. However, this manual workflow has been found to be prone to
random human error and the pace depended on the efficiency of those performing the QA. We have sought to decrease the time between observation and the delivery of the image product to the community and
to standardize the QA of each product by developing an automated QA workflow. In doing so we have transcribed the manual QA ruleset for Quick Look (QL) image products into a python code that employs heuristic methods and a neural network to identify image products that contain unwanted artifacts. After applying our new automated QA workflow to QL images produced during the first half of the third epoch of VLASS we present the results of our automation. We show that compared to previous observing cycles we have significantly increased the efficiency of QL image QA through our automation by decreasing delivery time to the community as well as other overhead costs of manually performing QA.

12:00PM to 1:30PM LUNCH BREAK
Notes: Event Description

There are many lunch options with walking distance or via the free streetcar or if you are in a hurry on the 2nd and 3rd floors of the Student Union.

1:30PM to 1:45PM C203: SPOT: A collaborative framework for Planetary Science Operations Planning
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: GROUND AND SPACE MISSION OPERATIONS SOFTWARE
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion--2]

pretalx [https://pretalx.com/adass2023/talk/HSB7K8/]

This abstract presents the Science Planning Operational Tool (SPOT), designed and developed by the RHEA Group team, located at the European Space Astronomy Centre (ESA/ESAC), responsible of the Payload Operations and Software Development Service for ESA Planetary Missions.

SPOT is a a collaborative framework to support the planning of Planetary scientific payload operations along the entire missions life, including the long cruise phases. SPOT is already being used by BepiColombo and JUICE missions and it is going to be adapted soon to other missions like the planetary defence mission HERA.
BepiColombo is an interdisciplinary ESA mission launched in October 2018 to explore Mercury in cooperation with the Japan Aerospace Exploration Agency (JAXA). A long cruise phase of 7.2 years toward the inner part of the Solar System will bring BepiColombo to Mercury, after nine planetary flybys, one to the Earth, two to Venus and six to Mercury.

JUICE -JUpiter ICy moons Explorer -is the first large-class mission, launched in April 2023 and arriving at Jupiter in 2031. It will spend at least three years making detailed observations of Jupiter and three of its largest moons, Ganymede, Callisto and Europa. A long cruise phase will bring JUICE to Jupiter and its moons, after four planetary flybys, three to the Earth and one to Venus.

SPOT provides operational capabilities to generate science observations, based on geometry conditions, define scenarios for the different phases of the mission, schedule observations according opportunity windows, and simulation of the scientific payload timelines and the main spacecraft resources used, such as power consumption or generated data volume. SPOT can also generate payload operational products, using the Command Request File format (CRF), in compliance with the European Space Operations Centre (ESOC) tools: Mission Planning System (MPS), Mission Control System (MCS) and Mission Information Database (MIB).

In addition, SPOT incorporates advanced 2D/3D visualisation tools that can display, among others, geospatial data sets or the spacecraft attitude, supporting operators and scientific users in the planning process, providing for example surface coverage data results. All the information and generated products are centralised and version-controlled, and privacy and confidentiality of the data is ensured through user authorisation and authentication processes.

The SPOT framework was originally design and developed for BepiColombo and has already supported the scientific payload teams during the Near Earth Commissioning Phase (NECP), the periodic payload
check-outs and the science operations carried out during

1:45PM to 2:00PM C204: Updating science operations planning software for a sudden loss of capacity in the HiRISE CCD array
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: GROUND AND SPACE MISSION OPERATIONS SOFTWARE
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion--2]

pretalx [https://pretalx.com/adass2023/talk/QMLQKQ/]

The High Resolution Imaging Science Experiment (HiRISE, [1][2]) on the Mars Reconnaissance Orbiter (MRO) has been acquiring high resolution images of the Martian surface since 2006. HiRISE acquires its images with an array of 14 CCDs - ten covered by broadband red filters that cover the full swath width (1.14° field of view), as well as two sets of two CCDs covered by blue-green and near-infrared filters, respectively, arranged to provide three-color coverage in the center of the swath.

In July of 2023, HiRISE experienced a sudden failure of one of the central red CCDs. This loss introduced a gap in the center of the processed image products, including the loss of half of the central color swath. The remaining color field of view is off-center, which isnot optimal for imaging many of the very small surface features that HiRISE typically targets.

HiRISE uses HiPlan, an in-house built extension of the MRO project's customized version of the Java Mission-planning and Analysis for Remote Sensing (JMARS, [3][4]), as its primary image planning software. Due to the rapid cadence of MRO science operations planning, quick updates to HiPlan after the loss of the CCD were essential for resuming operations. In response to the need to rapidly and accurately provide offset image centers for ongoing planning cycles, we have created a new application for the HiPlan suite to ingest files of partially-planned images, identify the images that require a shift in center coordinates, and apply the coordinate shift in updated files, using the JMARS implementation of the JPL NAIF SPICE toolkit [5]. We have also updated additional applications and procedures for the HiRISE science team and operations personnel to manage the offset targets, with minimum by-hand manipulations to avoid introducing errors.

Our response to the changing instrument conditions is focused on streamlining the incorporation of additional complications for the science operations engineers while maintaining scientific capability, and building in flexibility for future changes in operations procedure.

[1] McEwen, A. S., et al. (2007), J. Geophys. Res., 112, 10.1029/2005JE002605
[2] McEwen, A. S., et al. (2023), Icarus, in press.
[3] Zurich, R. W., et al. (2007), J. Geophys. Res., 112, 10.1029/2006JE002701
[4] Christensen, P. R., et al. (2009), AGU Fall Meeting 2009, Abstract IN22A-06
[5] Acton, C. H. (1996), Planetary and Space Sci., 44, 10.1016/0032-0633(95)00107-7

2:00PM to 2:30PM INVITED I201: SKA Observatory software
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?

level=level3]
Notes: Event Description

THEME: GROUND AND SPACE MISSION OPERATIONS SOFTWARE
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion--2]

pretalx [https://pretalx.com/adass2023/talk/PBSRSP/]

In this talk we will examine what are the main characteristics of the software supporting observations with the SKA telescopes.

Starting from the main requirements and use cases, an outline will be provided of the main subsystems composing the SKA software, and their
main design choices. This will include considerations on the technologies being adopted and also on the organisation of the development activity.

2:30PM to 2:45PM C803: Cloud Data Processing for the Event Horizon Telescope
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: CLOUD INFRASTRUCTURES FOR ASTRONOMICAL DATA ANALYSIS
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion--8]

pretalx [https://pretalx.com/adass2023/talk/RHRWPY/]

The Event Horizon Telescope (EHT), a heterogeneous Very Long Baseline Interferometry (VLBI) array that captures horizon-scale resolution images of black holes, utilizes the Google Cloud Platform (GCP) to process its data and construct its images. Using cloud-native technologies such as Docker and Kubernetes, the collaboration was able to scale its analyses and process its data with bit-to-bit reproducibility. In this talk, I will briefly overview EHT's data pathway, describe how GCP was used by the collaboration, and address some technical challenges and their resolutions. I will also outline the future plans for the EHT computing infrastructure and data processing pipelines.

2:45PM to 3:00PM C206: Open Source Software for Processing and Using Dark Energy Spectroscopic Instrument Data
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: GROUND AND SPACE MISSION OPERATIONS SOFTWARE
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion--2]

pretalx [https://pretalx.com/adass2023/talk/LC9DTB/]

I will briefly introduce the Dark Energy Spectroscopic Instrument (DESI) and DESI survey before focusing on the work of a small, dedicated team to develop open-source software for the reduction, analysis, and dissemination of the DESI data. The MPI- and GPU-enabled python code, with wrapped C functions in a few locations, is capable of parallelizing to multiple compute nodes. We further leverage the embarrassingly parallel nature of the data to process each set of individual targets independently, giving us the ability to scale our processing to tens of thousands of CPU cores. For each set of 5000 targets, the code simultaneously extracts the 5000 spectra from the raw data, wavelength-calibrates, sky-subtracts, and flux-calibrates them. It also estimates their inverse variances while propagating a resolution matrix encoding the wavelength-dependent non-Gaussian line
spread function per fiber, for proper modeling of the spectra in an analysis. The raw data, intermediate data products, and final data products are stored in Flexible Image Transport System (FITS) files along with metadata and derived quantities stored in the headers of the Header-Data Units.

I will give details about key improvements in the software to reduce wall-clock time, discuss the performance of the software, and conclude with a discussion of the recent release of early data with accompanying code tags in DESI's Early Data Release.

3:00PM to 4:00PM AFTERNOON BREAK
Location: Where
POSTER ROOM (Catalina/Tucson rooms)
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

Coffee breaks will be held in the poster room.

Afternoon tea and snacks.

3:15PM to 3:45PM FOCUS DEMO F901: hypothesis - property-based testing for Python
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

PREV
[https://adass2023.lpl.arizona.edu/event-categories/monday-session-3]NEXT
[https://adass2023.lpl.arizona.edu/event-categories/birds-feather]

THEME: OTHER CREATIVE TOPICS IN ASTRONOMICAL SOFTWARE
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion--9]

pretalx [https://pretalx.com/adass2023/talk/P897DB/]

In this focus demo, I will give a short introduction to the hypothesis Python library (https://hypothesis.readthedocs.io/), which provides a property-based testing framework that integrates into the existing Python testing frameworks of pytest and unittest. I'll provide some examples of how I've used hypothesis in the past, and show how effective it is at finding edge and corner cases in your code.

4:00PM to 5:20PM BOF B801: Science Platform in the multi messenger and exascale era
Location: Where
RINCON ROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: CLOUD INFRASTRUCTURES FOR ASTRONOMICAL DATA ANALYSIS
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion--8]

pretalx [https://pretalx.com/adass2023/talk/DPJXCR/]

Science platforms (MPs) have emerged as powerful tools that integrate vast astronomical datasets, advanced computational capabilities, and collaborative tools into a unified framework. They provide astronomers with a streamlined and efficient means to access, analyse, and visualise complex data sets, enabling breakthrough discoveries and fostering interdisciplinary collaborations. In Astronomy and Astrophysics there is growing interest towards SP driven in particular by large experiments (as LSST or SKA), and there already exists a number of different implementations of SPs, offering differing features and capabilities.

This BoF session will examine the state of the art and future perspectives involving data centers, computing centers or astrophysical projects. The BoF will address some of the key questions about SPs in astronomy. What platforms are already available for astronomers? Are platforms interoperable? Do we need interoperable platforms and which standards should be developed? How can platforms
simplify the use of complex cloud or HPC facilities?

In addition, the BoF will address a specific functionality to be supported and integrated in the SPs: high performance data visualization. This represents one of the most relevant - and challenging - services supported by the SP, since it requires the usage of remote computing resources, the access to distribute data, the support to complex workflows and to real-time user interaction. In the BoF we aim to discuss the requirements of the astronomers and the challenges to support such needs within a SP.

In conclusion, this BoF will provide an overview of SP technology for astronomy focusing in particular on big data visualization, and highlighting the efforts already done to develop science platforms able to offer a data analysis framework, and the role of IVOA in providing standards and services to design and develop interoperable platforms.

4:00PM to 5:20PM BOF B901: Quantifying & Mitigating Satellite Constellation Interference with SatHub
Location: Where
BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: OTHER CREATIVE TOPICS IN ASTRONOMICAL SOFTWARE
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion--9]

pretalx [https://pretalx.com/adass2023/talk/RZRTZZ/]

It's a star, it's a galaxy, it's a... satellite streak?! Join colleagues and leaders of the IAU Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference (CPS) SatHub for an engaging session about new software challenges in an era of thousands of commercial low-Earth orbit satellites. Come prepared to share and learn how the community is approaching this issue across the electromagnetic spectrum, what software tools already exist, and what the missing pieces are.

4:00PM to 5:20PM BOF B902: FITS Data Displays for Observatory Operations
Location: Where
SANTA RITA ROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: OTHER CREATIVE TOPICS IN ASTRONOMICAL SOFTWARE
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion--9]

pretalx [https://pretalx.com/adass2023/talk/G3HNWH/]

For the last several decades, observatories have enjoyed a convenient alignment between the data visualization needs of scientific researchers and observatory staff, largely through the development and widespread adoption of SAOImage/DS9 and IRAF. However, as the astronomy community at large orients itself towards a future of larger and larger datasets fed by ELTs and massive TDA surveys, the tools astronomers use to visualize data are increasingly oriented towards browser and notebook based UIs (e.g. jdaviz from the Space Telescope Science Institute or LSST's Rubin Science Platform), and away from the stand-alone applications that frequently populate the screens found in our observatory control rooms. While these tools may be of great utility to researchers, they often fail to fulfill the needs of observatory operators in terms of legacy support, customizability, and their ability to be run within VNC sessions. The tools used by observatory staff (such as the Ginga FITS viewing toolkit or DS9) generally do not receive nearly as much attention or investment as the new browser-based programs.

In this BOF session, we will discuss and record what software tools and/or programs observatory developers are using for their operational needs (such as data readouts or quick-look analysis), what concerns developers have about those tools, and finally whether any coordinated action is needed to ensure that observatories have access to modern and reliable FITS data viewers in the future.

5:40PM to 7:00PM BOF B101: Best practices in data presentation
Location: Where
RINCON ROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: SCIENCE WITH DATA ARCHIVES: CHALLENGES IN MULTI-WAVELENGTH AND
TIME DOMAIN DATA ANALYSIS
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion]

pretalx [https://pretalx.com/adass2023/talk/PCRCJV/]

Panel members for _BEST PRACTICES IN DATA PRESENTATION_

* XIUQIN WU, _NED task lead, Caltech, IPAC_
(PG4gdWVycz0iem52eWdiOmt2aGR2YUB2Y25wLnBueWdycHUucnFoI-j5rdmhkdmFAdmNucC5wbnlncnB1LnJxaDwvbj4=)
MODERATOR
* ALBERTO ACCOMAZZI, _ADS Program Manager and Principal Investigator_
(PG4gdWVycz0iem52eWdiOm5ucHBiem5tbXZAcHNuLnVuZWluZXEucn-FoIj5ubnBwYnpubW12QHBzbi51bmVpbmVxLnJxaDwvbj4=)
* AUGUST (GUS) MUENCH, _Journals Data Editor American Astronomical Society_
(PG4gdWVycz0iem52eWdiOm5odGhmZy56aHJhcHVAbm5mLmJldCI+bmh0aGZnLnpocmFwdUBubmYuYmV0PC9uPg==)
* G. BRUCE BERRIMAN, _Caltech, IPAC-NExScI_
(PG4gdWVycz0iem52eWdiOnRvb0B2Y25wLnBueWdycHUucnFoI-j50b29AdmNucC5wbnlncnB1LnJxaDwvbj4=)

Last year, NED (NASA/IPAC Extragalactic Database) team members led the effort to work with many archives to publish the paper "Best Practices for Data Publication in the Astronomical Literature [https://iopscience.iop.org/article/10.3847/1538-4365/ac6268/pdf]" (Chen et al. 2022, https://ui.adsabs.harvard.edu/abs/2022ApJS..260....5C/abstract) article. The paper provided many guidelines for researchers on how to publish their data accurately and make them more open and FAIR [https://www.go-fair.org/fair-principles/] (Findable, Accessible, Interoperable and Reusable). Although the published paper was originally geared towards researchers in publishing their data, many guidelines also apply to archives in how to present the data to make them more scientifically accurate, open and FAIR. The BoF will discuss on those guidelines with examples to explain the justification behind these best practices recommendations. We will also showcase how, by following these guidelines, it will not only improve the scientific records, but also help to facilitate new modes of open science discovery. Several coauthors of the Best Practice paper will serve as panel members for this BoF discussion.

5:40PM to 7:00PM BOF B301: The Future of FITS and Other Standardized Astronomical Data Formats
Location: Where
SANTA RITA ROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: USER EXPERIENCE FOR ASTRONOMICAL SOFTWARE
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion--3]

pretalx [https://pretalx.com/adass2023/talk/AKNGTC/]

The FITS data standard has served astronomers well for four decades. The original integer image format has been revised to support additional pixel data types, to support world coordinates and other scientific metadata, to include an integrated data compression framework, and to support generalized binary tables, among other features.

Over the years, a variety of alternative scientific data standards have been proposed. These usually reach only a limited audience specific to a particular project or community. No other format has ever garnered the widespread support of FITS.

We'll hear from several groups who are generating data and how they have been using FITS standards and extending or creating standards for newer projects. Are people talking across projects about new standards, even partial ones? Have people published details of their standard formats? Where?

Various FITS topics will be discussed, including:

* Tile Compression
[https://adass2023.lpl.arizona.edu/events/bof-talk-beyond-fits-tiled-compression-elefits-fly-adaptive-compression]

5:40PM to 7:00PM BOF B601: Software and Shared Workflows for the Planetary Defense Community
Location: Where

BALLROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: SCIENCE WITH DATA ARCHIVES: CHALLENGES IN MULTI-WAVELENGTH AND
TIME DOMAIN DATA ANALYSIS
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion]

pretalx [https://pretalx.com/adass2023/talk/CQPQK8/]

Planetary Defense is practical astronomy: the applied science of discovering, tracking, and characterizing near-Earth asteroids and comets (NEOs). The goal is to retire the risk of Potentially Hazardous Asteroids that may impact the Earth in the coming decades. In this BOF, we will explore the concept of the global planetary defense effort as a distributed real-time system with complex and unpredictable components. Instead of specific solutions, we'll be addressing the meta-questions of how these components should be connected and how to do it so that the system is responsive, resilient, and secure.

Planetary Defense Community contributors:

* Larry Denneau (chair), Asteroid Terrestrial-impact Last Alert System
 * Dave Bell, Minor Planet Center
 * Melissa Brucker, Spacewatch
 * Alan Chamberlin, CNEOS
 * Carson Fuls, Catalina Sky Survey
 * Alex Gibbs, Catalina Sky Survey
 * Mario Juric, Rubin Observatory
 * Tyler Linder, Planetary Science Institute
 * Carrie Nugent, Olin College
 * Paresh Prema, Minor Planet Center
 * Rob Seaman, Catalina Sky Survey

* Overview (Larry)

* Planetary defense (PD) as a real-time system, e.g. PDCO "OODA loop" model
 * PD Actors and components
 * "Bezos API Mandate", or API-centric thinking
 * Current state of the art in PD and what's coming (Rubin, NEOSM, large archives)

* Observations

* Survey discovery (Carson)
 * Follow up, arc extension (Tyler)
 * How Rubin will extend the NEO ecosystem (Mario)

* APIs

* NEOFixer (Alex)
 * API requirement discovery and stability (TBD)
 * Remote 3rd party requests/control (Alan)

* Catalogs/Databases

* MPC interfaces (Dave)
 * PDS/CATCH (TBD)
 * Other databases, e.g. NEAT (Carrie)

* Group discussion, possible topics:

* What services should be available? Some examples:

* ephemerides
 * orbit evaluation; are these detections compatible with some orbit?
 * automated precovery
 * queries for observer-specific info (usually images) about observations

* Service discovery

* How to achieve consensus (if desirable) about available services
 * Modern software evolves much faster than observatories/institutions; how to cope

* System health, resiliency

* How to test the system -- IAWN-style campaigns?
 * Info security — what are the vulnerabilities and what actions are needed?

6:00PM to 6:10PM BOF Talk: Beyond FITS tiled compression: EleFits on-the-fly adaptive compression
Location: Where
SANTA RITA ROOM
[https://union.arizona.edu/infodesk/maps/sumc_maps.php?level=level3]
Notes: Event Description

THEME: USER EXPERIENCE FOR ASTRONOMICAL SOFTWARE
[https://adass2023.lpl.arizona.edu/themes-0#az-accordion--3]

TALK DURING THE BOF: THE FUTURE OF FITS
[https://adass2023.lpl.arizona.edu/events/bof-future-fits-and-other-standardized-astronomical-data-formats]
AND OTHER STANDARDIZED ASTRONOMICAL DATA FORMATS

The FITS file format is ubiquitous in astronomy. In addition to the classical external compression methods, it features an internal, tile-based image compression. This allows (de)compressing timely only relevant images instead of the entire file, and greatly reduces the memory usage at any given time. Metadata is even accessible without decompressing. Several compression algorithms have been adapted or introduced to handle various kinds of images, notably GZIP, Rice, H-compress and PLIO. Naturally, depending on the algorithm and the image it is applied to, the compression ratio can vary greatly. There is no one-fits-all algorithm and the same algorithm should not be applied unconditionally. However, up until now, FITS libraries like CFITSIO and Astropy have all relied on static compression settings, making the use of several algorithms depending on context quite tedious.

EleFits (https://github.com/CNES/EleFits) introduces compression strategies, which allow the user to define an adaptive heuristic for compressing FITS files dynamically. An arbitrary number of pre- or user-defined compression settings build a chain of responsibility: Each time an image is written, the first algorithm in the chain which can handle it is selected. The images which each algorithm can handle are defined by the properties of the HDU, e.g. image size, max pixel value, BITPIX or other keywords. The compression strategy is set once and then automatically applied when writing a FITS file, making compressing with EleFits' API straightforward (see snippet below). EleFits also provides its own turnkey strategies, including CompressAuto, which selects for each HDU the algorithm which should maximize the compression ratio. CompressAuto features tuned parameters
for each algorithm and provides the option to choose between or combine lossy and lossless compressions.

```
MefFile f(filename, FileMode::Edit, CompressAuto());
f.append_image("SCI", {}, image); // Auto-compresses with GZIP
f.append_image("MASK", {}, mask); // Auto-compresses with PLIO
```

To assess the performance of our implementation, we have run a quantitative benchmark over a range of FITS files which cover a variety of use cases: they include images and masks of various sizes, types and statistics. The compression ratio and compression time are measured at file and HDU levels. CompressAuto is compared to common
strategies which consist in applying one algorithm for integers and another algorithm for floating points. Lossless and lossy compressions are also compared. The results show that CompressAuto almost systematically produces the best compression ratios, sometimes by a large margin. Otherwise, differences with the optimal solution are negligible. Thanks to its adaptive parameters, the algorithm selected by CompressAuto also generally outperforms the default settings. Finally, choosing a more complex strategy, such as CompressAuto, does not significantly increase the walltime for compressing a FITS.