



# LSST@LATAM



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III LASF4RI Symposium  
August 29 - 2024



# Cosmology: from quantum fluctuations to galaxies

Is the late time clustering compatible with the  $\Lambda$ CDM prediction assuming initial conditions from the CMB?

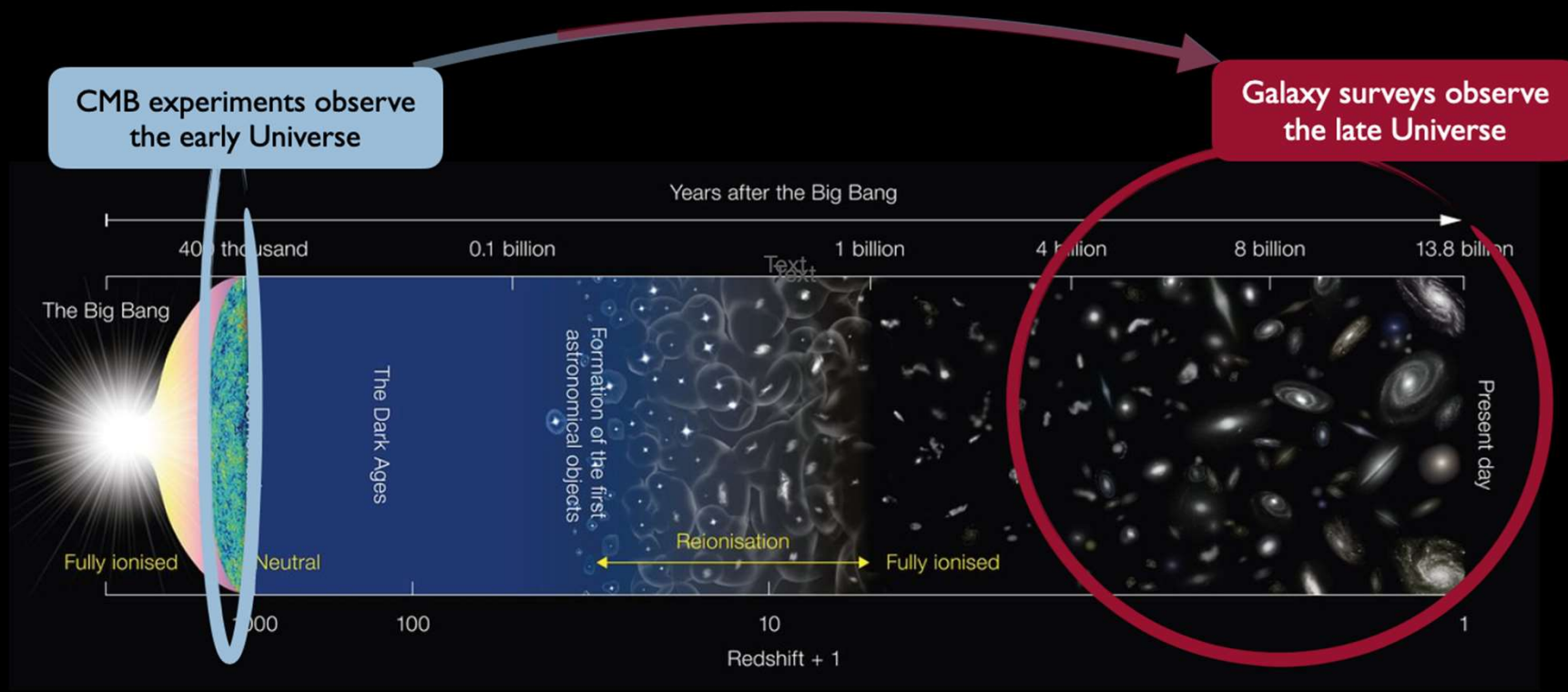


Image credit: NAOJ

From A. Amon: DES-Y3 webinar

# Galaxy surveys

Two main types of galaxy surveys:

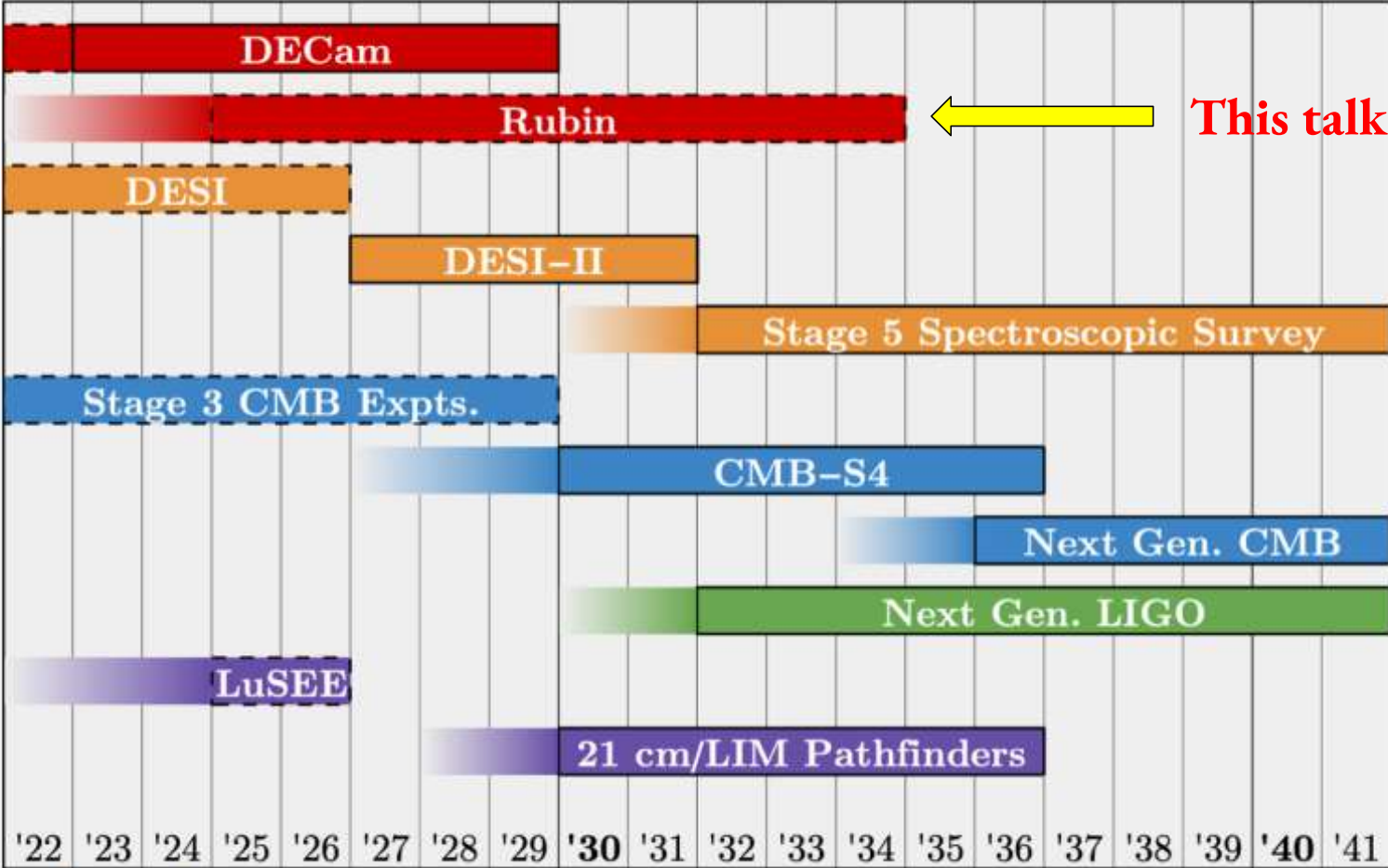
- Spectroscopic: take spectra of galaxies  
(good quality spectroscopic redshift vs smaller number of objects; no imaging)
- Photometric (imaging): take pictures of galaxies with different color filters  
(fair quality photometric redshift vs larger number of objects; imaging)

DES and LSST are photometric surveys  
DESI is a spectroscopic survey

Report of the Topical Group on Dark Energy and Cosmic Acceleration:  
 Complementarity of Probes and New Facilities for Snowmass 2021

Conveners: Brenna Flaugher, Vivian Miranda, David J. Schlegel

**Snowmass 2021**  
**2209.08654**



**Figure 6-1.** Current and potential future facilities probing cosmic acceleration that are or may be supported by DOE or NSF. Dashed boxes indicate fully-funded facilities. Facilities in red are optical imaging, in orange are optical spectroscopy, in blue are CMB, in green are gravitational waves, and in purple are radio/mm spectroscopy. The fade-in regions indicate commissioning periods, while the boxes indicate full survey observations.

# P5 report

Particle Physics Project Prioritization Panel  
High Energy Physics Advisory Panel  
December 7, 2023

**Recommendation 1: As the highest priority independent of the budget scenarios, complete construction projects and support operations of ongoing experiments and research to enable maximum science.**

We reaffirm the previous P5 recommendations on major initiatives:

- a. HL-LHC (including ATLAS and CMS detectors, as well as Accelerator Upgrade Project) to start addressing why the Higgs boson condensed in the universe (*reveal the secrets of the Higgs boson*, section 3.2), to *search for direct evidence for new particles* (section 5.1), to *pursue quantum imprints of new phenomena* (section 5.2), and to *determine the nature of dark matter* (section 4.1).
- b. The first phase of DUNE and PIP-II to determine the mass ordering among neutrinos, a fundamental property and a crucial input to cosmology and nuclear science (*elucidate the mysteries of neutrinos*, section 3.1).



Decipher  
the  
Quantum  
Realm

Elucidate the Mysteries  
of Neutrinos

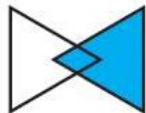
Reveal the Secrets of  
the Higgs Boson



Explore  
New  
Paradigms  
in Physics

Search for Direct Evidence  
of New Particles

Pursue Quantum Imprints  
of New Phenomena



Illuminate  
the  
Hidden  
Universe

Determine the Nature  
of Dark Matter

Understand What Drives  
Cosmic Evolution

ing the Quantum Universe: Pathways to Innovation and Discovery in Particle Physics

mended Particle Physics Program



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- c. The Vera C. Rubin Observatory to carry out the LSST, and the LSST Dark Energy Science Collaboration, to *understand what drives cosmic evolution* (section 4.2).



# Legacy Survey of Space and Time

**LSST** is a 10-year survey to be conducted at the **Vera Rubin Observatory** in Chile (CTIO)

using the

**Simonyi Survey Telescope** – 8.4 meters primary mirror  
9.6 deg<sup>2</sup> field of view

with the

**LSSTCam**

largest digital camera ever built (SLAC) – 3.2 Gigapixels  
189 science CCDs  
6 filters: ugrizy

Construction started in 2015

10 years of observations are planned – 2025 to 2035

## Raw Data: 20TB/night

Sequential 30s images that cover the entire visible sky every few days.



## Prompt Data Products

Alerts: up to 10 million per night

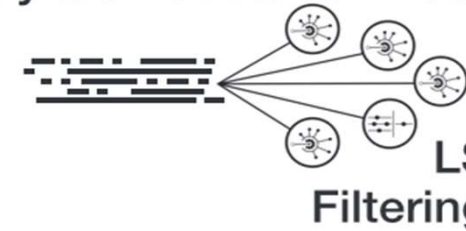
Results of Difference Image Analysis (DIA): transient and variable sources

Solar System Objects: ~6 million by year 10

## Data Release Data Products

Final 10 year Data Release images: 5.5 million x 3.2 Gpx catalogs: 37 billion objects, 15PB

via nightly alert streams



Community Brokers

LSST Alert Filtering Service



via Prompt Products Database

LSST DACs (Chile & NCSA)

Independent DACs (iDACs)



via Data Releases

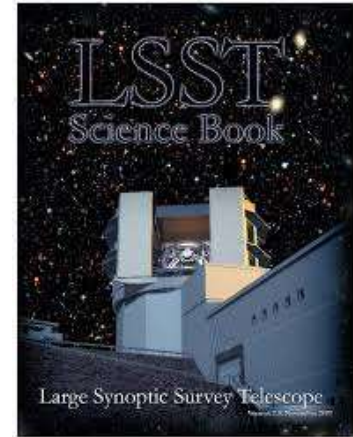
Slide from Melissa Graham's presentation at PCW22

## LSST Science Platform

Provides access to LSST Data Products and services for all science users and project staff.



# LSST Science



[www.lsst.org/scientists/scibook](http://www.lsst.org/scientists/scibook)

LSST can do much more than study Dark Energy:  
unprecedented amount of data for multiple science goals

Science Topics are addressed within

**LSST Science Collaborations**

(autonomous, self-managed teams)



# LSST Science Collaborations

## 8 Science Collaborations



Active Galactic Nuclei



Stars, Milky Way, and Local Volume



Dark Energy



Strong Lensing



Informatics and Statistics



Galaxies



Transients and Variable Stars



Solar System

# LSST in Latin America

Currently there are 4 countries participating in LSST:

Chile

Brazil

Mexico

Argentina

(in temporal order)

# Chile

Chile is the host country of the Vera Rubin Observatory. Since 2008, every member of the Chilean astronomical community can be a member. The Chilean community is granted ~10% representation in most of the Rubin scientific and administration committees including the Science Advisory Committee, the User's Committee, the AURA Management Council for the Rubin Observatory, the LSST Discovery Alliance Board and the Survey Cadence Optimization Committee.

The LSST project has secured the so-called Rubin/Chile fund, aimed at developing Chilean astronomy in relation to Rubin during LSST operations. ANID, has funded three large centers with LSST-related science with participation of ~200 members of the Chilean astronomical community:

BASAL - Centro de Astrofísica y Tecnologías Afines, Instituto Milenio de Astrofísica and the Nucleo Milenio Titans

Several scientists from the Chilean community are making significant contributions including several leadership roles. For example, the Automatic Learning for the Rapid Classification of Events (ALeRCE)<sup>2</sup>, a Community Broker for LSST alerts, is led by Chile. On the Galactic side, several researchers are working to characterize optical and NIR variability of various interesting stellar classes of objects, to understand their physics and use them as rungs on the local distance ladder.

# Brazil

Brazil joined LSST in 2015 under the leadership of the Laboratório Interinstitucional de e-Astronomia (LIneA) and the Laboratório Nacional de Astrofísica (LNA) with the signing of an Agreement which guaranteed the participation of 10 Principal Investigators (PIs) and the corresponding 40 Junior Associates (JAs). In that year, the Brazilian Participation Group in LSST (BPG-LSST) was created to coordinate the scientific activities of the scientists involved in the project. In 2024 an ICRADA between the LIneA Association and SLAC secured an additional 16 PIs and the corresponding 64 JAs through an in-kind contribution including the construction and operation of an Independent Data Access Center (IDAC) and the development of infrastructure for photometric redshifts. LineA is also a member of the LSST Discovery Alliance.

The financing of the Brazilian participation so far was possible due to contributions from FAPESP and the Rede Nacional de Pesquisa (RNP) for the infrastructure for data transmission from La Serena to the US. We also have a “Instituto Nacional de Ciência e Tecnologia do e-Universo” (L. da Costa coordinator, R. Rosenfeld deputy coordinator) and a CNPq project for international cooperation (R. Rosenfeld). We also received support from the agency Financiadora de Estudos e Projetos (FINEP). *However, the operation of the IDAC requires long-term financing that will secure the participation of scientists in Brazil in the project.*

**At the moment the BPG-LSST has more than 100 participants from 26 institutions. The current 23 PIs are involved in the DESC, AGN, SSSC, SMWLV and ISSC.**

Revista  
Brasileira de

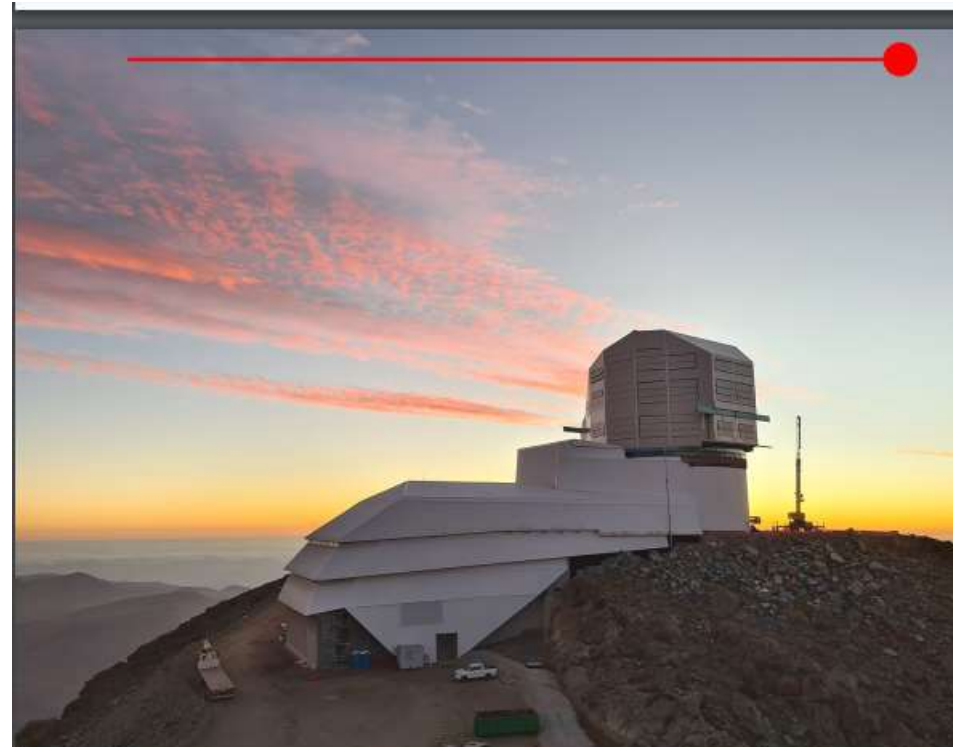
# ASTRO NOMIA

Produzida pela Sociedade  
Astronômica Brasileira

Volume 5 | Número 20  
Ano 2023

## LSST

O poderoso telescópio  
que produzirá um  
filme do Cosmos



## O Brasil no LSST

Cientistas de instituições brasileiras participam do projeto internacional que produzirá o mais profundo censo dinâmico do Universo.

**A**pós mais de 20 anos de planejamento e construção, o Observatório Vera C. Rubin, onde será conduzido o projeto *Legacy Survey of Space and Time* (LSST), está prestes a se tornar realidade. As primeiras propostas para seu desenvolvimento foram discutidas nos anos de 1990 e a hoje chamada *LSST Discovery Alliance* foi criada em 2003 nos Estados Unidos para dar suporte ao projeto. A construção teve início em 2015 em Cerro Pachón (Chile), sendo parte do complexo de telescópios do NOIRLab — *National Optical-Infrared Astronomy Research Laboratory*, da National Science Foundation (EUA). O projeto LSST será executado por 10 anos, usando o novo telescópio Simonyi, com es-

[https://sab-astro.org.br/wp-content/uploads/2023/12/RBA-20\\_online.pdf](https://sab-astro.org.br/wp-content/uploads/2023/12/RBA-20_online.pdf)

# Mexico

The Mexican participation started in 2020 and is coordinated by LSST-MX, an academic consortium led by UNAM and Universidad de Guanajuato, created to coordinate and maximize the impact of the Mexican contribution to Rubin/LSST, through the in-kind program, and to further promote the scientific exploitation of Rubin data.

The Mexican in-kind program contemplates **20 PI slots, and the associated JAs**, to be covered by software development through 3 directable contributions, 2 non-directable contributions and the installment of a Lite-IDAC. As of today, LSST-MX is in the process of finalizing and signing off the ICRADA agreement with SLAC and DOE.

*More in Alma's talk.*

# Argentina

Argentinian participation in LSST started in July 2021 through an in-kind contribution program.

The Argentinian participation is led by the IATE institute (OAC-UNC and CONICET). It involves **12 PIs and their 48 JAs** from almost all the country's astronomical institutions participating in the eighth Scientific collaboration.

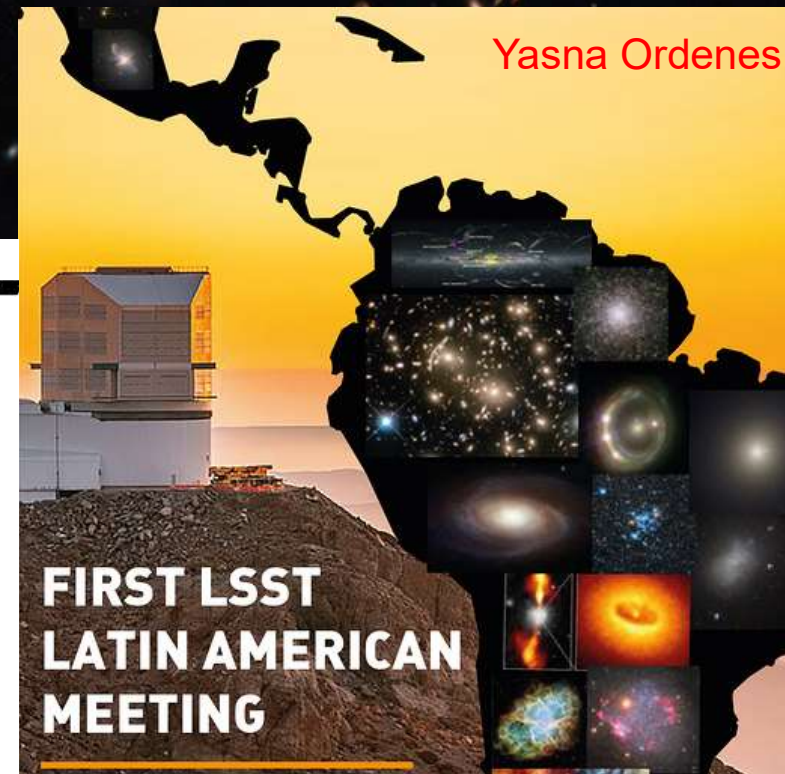
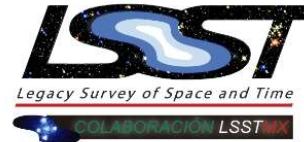
The IATE coordinates the activities and involves yearly meetings, programming, and evaluations of the member's activities. Currently, Argentinian researchers are using CASLEO Observatory facilities for microlensing events follow-ups as part of the Omega Network. Initial activities were supported by the TVS Collaboration Kickstarter community awards: Preparing for Astrophysics with LSST. Argentina contributes to Rubin Software's development activities and, through NOIRLAB, to the follow-up AEON networks by observing time of the TOROS, MATE, and DSA3 (CONAE-ESA) optical and radio facilities. Also, an independent data analysis center (Little-IDAC) is planned.

There is an ongoing participation of UNSJ and UNC scientists in the LINCC incubator program. Several outreach and citizen science activities have been developed around the Vera C. Rubin Observatory and LSST data precursors, simulations, and upcoming data nationwide.

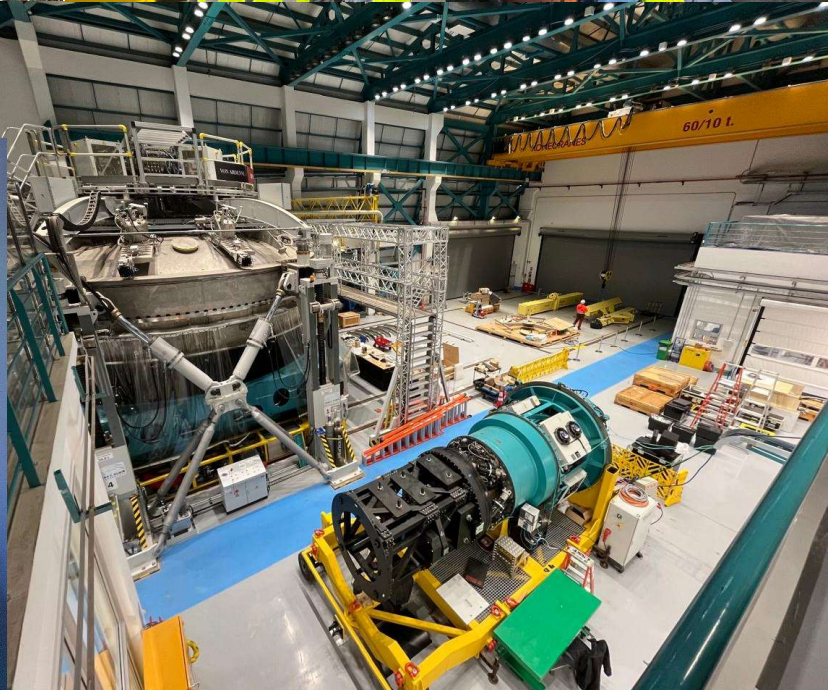
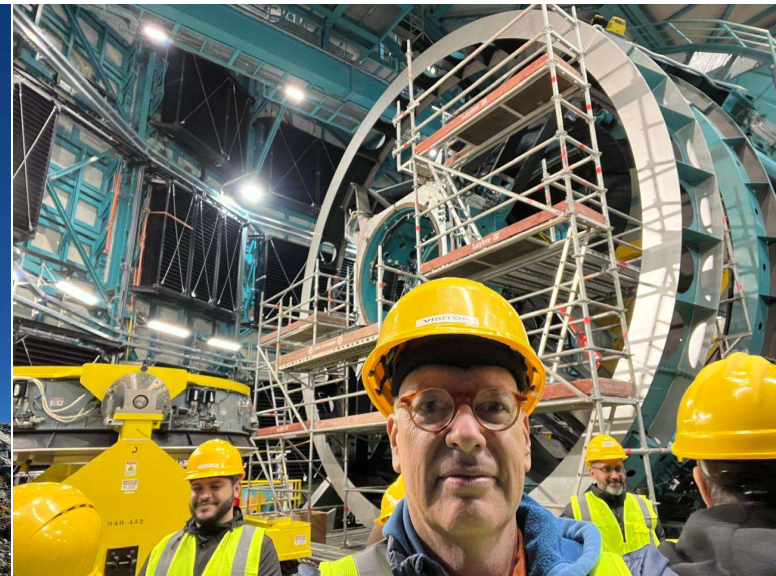
# LSST@LATAM

June 10-14, 2024

La Serena, Chile







# Fink-Brazil Workshop

May 6 – 10, 2024  
Centro Brasileiro de Pesquisas Físicas  
America/Sao\_Paulo timezone



Overview

Venue

Registration fee

Registration

Accommodation

Keynote speakers

Organizers



Enabling Astronomical Transient discoveries in the Rubin era: the  
Fink-Brazil Workshop

**Community brokers:  
receive millions of alerts each  
night from Rubin - Transients!**

# CAPACITACIÓN EN LÍNEA PARA PROFESORAS(ES)

¿DÓNDE?

Zoom  
El link se enviará a los participantes registrados.

¿CUÁNDO?

23 de Agosto del 2024.

¿PARA QUIÉN?

Profesoras(es) de educación media superior y superior.

HORA

10:00-12:00 hrs Ciudad de México  
12:00-14:00hrs Santiago, Chile  
13:00 to 15:00hrs Buenos Aires, Argentina y Brasilia, Brasil.

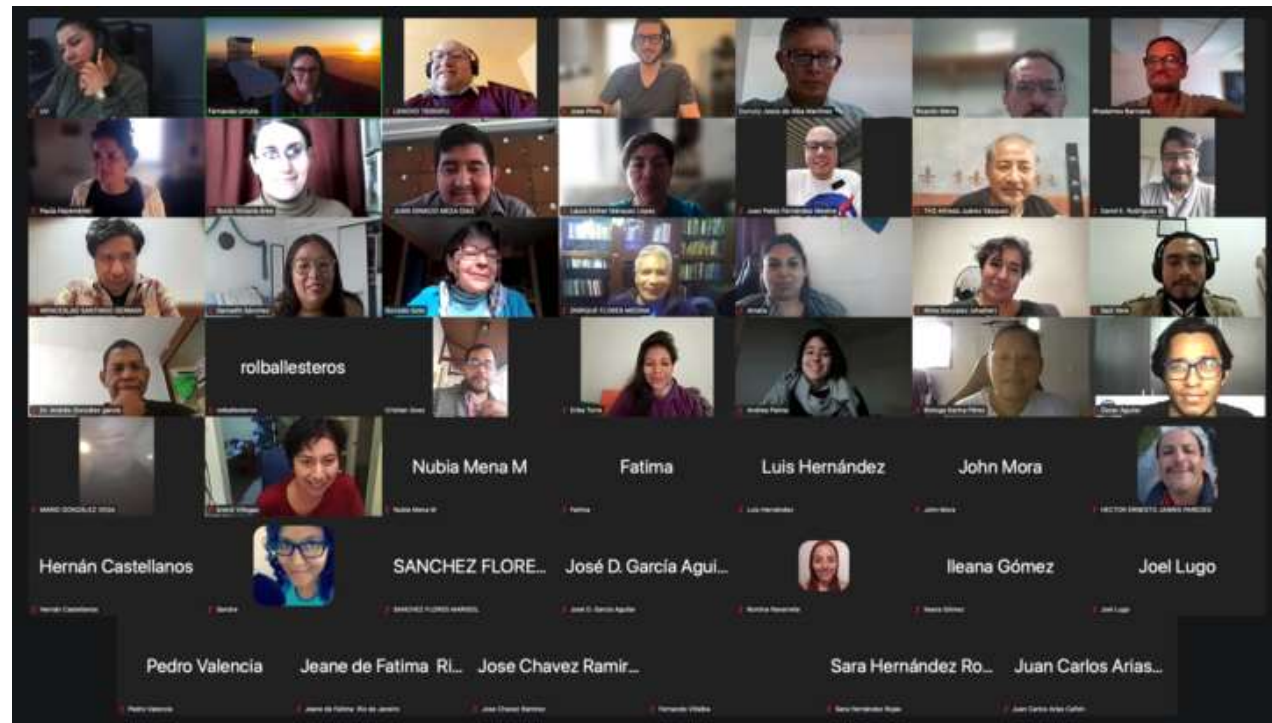
Conoce el Observatorio Vera Rubin, la forma en que revolucionará la astronomía y las actividades educativas desarrolladas por el observatorio, en particular la investigación "Expansión del Universo".

Registro: <https://forms.gle/Gn6UdQHRyEfvY4Uj7>

Fecha límite: 20 de Agosto del 2024  
Evento Gratuito

Más información en <https://shorturl.at/1gqyr>  
Contacto: [gonzalez.alma@ugto.mx](mailto:gonzalez.alma@ugto.mx)

Teacher's online workshop: ~350 registration and a mean attendance of 100 participants, with a peak of 190, during the 2.5 hr event. Coordinated by Fernanda Urrutia, Liaison of Rubin EPO in Chile.





# Major updates



Mexico (2020) and Argentina (2021) joined LSST.

First ICRADA signed with Brazil (LineA) in 2024.

First LSST@LATAM meeting in 2024.

First photon with the Commissioning Camera imminent.

First light with LSSTCam in 2025.