



1

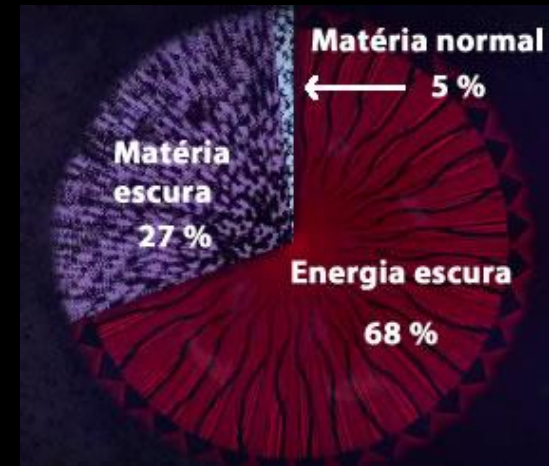
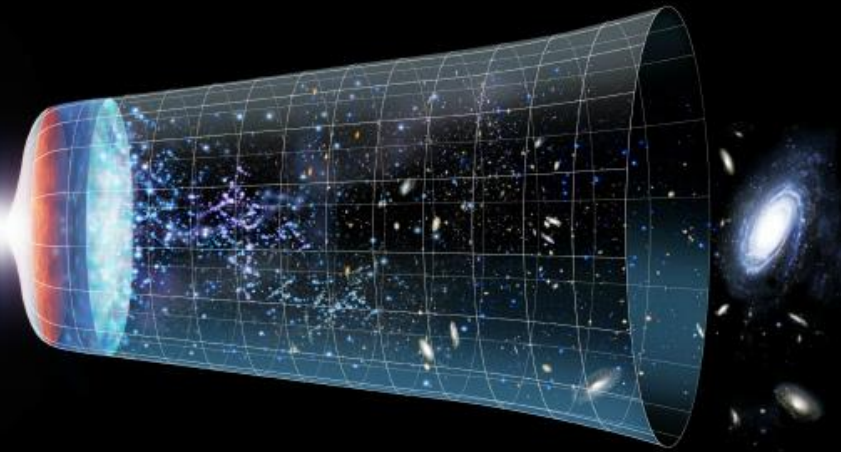
# INCT do e-Universo

**LUIZ NICOLACI DA COSTA**

# Missão INCT

Apoiar a participação de pesquisadores  
brasileiros em grandes projetos internacionais

# Motivação



Implications:

- Cosmological constant ?
- Quantum vacuum energy ?
- Modified gravity theory ?
- A new kind of field ?

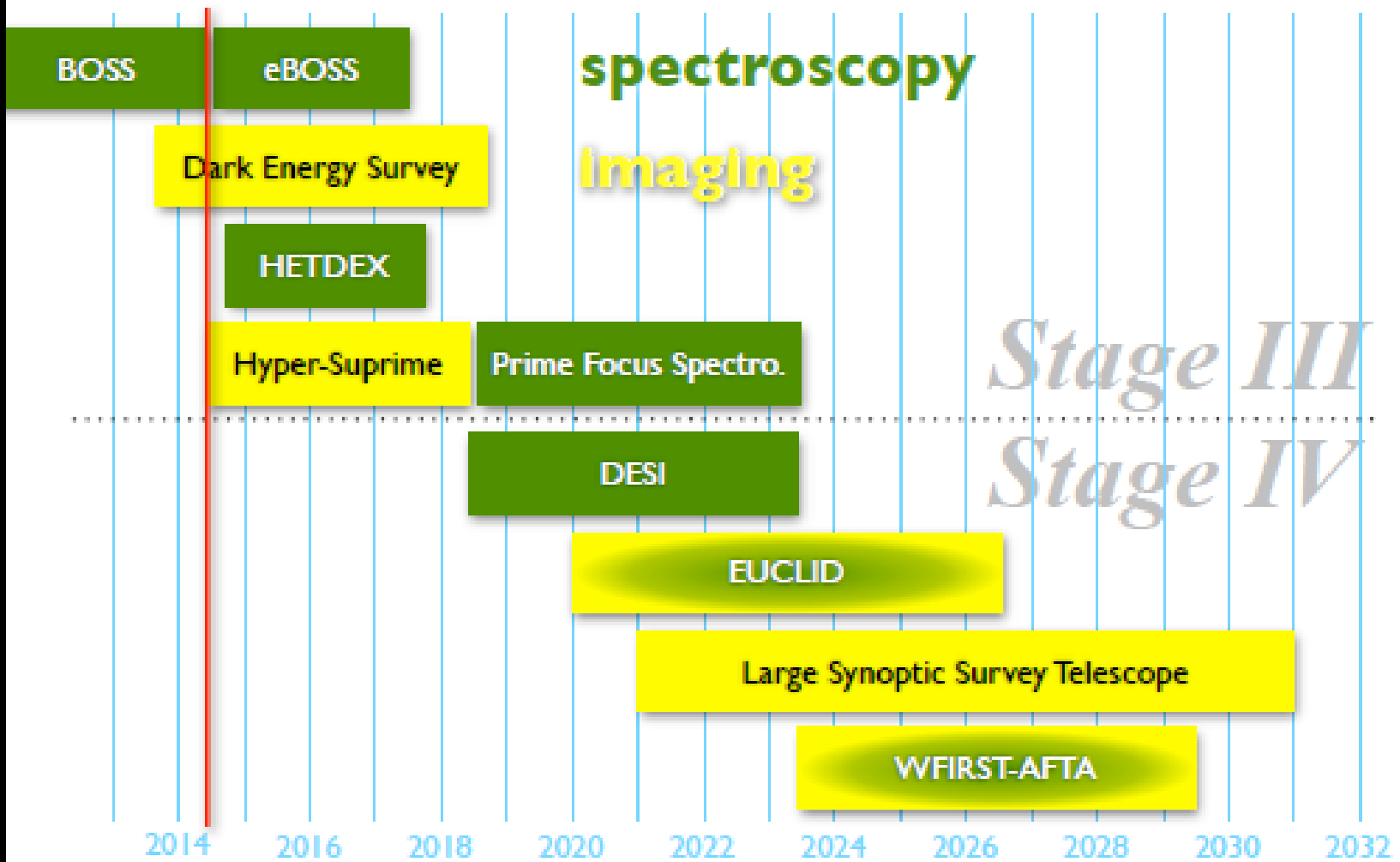


**New Physics**



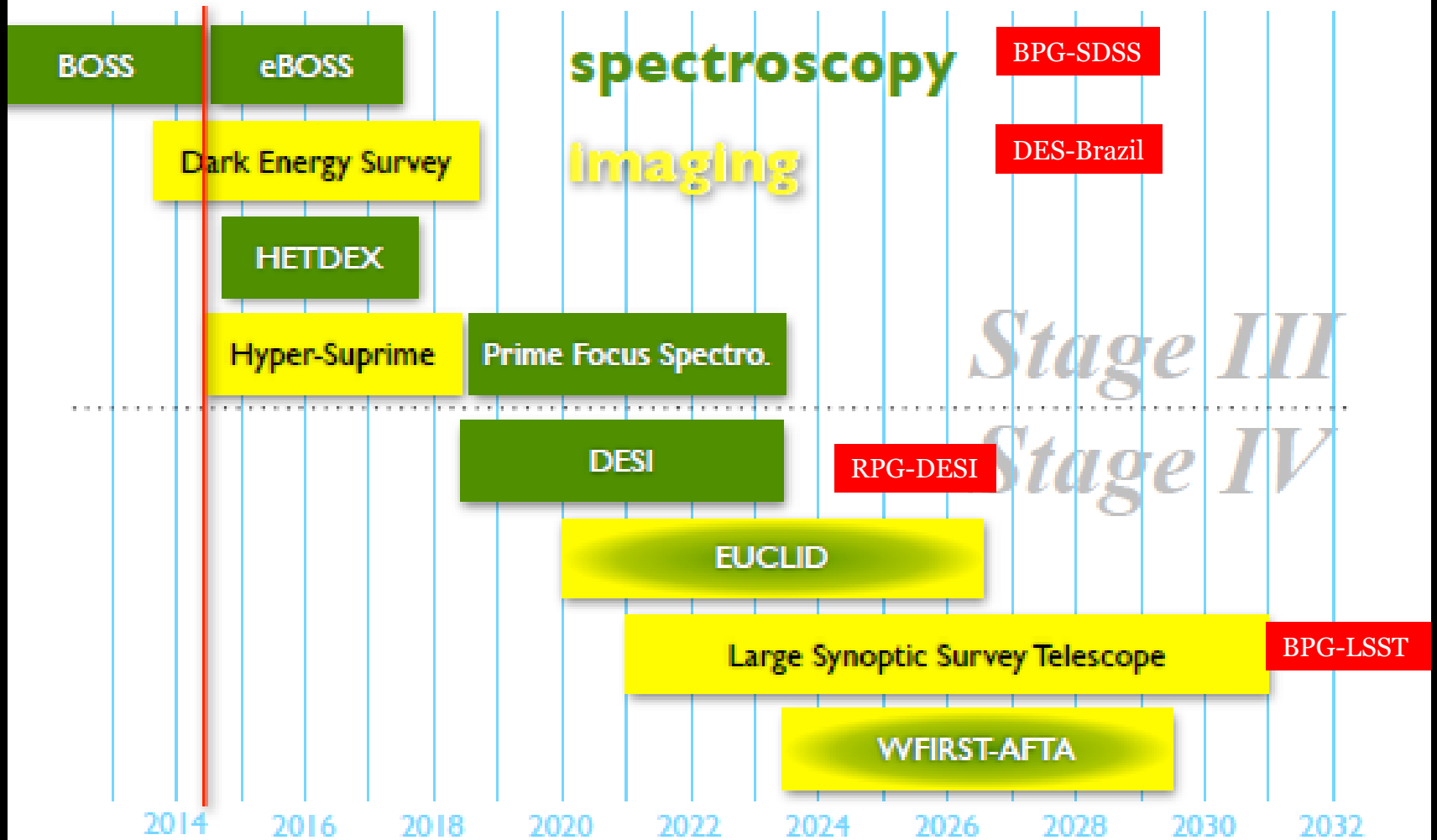
# The dark energy facilities roadmap

**DoE panel**



# Projetos Apoiados

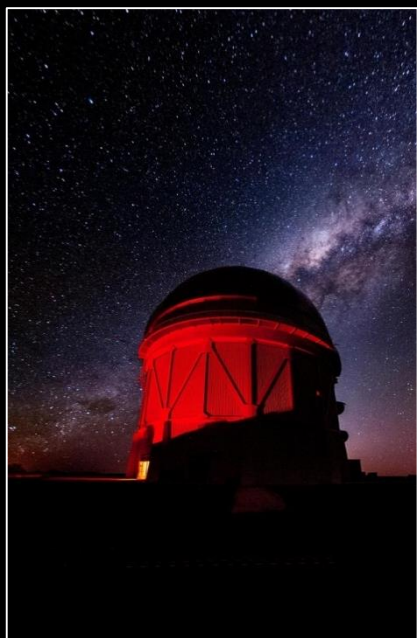
# The dark energy facilities roadmap







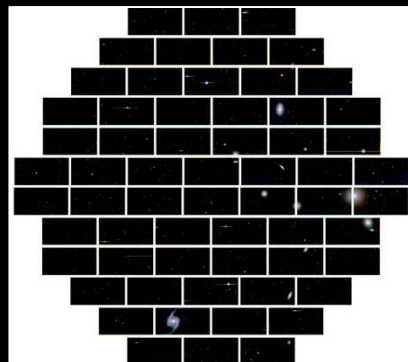
# Dark Energy Survey (DES)



CTIO Chile



Telescópio Blanco 4-m



DECam  
62 CCDs  
570 Mpix  
12 luas

5,000 graus quadrados  
grizY em 600 noites  
10 visitas por filtro  
500 milhões de objetos





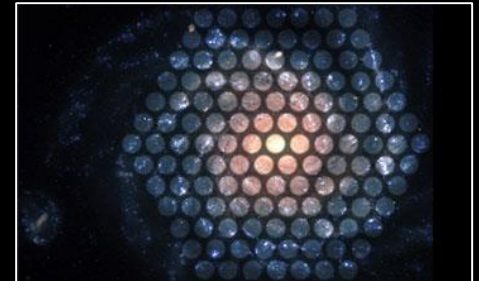
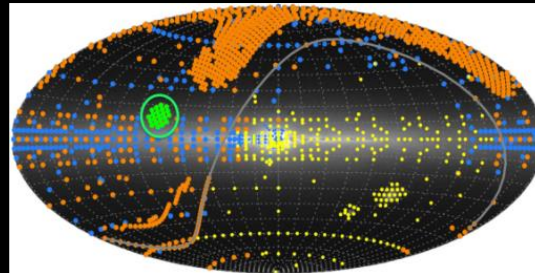
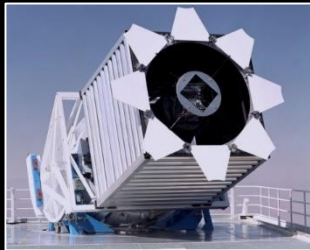
# SDSS

# Sloan Digital Sky Survey

300,000 estrelas

10,000 galáxias

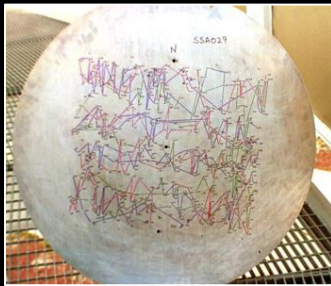
2.5 m



APOGEE

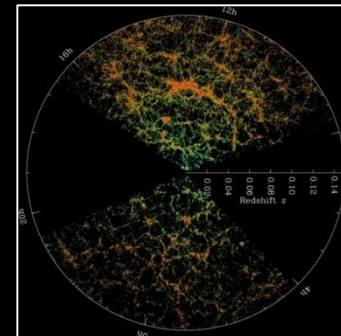
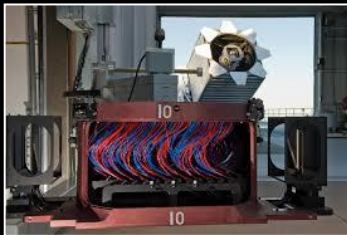
MaNGA

1,000 fibras



1 milhão de galáxias

eBOSS





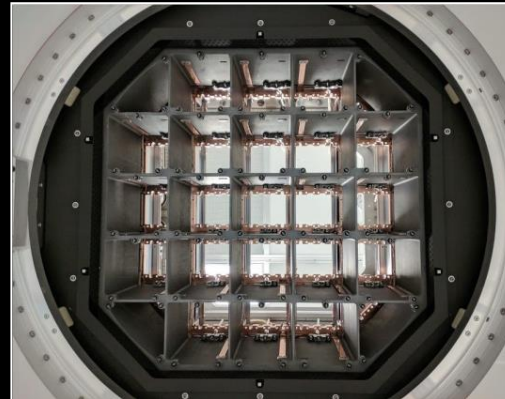
# Large Synoptic Survey Telescope

 LSST: Brazilian Participation Group

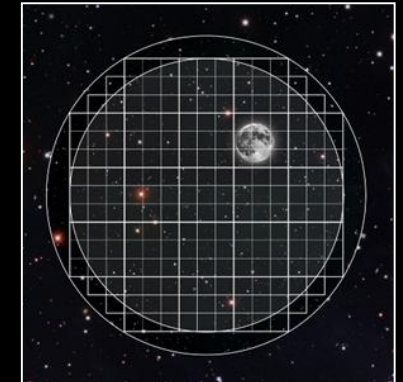


2022-2032 (10 anos)  
20,000 graus quadrados  
800 visitas em cada filtro ugrizy

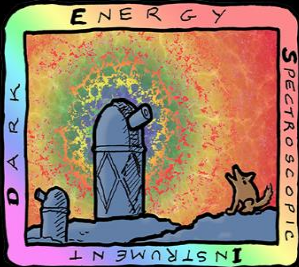
15 Tb/noite  
10 milhões de alertas/noite



3.2 Gpix  
189 CCDs  
40 luas







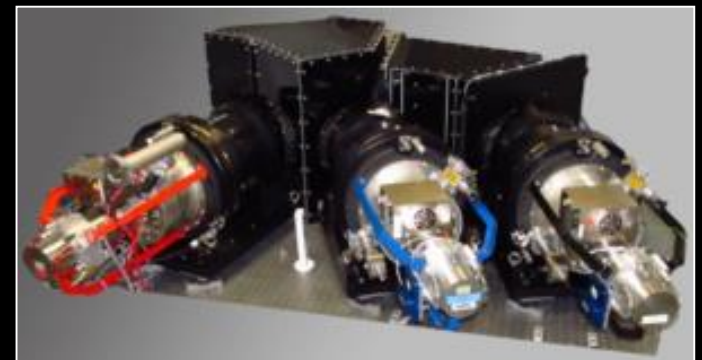
# Dark Energy Spectroscopic Instrument (DESI)



Telescópio Mayall 4-m KPNO, USA

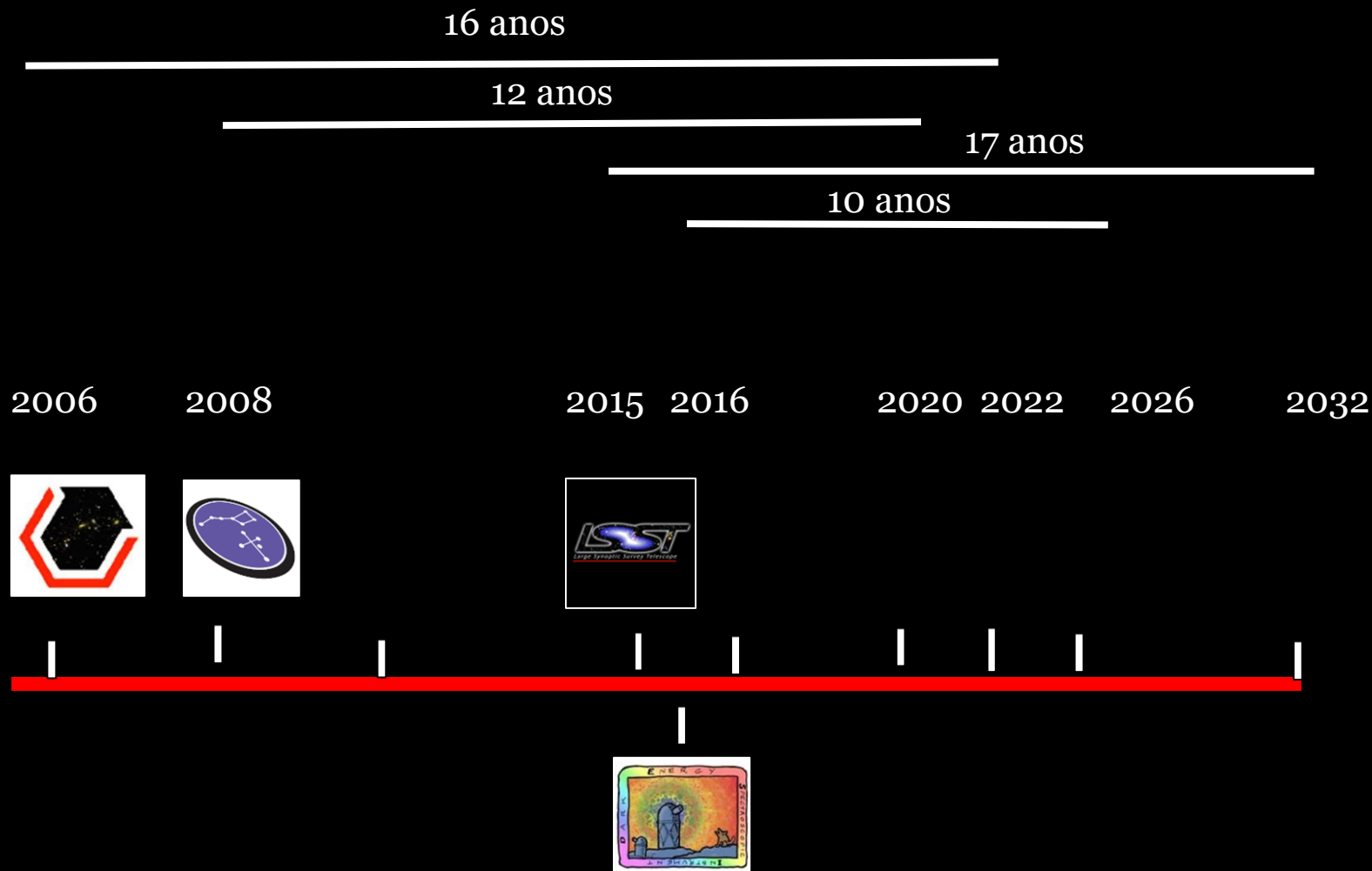


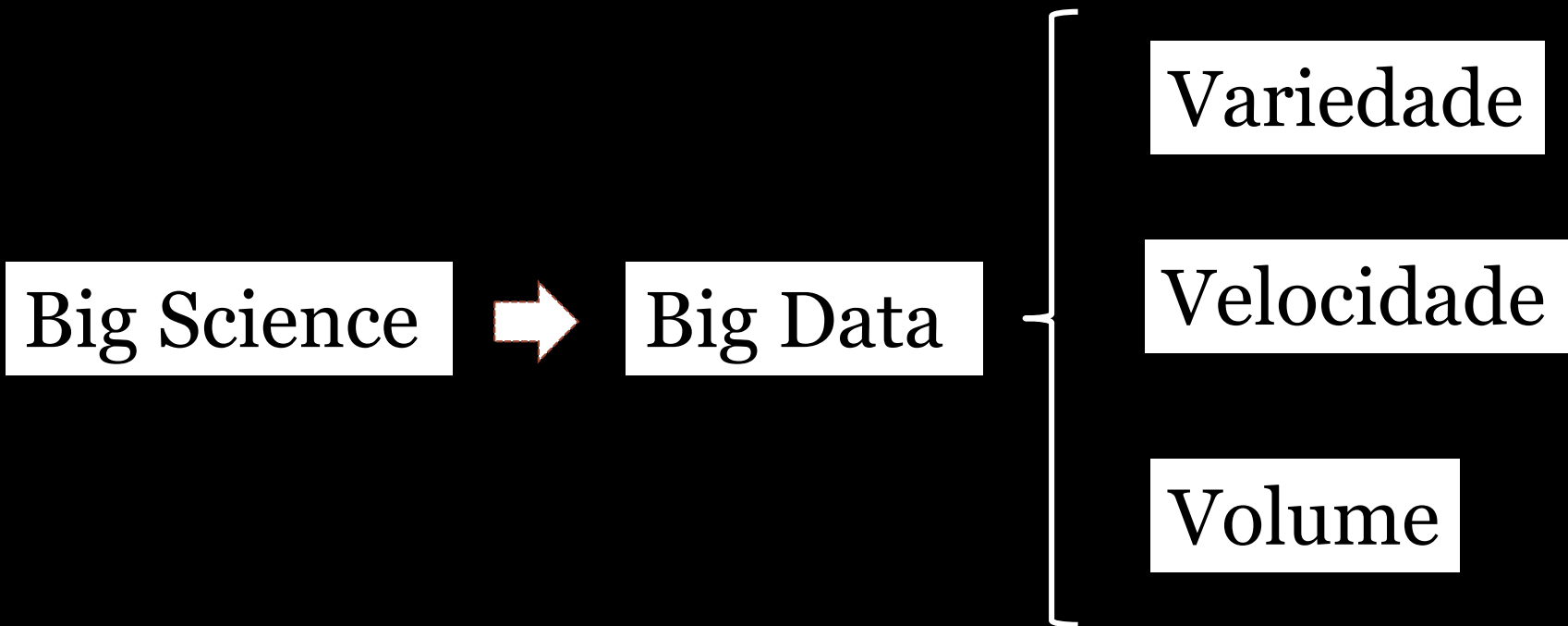
5,000 objetos/exposição



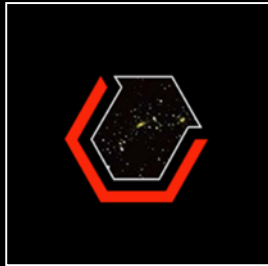
Goal: 35 milhões de espectros

# Linha do tempo

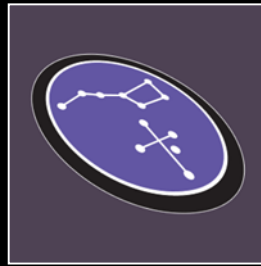




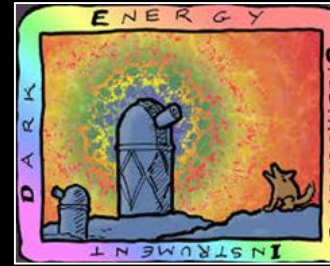
DES



SDSS



DESI



LSST



**Big Science**

**Big Data**

**LineA/INCT**  
(LNCC, ON, RNP)

*Ciência  
Programação  
Operação  
Banco de Dados  
Workflows  
HPC  
Rede*



**Centro de Dados**



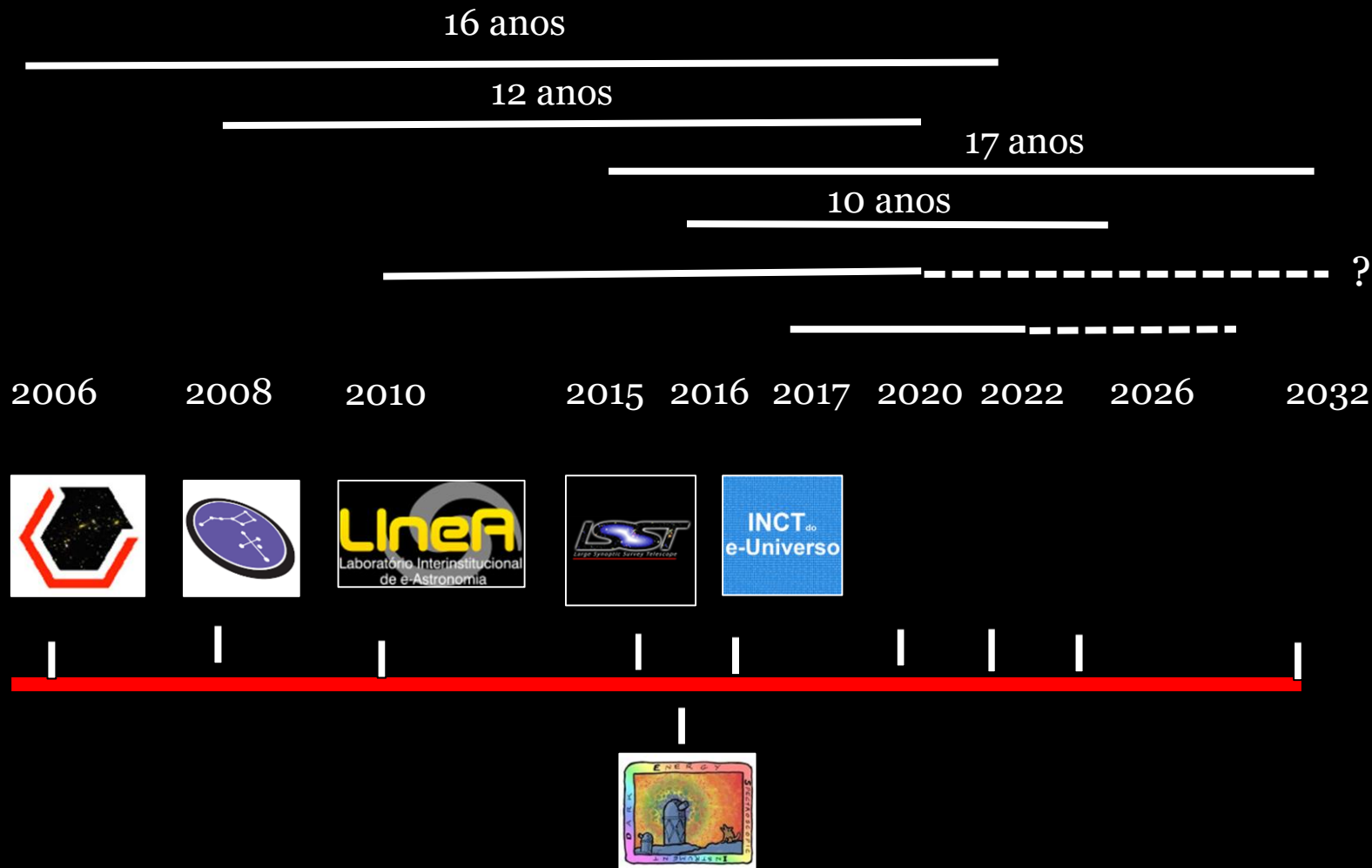
**Software**



**Serviços**



# Linha do tempo

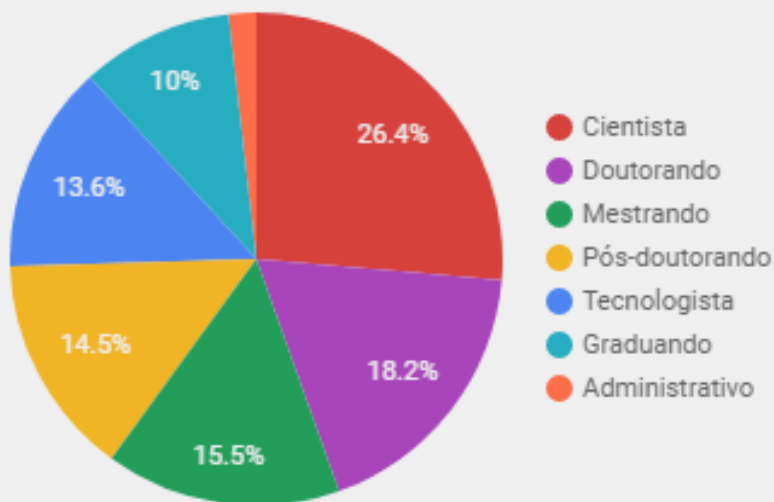


# INCT-LineA: Participantes

# Afiliados

Total  
110

cargo



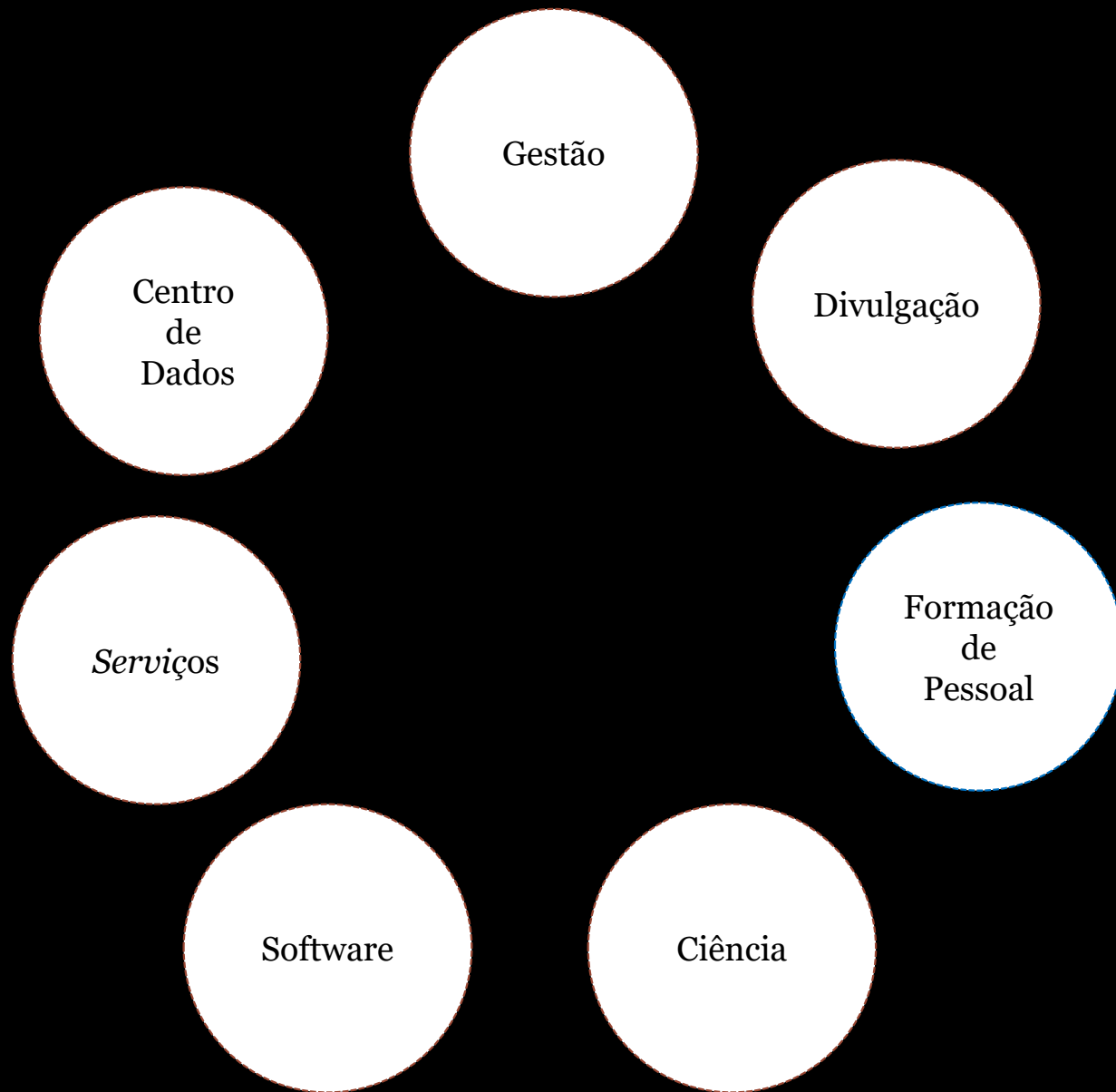
90 pesquisadores

29 pesquisadores seniors

<http://www.linea.gov.br/sobre/>



# Atividades



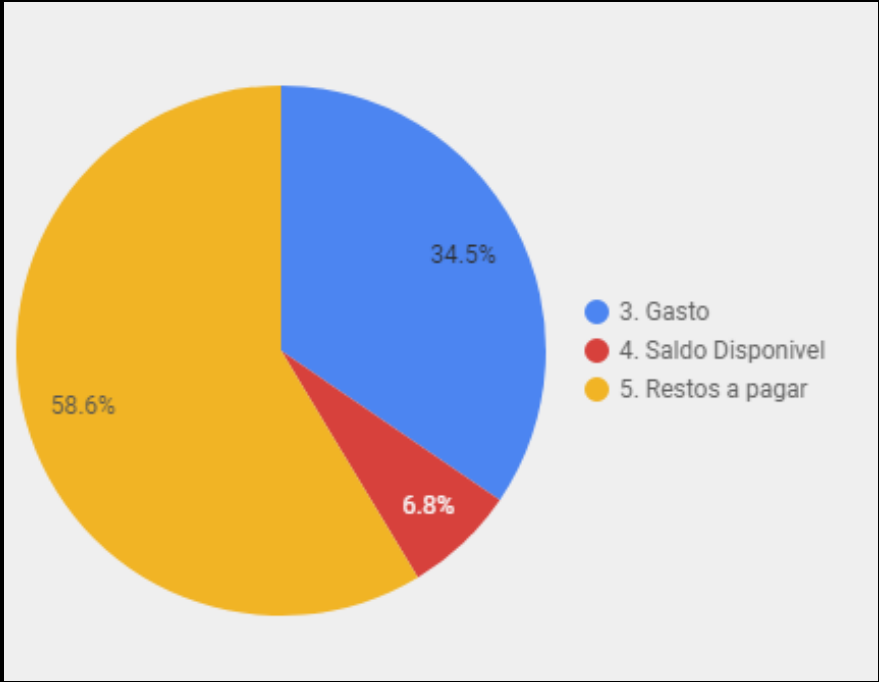
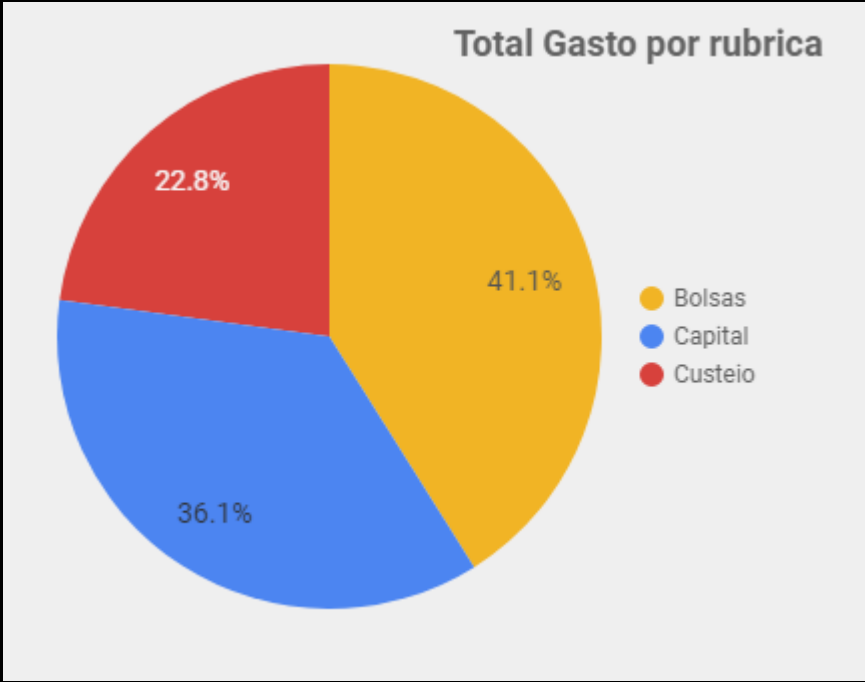


# Gestão

# Interfaces Administrativas

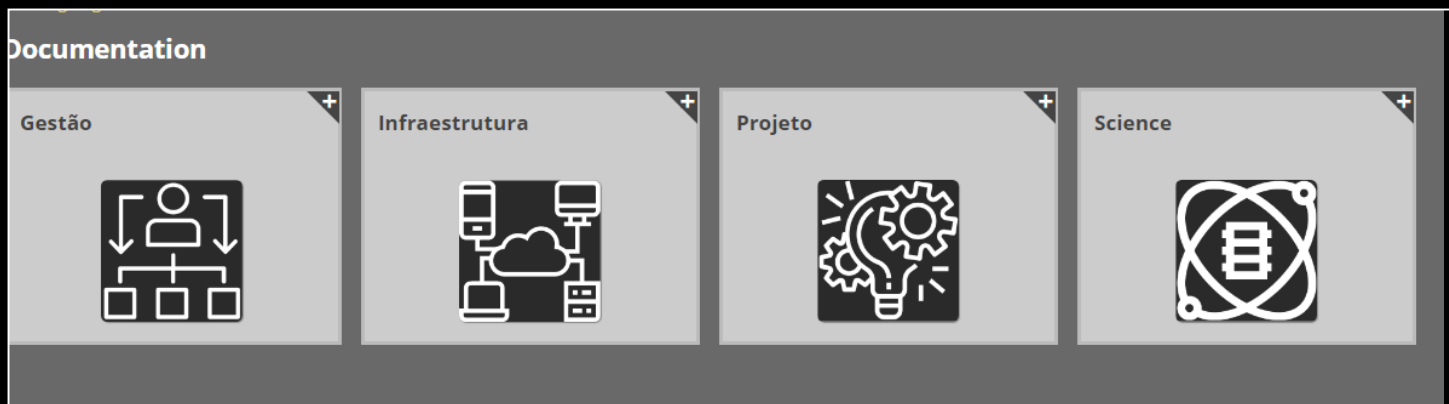
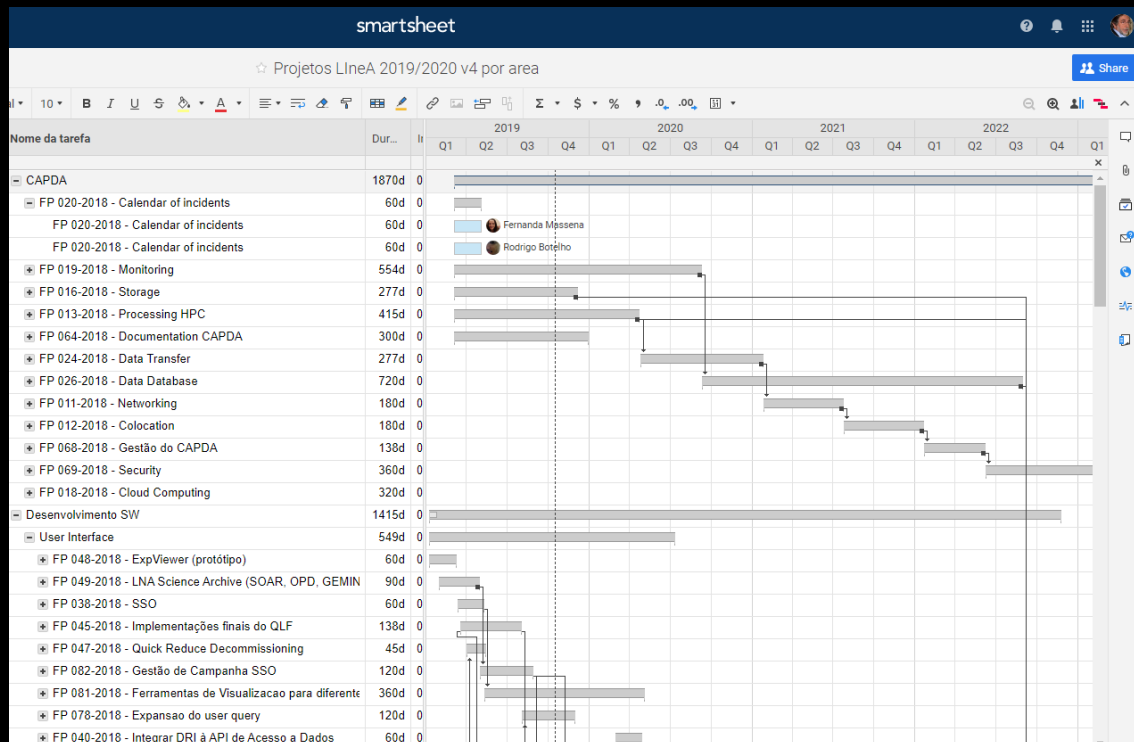


# Interfaces Administrativas

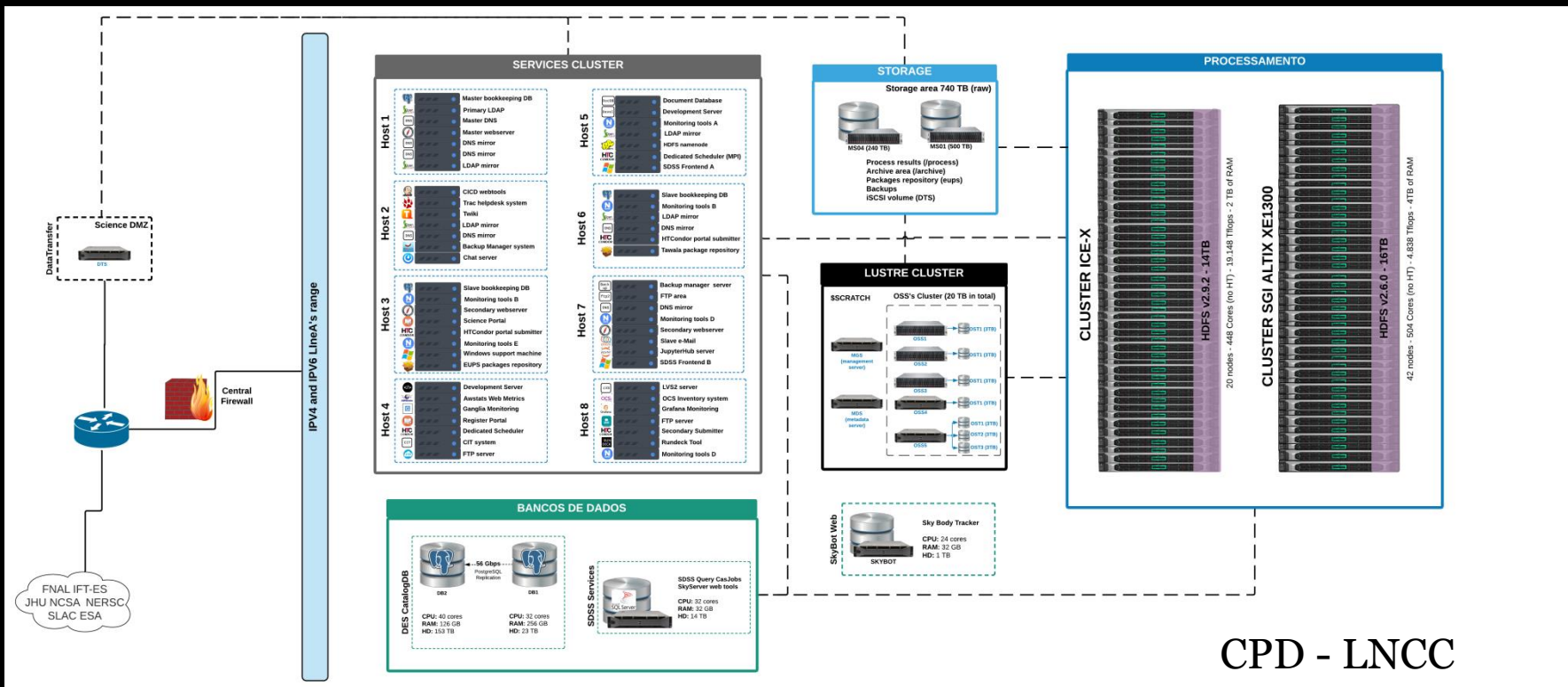


# Planejamento Estratégico

# Documentação



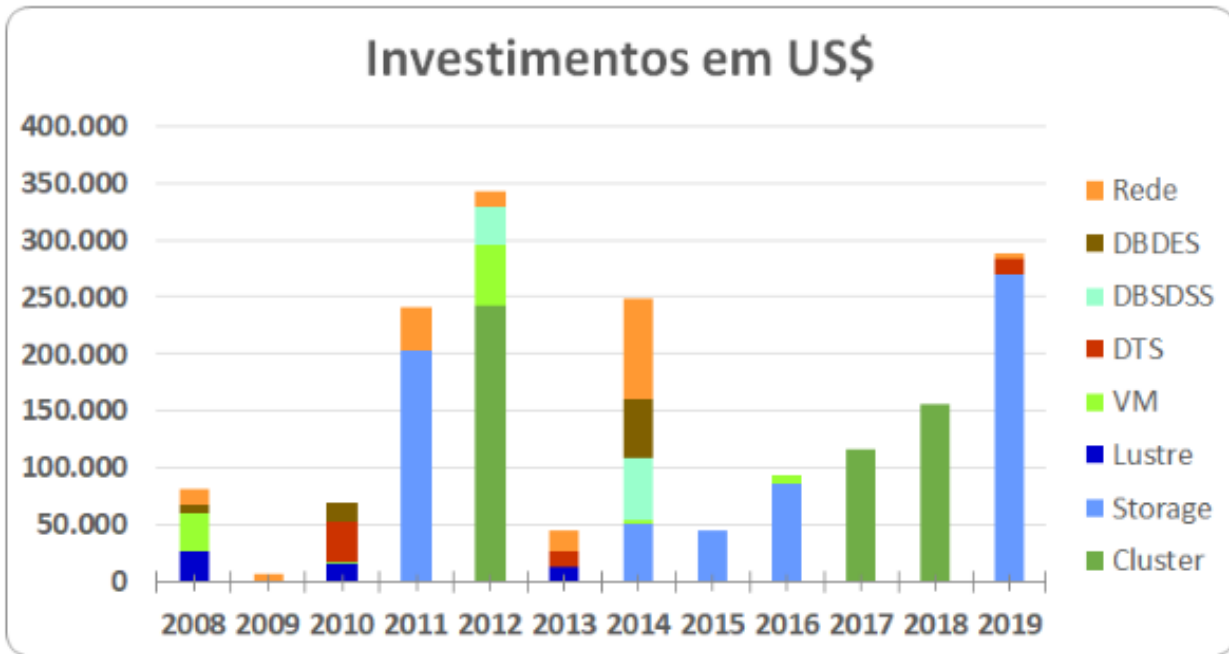
# Centro de Datos



cluster	# nós	# cores	total de ram	Tflops	Instalado em
SGI Altix XE1300	42	504	4TB	4.838	Ago-2012
SGI ICE X	4	96	512GB	3.379	Abr-2017
HPE Apollo 2000	16	448	2TB	15.769	Abr-2019
<b>Total</b>	<b>62</b>	<b>1048</b>	<b>6.5TB</b>	<b>23.986</b>	<b>Abr-2019</b>

**1 PB de armazenamento**





**TOTAL NO PERÍODO US\$ 1.733.600,49**

# Serviços

# Distribuição de Dados

## Acesso à Dados



DES DR1



SDSS



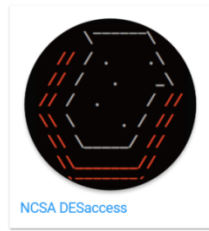
TNO



## Management

### DR1 Data Access

If you'd like to access the images and catalogs from DES DR1, please use the complementary set of tools created by a collaborative effort between NCSA, NOAO, and LineA. These tools allow the users to access, obtain, visualize, and explore DES DR1 products. When using DES data and/or DES access tools please consider the notes in the [Acknowledgement](#) page. Click on the logos below to start exploring DES data tools. Follow the links below to learn more about each tool and their functionalities.



NCSA DESaccess



NOAO DataLab



DES-BRAZIL  
LineA Science Server

From these institutions, a rich and complementary set of tools and interfaces were developed to access and interact with DES data in different

A screenshot of the Sloan Digital Sky Survey III SkyServer website. The page features a navigation menu with links for Home, Data, Schema, Education, Astronomy, SDSS, Contact Us, Download, Site Search, and Help. The main content area includes a welcome message, a news section, and several columns of links for Data Access, Education, Links, and Help. The footer includes a contact information section and a Microsoft logo.

# Ferramentas Colaborativas



# Desenvolvimento de Software

Verification



Quick Reduce  
Quick Look Framework  
LSST expviewer



Access/Validation



CTIO  
Data Science Server  
LineA Science Server



Analysis



Science Portal  
Small Solar System Objects Portal



KPNO



LSST

CTIO



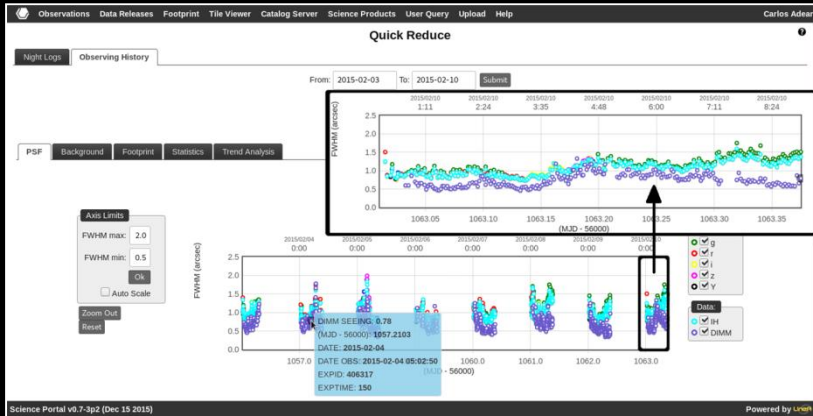
10/10/2



FINEP



# Verificação: análise em tempo-real



## DES Quick Reduce

DESI Quick Look

Home About Us Help Tutorials Contact Us Releases

- Pipeline Monitor**: Control and monitor the execution of the Quick Look pipeline.
- Processing History**: List exposures that have been processed.
- Observing History**: Display time series plots for QA metrics, list of exposures and observed targets for the current night of for a range of nights.
- Afternoon Planning**: Browse QA results for exposures processed by the offline pipeline at NERSC.
- Trend Analysis**: Simple plots using quantities stored in the database.
- Observing Conditions**: Display observing conditions such as atmospheric transparency, seeing, and observing background from the GFA camera.
- Survey Reports**: Show the overall progress and performance of survey.
- Configuration**: Configuration of initial settings for execution.

© Copyright 2016. Powered by Linc. c016c3e 2016-02-20 17:09:58 -0500



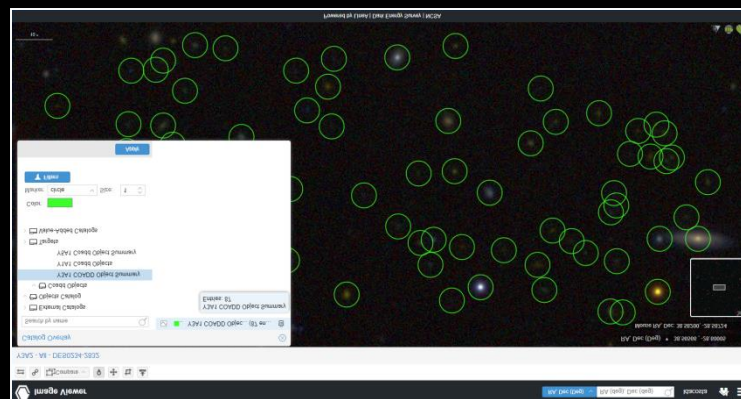
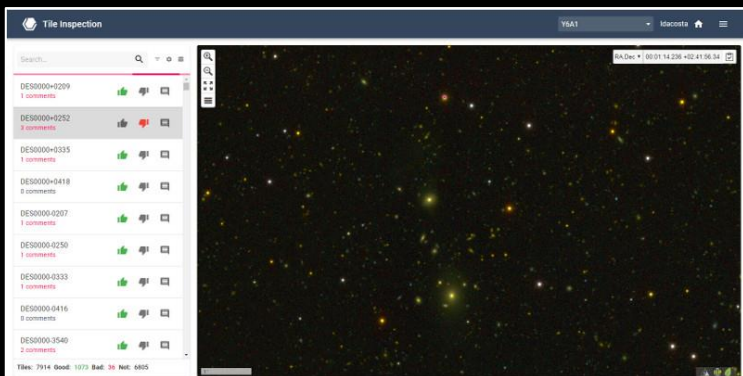
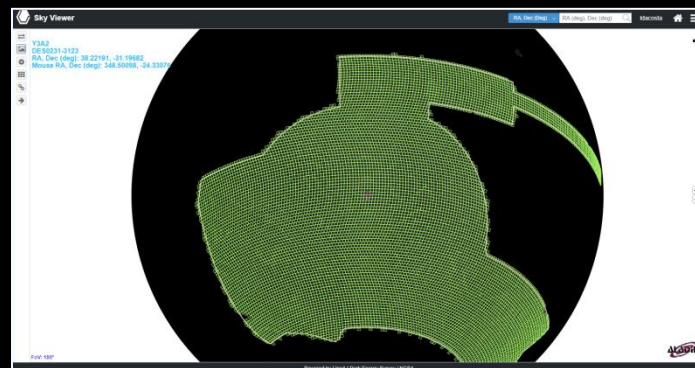
## LSST exposure viewer

## DESI Quick Look Framework



# Validação / Exploração

300 usuários





# DES Science Portal



# LSST Science Portal

Dashboard My Workspace Pipelines Tools Science Products Data Server Documentation Help Luiz da Costa

>>

DES Science Portal: Work

The Science Portal has two instances:

- Workflows: hosts workflows for
- Data Server: provide access to

The system is designed to be self-evident

pré-análise

análise

Grupo de trabalho

Tweets by @des\_portal

DES Science Portal @des\_portal QR results for night 2019-01-25 are available Jan 25, 2019

DES Science Portal @des\_portal QR results for night 2019-01-24 are available Jan 24, 2019

Embed View on Twitter

https://des-portal.lnea.gov.br/ 30 2019 Powered by LineA

# Solar System Portal

# MaNGA Portal

LineA

Occultations

Predictions of occultations for TNOs

This page presents the prediction of occultations by TNOs and Centaurs of Dark Energy Survey for 2019. These predictions are made in the framework of Lucky Star project (led by B. Sicardy) and in collaboration with groups from Paris, Meudon, Granada and Rio.

Information about the predictions can be found in Asafin et al. (2012) and Camargo et al. (2014). Predictions make use of ephemerides section and of Gaia DR2 (Gaia Collaboration, 2018) for the position of the stars and the proper motions.

Occultations for objects with too uncertain orbit are not presented. (2060) Chiron, (136199) Ena, (47171) 1999TC36, (120348) 2004TY364, (144897) 2004UX10, (303775) 2005QU182, (145452) 2005RN43, (145488) 2005TB190 are presented in the main Lucky Star webpage.

Date Filter

Start Date [ ] End Date [ ] Magnitude: 4.18 Diameter (km): 0.0

Object: [ ] Dynamic Class: [ ] Zone: [ ]

Object Number, name or designation: [ ] Select a Dynamic Class: [ ] Select a Zone: [ ]

Sort By: [ ]

2014 QE442 2014 QE442 2007 TZ417 2007 TZ417

LineA

LineA

Verfer

Visualization

Inputs

Wavelength: manga-6138-6101-MEGA Filter: F\_Norm

Galaxy

F\_Norm

Spectra

x=30, y=27

Flux

Depth

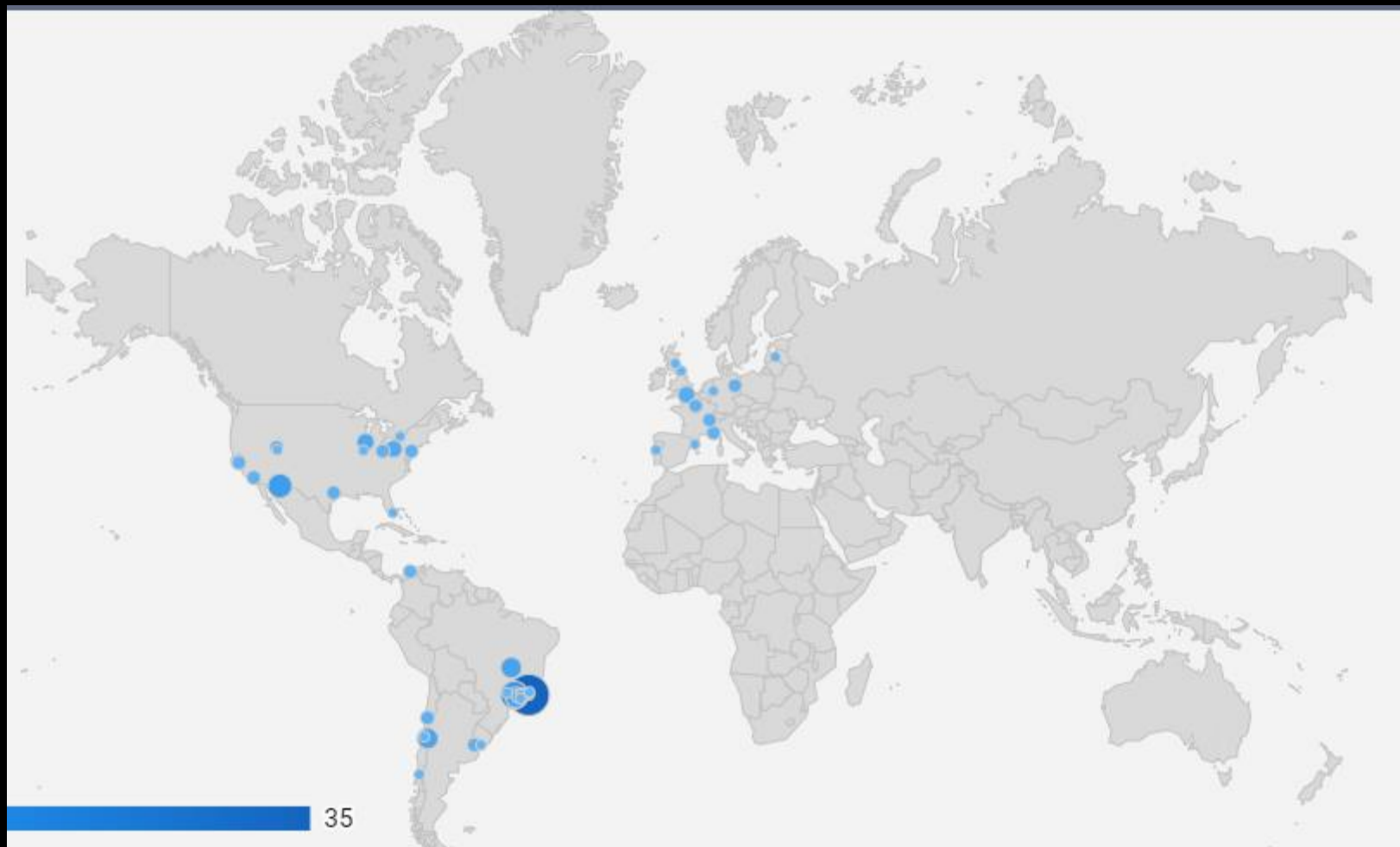
LineA

# Ciência

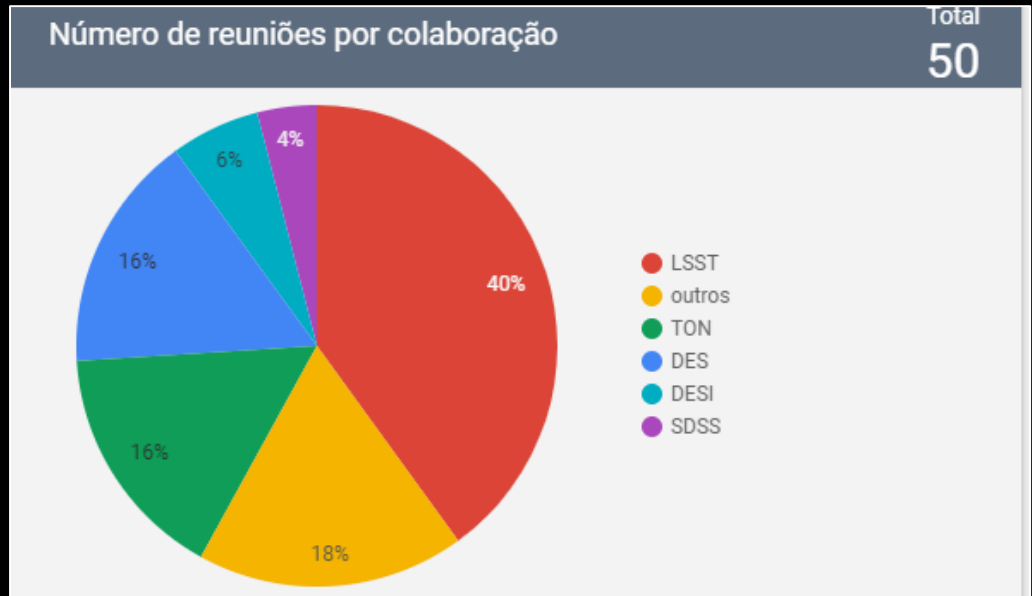
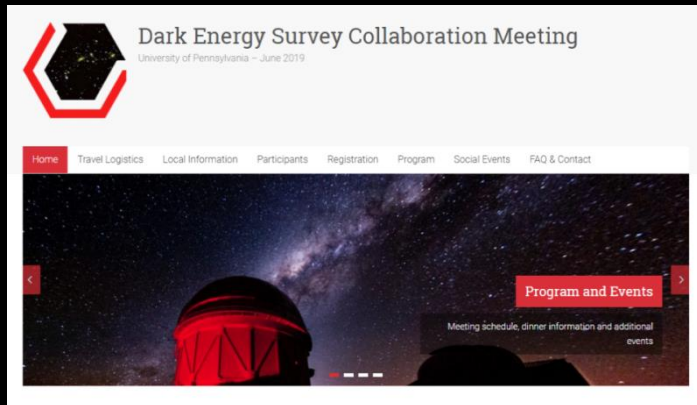
# Internacionalização

Total de Eventos

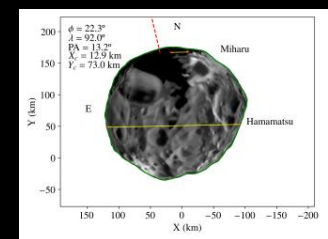
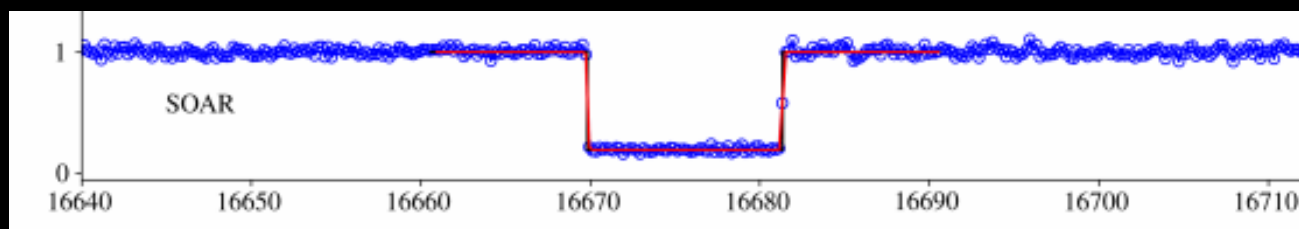
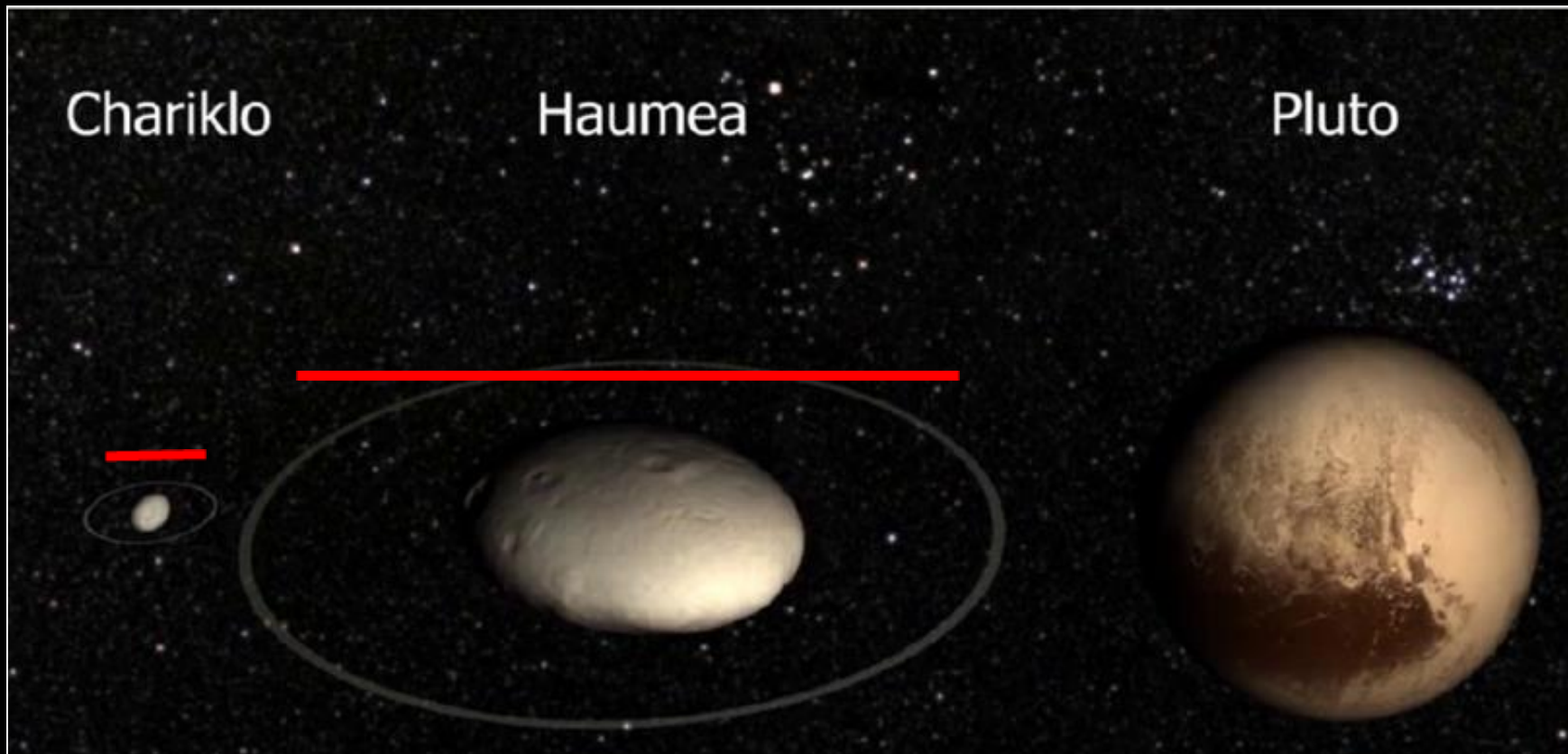
112



# Reuniões Internacionais



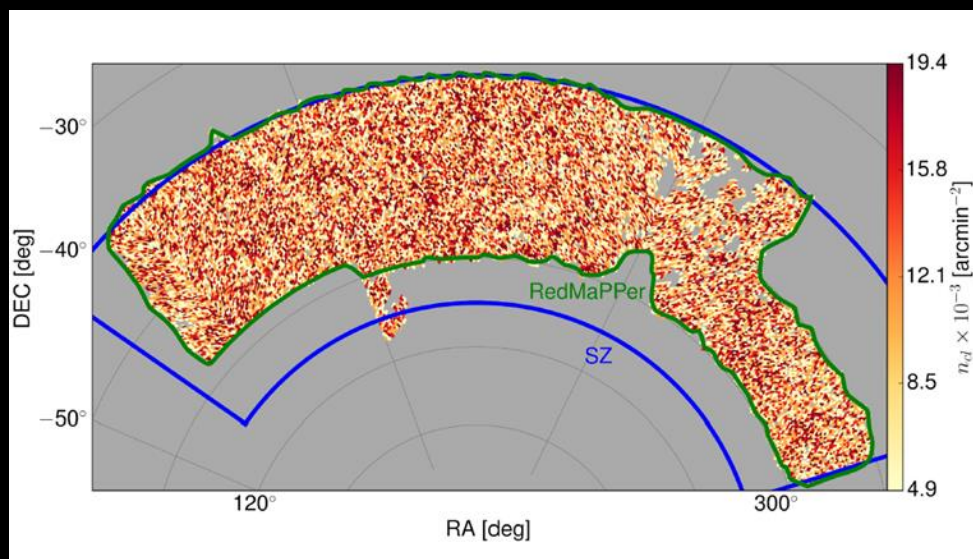
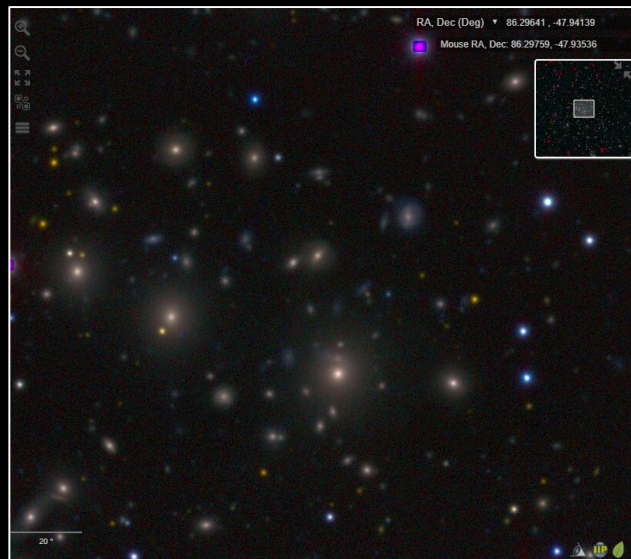
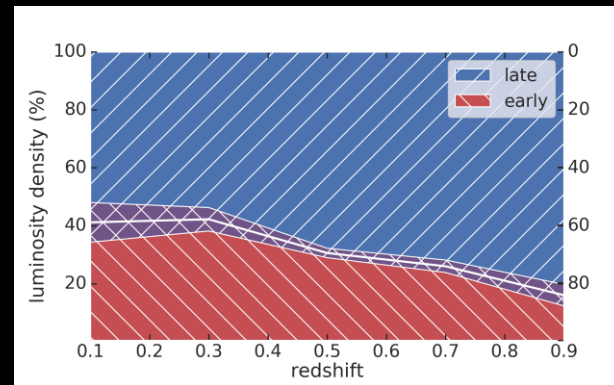
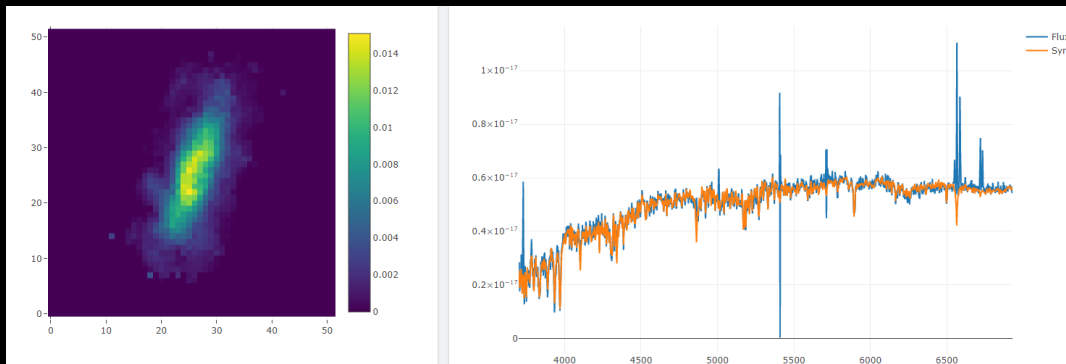
# Sistema Solar





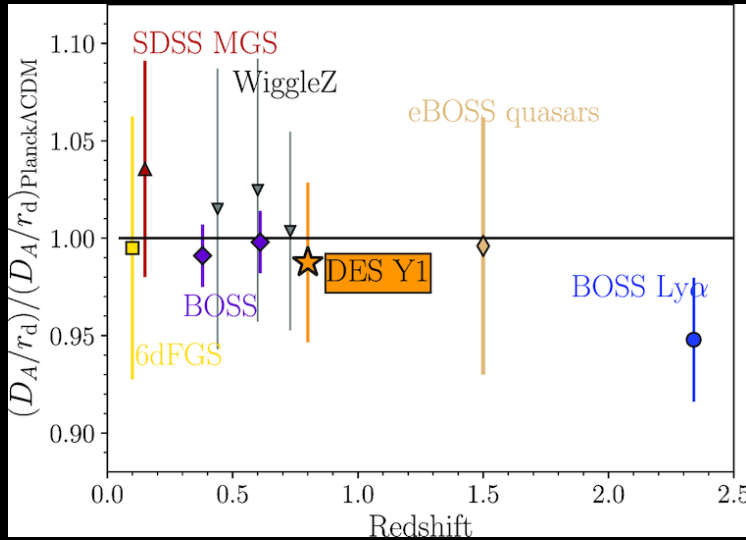


# Astronomia Extragaláctica

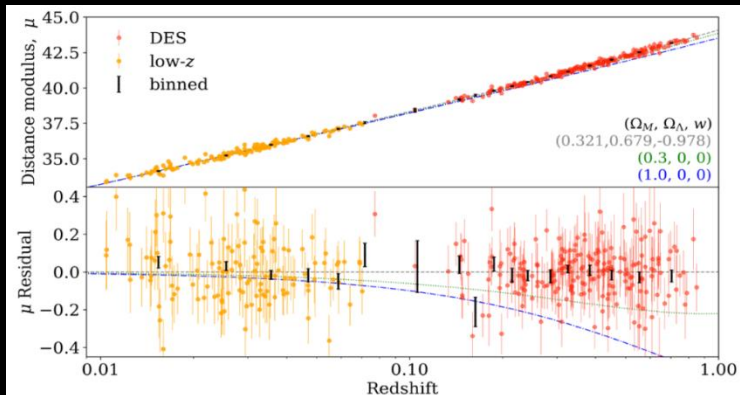
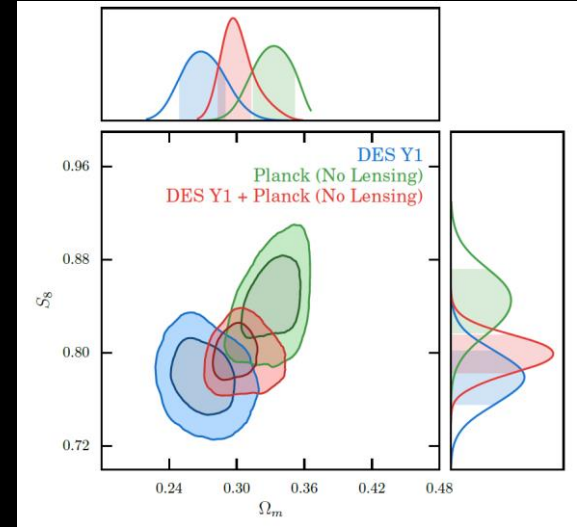


# Cosmologia

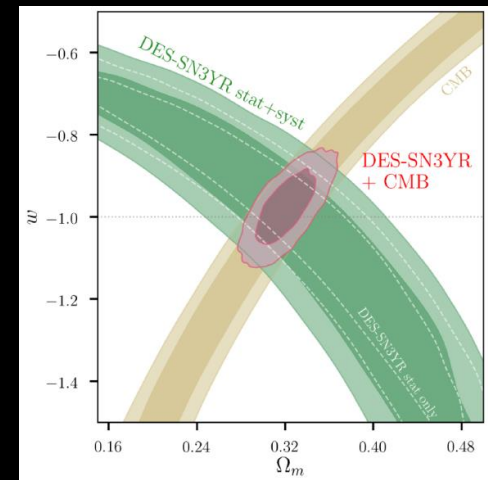
## BAO



## 3 x 2pt

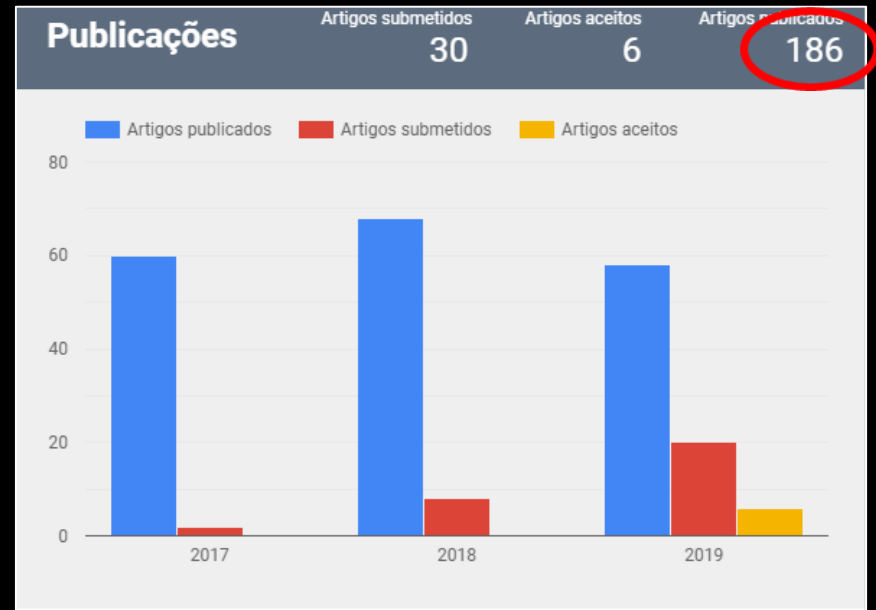
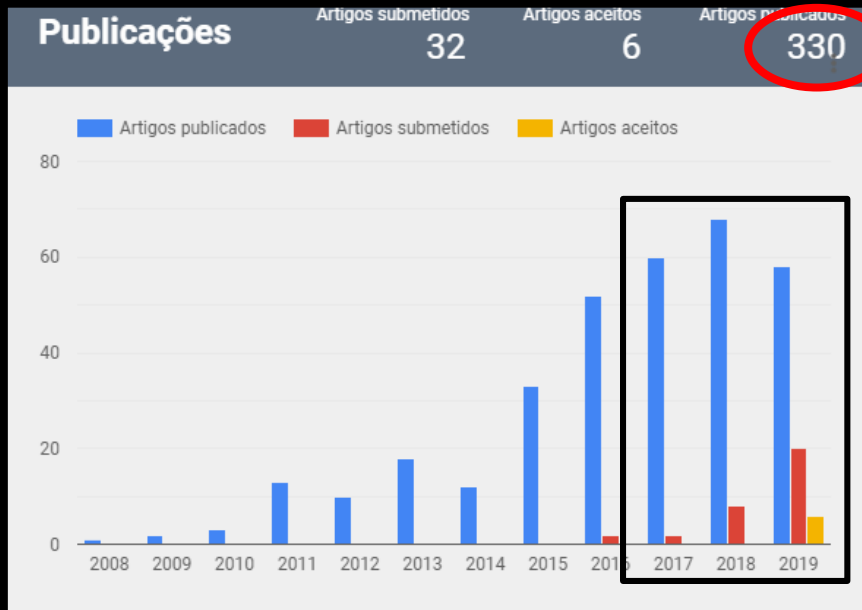


## SN Ia





# Publicações



62 artigos/ano

# Formação de Pessoal

# Webinars

2019 26



Nathalie Palanque-Delabrouille (CEA) – 26/09/19

26/09/2019



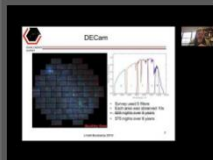
Andrea Cattaneo (Observatoire de Paris) – 19/09/19

19/09/2019



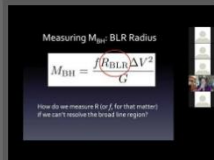
Pedro Beaklini (USP) – 12/09/19

12/09/2019



Robert Gruendl (University of Illinois) – 05/09/19

05/09/2019



Kate Grier (University of Arizona) – 29/08/19

29/08/2019



Sugata Kaviraj (University of Hertfordshire) – 22/08/19

22/08/2019



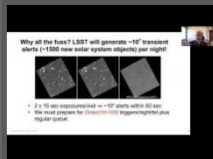
Edward Schlafly (Lawrence Berkeley National Laboratory) –

08/08/2019



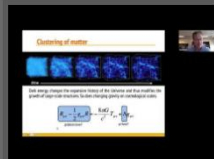
Joe Zuntz (University of Edinburgh) – 01/08/19

01/08/2019



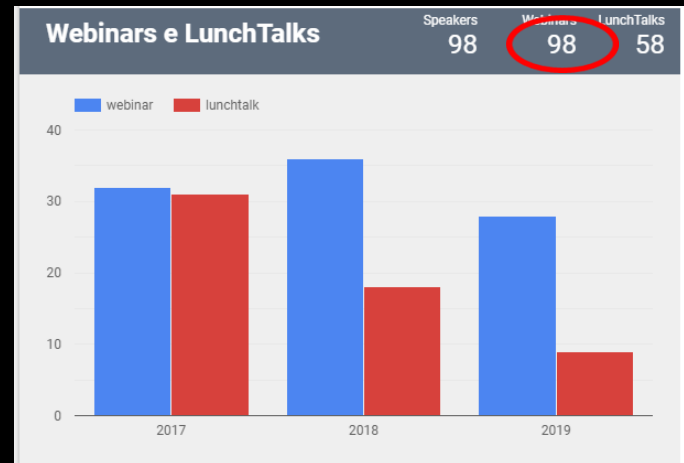
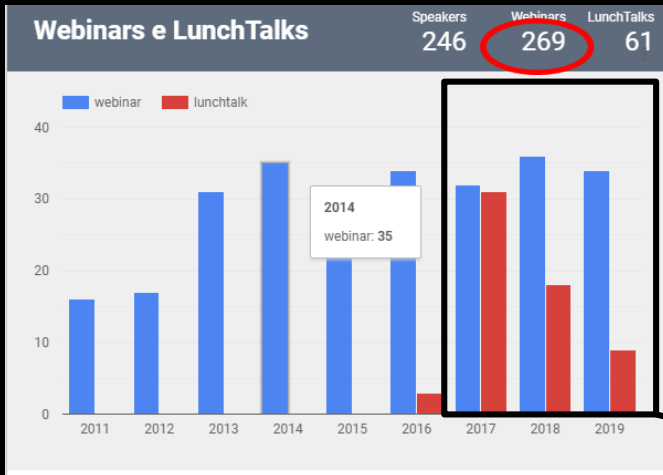
Bryan Miller (Gemini Observatory) – 25/07/19

25/07/2019

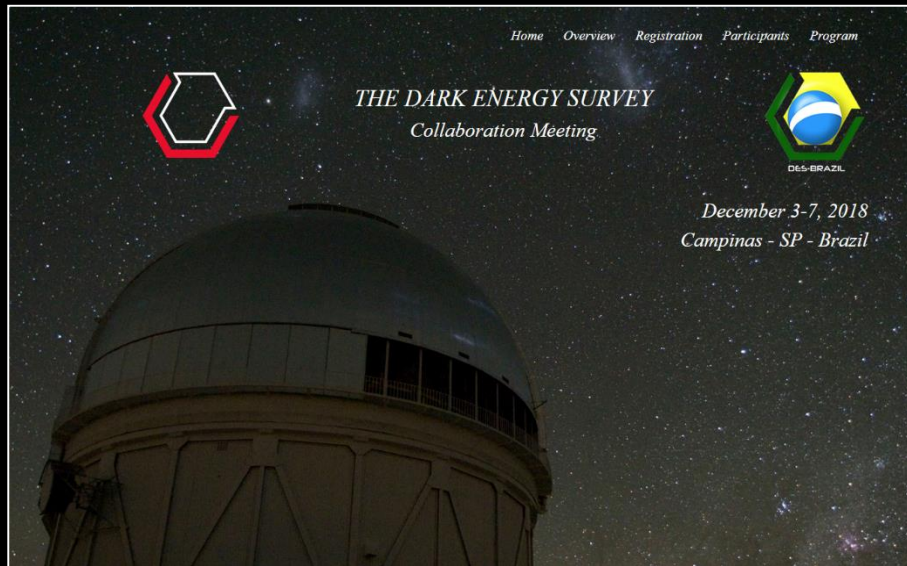


Henk Hoekstra (Leiden University) – 18/07/19

18/07/2019



# Reuniões internacionais organizadas no Brasil



## South American Workshop on Cosmology in the LSST Era

December 17-21, 2018

São Paulo, Brazil

ICTP-SAIFR/IFT-UNESP



# Treinamento



OPORTUNIDADE PARA NOVOS MEMBROS

VENHA CONHECER SERVIÇOS E FERRAMENTAS DISPONÍVEIS

APRESENTAÇÕES

TUTORIAIS

AULAS PRÁTICAS

**LineA BOOT CAMP**

2 - 6 SETEMBRO 2019

Auditório do LineA  
Casa Branca - Observatório Nacional RJ  
Informações: [bootcamp@linea.gov.br](mailto:bootcamp@linea.gov.br)

LineA Laboratório Interinstitucional de e-Astronomia  
Rua General Saldanha  
Vila do Paraisópolis, RJ  
09090-000  
[www.linea.gov.br](http://www.linea.gov.br)

LineA INCT do Universo



# Aula de Inglês

# Divulgação



# Ciência para todos



LineA News Nº 43, 2019

## Notícias

08 de Abril  
INCT do e-Universo e LineA realizam planejamento estratégico

05 de Abril  
Novos dados de levantamento astronômico incluem ferramentas para...

04 de Abril  
Colaboração científica entre afiliado do INCT do e-Universo e pesquisadora da...

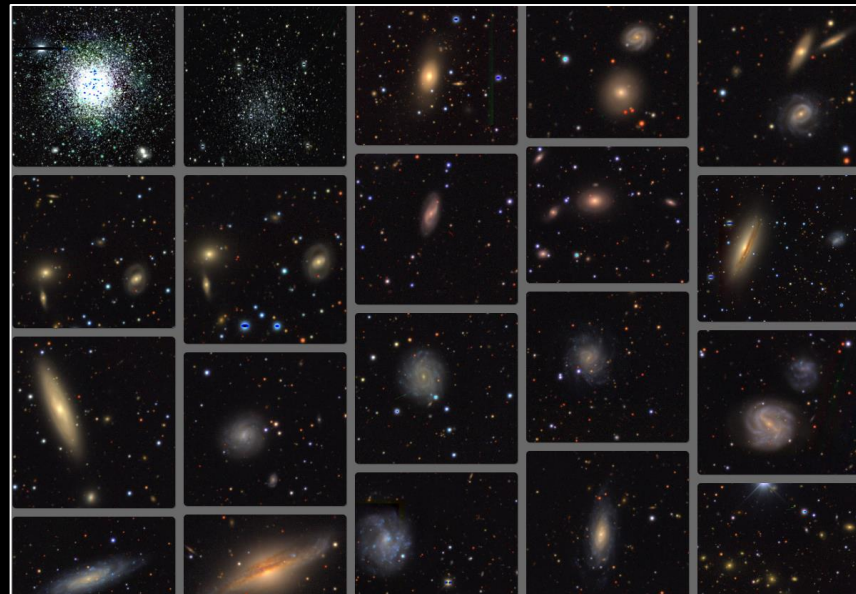
27 de Março  
17ª edição do Programa de Verão do LNCC

06 de Fevereiro  
Nos limites do Sistema Solar: a passagem da sonda New Horizons pelo...

11 de Janeiro  
Dark Energy Survey completa missão de seis anos

03 de Janeiro  
Predição de ocultações estelares por objetos Troianos de Júpiter

21 de Dezembro  
Especialistas discutem resultados esperados de futuro megatelescópio



## Física do Universo

Rogério Rosenfeld  
Instituto de Física Teórica-UNESP  
ICTP-SAIFR

Ensino Médio - 2017

## De PLANETAS A Buracos negros

DIA 30 DE AGOSTO



ON



2018

SNCT 2019



Planetário-RJ



2019

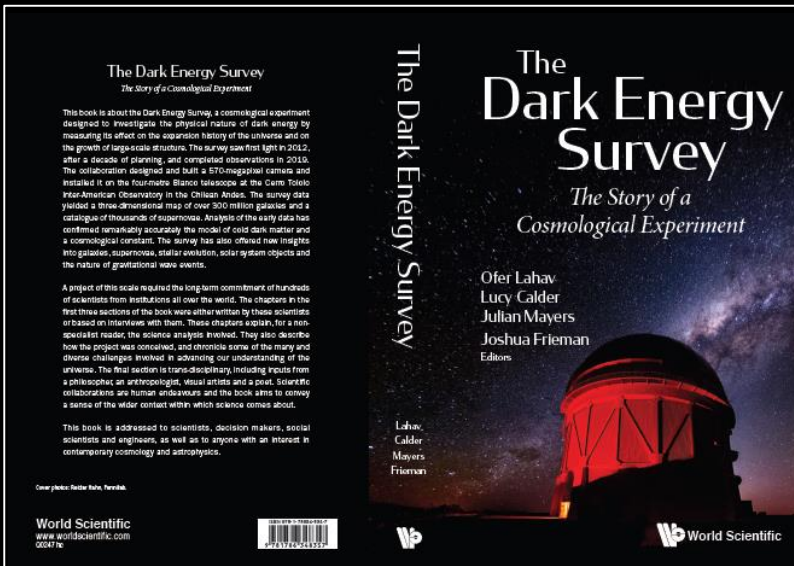
5,000 visitantes



Casa da Descoberta



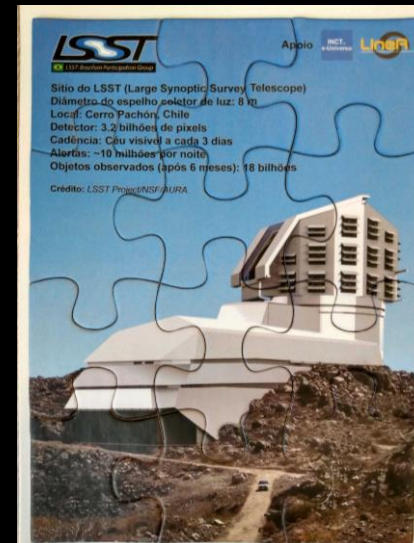
# Livro do DES



# Vídeo INCT



# Quebra-cabeças



# Ciência na Escola

PI PERIMETER INSTITUTE

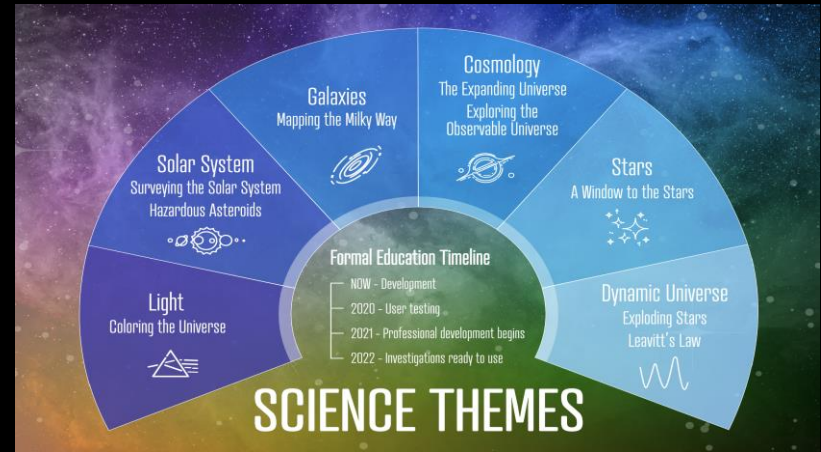
GRADE TYPE TOPIC POSTERS COMMUNITY

**Individual Lessons**

Looking for an activity or worksheet for a specific topic? Find it here.

Sort by:

Understanding the Image of M87*	Seeing Black Holes with an Earth-sized Telescope	Science in the News - Biggest Radio Telescope Gets Bigger	Making Models: Wooden Blocks	
An Introduction to Dark Matter	Asking Questions	Black Hole Video Summary	Black holes and the Schwarzschild Radius	
Bubble Chamber	Case Studies	Dark Matter and	Dark Matter and	



Jupyter notebooks

**TEEN ASTRONOMY CAFÉ PROGRAM**

High school students explore the Cosmic Microwave Background, Dark Matter, and Dark Energy.

**Galactic Archaeology** from Little to Big with Erika Patel

**Life and Death of Stars** with Dr. Gautham Narayan

**Black Holes and the Fate of Galaxies** with Dr. Stephanie Janusz

**Looking through Gravitational Lenses** with Dr. Adam Bolton

**LSST**

**Making H-R Diagrams: Star Cluster NGC 2516**

Locate the star cluster in this image. Not all the stars you see in the image are actually stars in the cluster—some are much closer to Earth than the stars in the cluster, and some are farther away. Because of their different distances, these stars can provide inaccurate information on an H-R Diagram if plotted with the stars in the cluster.

Draw a circle around the stars that you think belong to the star cluster. Those stars will be plotted on the H-R Diagram.

**H-R Diagram**

Solar Luminosity (y-axis)

Temperature (K) (x-axis)

Colors approximate star colors

← BACK CONTINUE →



# Ciência Cidadã

Rede Brasileira de Ocultação

50 -40 cm telescopes  
Escolas secundarias

Fundação Templeton  
US\$ 500k



# Resultados

# Impacto Intelectual

- Publicação de mais de **180 publicações** nos últimos três anos nos mais variados tópicos de astronomia e cosmologia.
- **Oito** teses de doutorado e **seis** dissertações de mestrado.
- Desenvolvimento de sistemas de software para as colaborações internacionais.
- Criação de um laboratório de ciência de dados voltado para explorar o céu digital.
- Participação de pesquisadores brasileiros em projetos de pesquisa de ponta.

# Impacto Social

- Internacionalização de pesquisadores e tecnologistas através de colaborações científicas e tecnológicas.
- Projeção internacional de tecnologistas brasileiros.
- Formação científica da população através de diferentes iniciativas de divulgação.
- Preparação de projetos de Ciência cidadã utilizando ferramentas desenvolvidas pelo time de TI e usando a infraestrutura do LIneA.

# Impacto Econômico

- Grande economia no pagamento da taxa de entrada nas colaborações.
- Caso de uso para a criação de um centro de suporte de e-ciência.
- Transferência de novas tecnologias através do intercâmbio técnico promovido.
- Formação de jovens pesquisadores na ciência de dados.

# Conclusão

1. INCT foi fundamental para viabilizar a participação brasileira nos projetos internacionais.
2. Continuidade do programa é extremamente importante considerando a longa duração (> 10 anos) dos projetos.
3. Importante recompor o valor original dos recursos aprovados.



Agradecimentos:

Membros do INCT  
Membros do LIneA

