

# Rubin Observatory

SLAC National Accelerator Laboratory,  
2575 Sand Hill Road, MS29,  
Menlo Park, CA 94025.  
[www.lsst.org](http://www.lsst.org)

Prof. Luiz da Costa,  
Laboratório Interinstitucional de e-Astronomia,  
Rua General José Cristino, 77, São Cristóvão  
Rio de Janeiro, Brasil, CEP: 20921-400  
Wednesday July 1, 2020

## **Brazil LIneA In-kind Contributions to Rubin Observatory**

Dear Professor da Costa,

Following a change in evaluation schedule brought on by the ongoing COVID-19 pandemic, I am writing to confirm the key upcoming dates, and reaffirm the support of Vera C. Rubin Observatory for your involvement. Thank you for your enthusiasm, and your participation in the process so far.

As you know, Rubin Observatory is a billion-dollar dedicated sky survey facility, currently under construction by the US National Science Foundation (NSF) and the US Department of Energy (DOE) at its Tucson Headquarters, SLAC National Accelerator Laboratory, and on its summit and base facility sites at Cerro Pachón and La Serena, Chile. Rubin will transform and support the scientific research of some 10,000 physicists in 40 countries around the globe. Its Legacy Survey of Space and Time (LSST) will revolutionize the field of astronomy, providing trillions of measurements of billions of galaxies, stars, and solar system objects over the ten years of Rubin's first observing campaign. Its census of the solar system, 800-frame movie of the transient and explosive universe, mapping of the Milky Way galaxy, and probing of the properties of the elusive dark matter and dark energy will provide a wealth of scientific discoveries. In analyzing such a big dataset, the Rubin Observatory staff and LSST science community will solve numerous problems in data science, while Rubin's mission to involve, inform and inspire using the LSST data will help increase the public's understanding and engagement with science, and train the next generation of scientists.

LIneA is very well placed to make a number of key contributions to the success of Rubin Observatory and the LSST by providing important support of the worldwide science

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community and local coordination in Brazil, as well as carrying out cutting edge astronomical research using the LSST data. LIneA staff have highly valuable expertise in astronomy, data science, and scientific software development, and very valuable experience in supporting and exploiting previous US-led sky surveys such as the Dark Energy Survey. We expect that LIneA will provide a natural connection between the wider Brazilian science community and the Rubin Observatory, to the benefit of both. Brazil will provide vital dedicated network bandwidth for transferring the image data from the summit to the Rubin US data facility and beyond, a critical contribution to the operation of the observatory. Further high-value contributions to the support of the science by LIneA will cement Brazil's position as a key participant in the international Rubin enterprise, and secure the data rights and access needed by the Brazilian astronomical community.

Your Letter of Interest (LOI), outlining possible in-kind contributions that LIneA could make to Rubin Observatory and/or the LSST science community in return for additional LSST data rights and access for LIneA staff, has been reviewed by the NSF and DOE and approved for further development. I can confirm that the deadline for full proposals is September 25 of this year, and I look forward to reading the proposal from LIneA. The Rubin LSST International In-kind Contribution Evaluation Committee (CEC) is working to provide feedback for you, by July 31, that will help steer the development of your full proposal to success. To remind you, the concept for these proposals is to contain a brief statement of work, formatted to be easily adapted to a standard data rights agreement template, with a more detailed plan attached. A template proposal will be provided, and I invite you to attend this year's fully remote Rubin Observatory Project and Community Workshop in the week of August 11-14 where we will provide a session dedicated to supporting Principal Investigators as they write their proposals. Details for how to attend this workshop will be provided via the LSST Science email list. My goal is to help you design and propose a program of in-kind contributions by LIneA that compels the award of the LSST data rights that you seek: I am confident we can achieve that goal.

Best wishes for the development of your proposal,

A handwritten signature in black ink that reads "P Marshall". The signature is written in a cursive, slightly slanted style.

Dr. Phil Marshall  
Deputy Director of Operations at SLAC,  
Vera C. Rubin Observatory



June 23, 2020

Prof. Luiz Nicolaci da Costa  
Coordenador do LIneA e do INCT do e-Universo

Dear Luiz,

As Director of the Dark Energy Survey (DES), it is a pleasure to write concerning expectations for contributions from your group at LIneA to our international collaboration to study the physics of dark energy, the motivating entity for the accelerating expansion of the Universe.

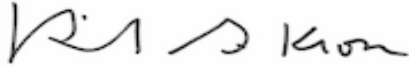
But let me first express gratitude for the many important contributions your group has already made, including the Quick Reduce (QR) software that did the necessary quality assurance as the data were collected at the telescope with the Dark Energy Camera. This QR pipeline operated from 2013-2019 and was used by DES as well as by general astronomical users of the Cerro Tololo Inter-American Observatory in Chile. Your group also developed a Science Server that was used to validate reduced images and catalogs produced by the National Center for Supercomputing Applications (NCSA). The Science Server was implemented both at the Fermi National Accelerator Laboratory and at NCSA, and has been used productively by 115 members of DES and 245 general scientists. Very significantly, your group was centrally involved in developing the first Data Release (DR1) for DES, reaching a large community of scientists around the world.

LIneA also created the DES Science Portal, which produces enhanced data products that are needed for the key cosmological analyses, such as spectroscopic samples, training files, photometric redshift estimates, systematic maps, catalogs of clusters of galaxies, and many other advanced data products. The Science Portal is extremely flexible in application, and this list of enhanced data products will continue to grow. Besides creating new data products, the Server and Portal also crucially provide tools to explore and access the DES survey data. Given the size of the survey data and the complexity of the analysis, these innovative tools have been essential. It is noteworthy that the same kind of methodology that you developed for DES can apply for the next generation of large sky surveys, LSST.

Looking forward, it will be very important for DES to have the involvement of your group in DR2, the last public data release for DES, expected in January 2021. This involvement would be similar to your contribution for DR1. But beyond these technical contributions, we as a scientific collaboration look forward to continued scientific participation by your group: this is the reward for 16 years of hard work, and the next two years will allow your group to do the analysis and publish exciting

results. They have developed deep scientific expertise and are fully engaged in the DES Science Working Groups. Many of them are in the early stages of their careers and I have been impressed with your success in attracting them to astrophysics and in mentoring them along the way. DES will continue to benefit from their scientific contributions, and I sincerely hope that, in return, DES will have helped them grow as scientists.

With best wishes,

A handwritten signature in black ink, appearing to read "Richard G. Kron". The signature is fluid and cursive, with the first name "Richard" and last name "Kron" clearly legible.

Richard G. Kron  
Director of the Dark Energy Survey  
Professor of Astronomy & Astrophysics  
The University of Chicago



June 30, 2020

Dr. Luiz Nicolaci da Costa  
Director  
Laboratorio Interinstitucional de e-Astronomic (LIneA)  
Rio de Janeiro

**SUBJECT: LSSTC Letter of Support**

Dear Dr. Luiz da Costa,

The LSST Corporation (LSSTC) enthusiastically endorses the efforts and participation of LIneA and Brazilian scientists in the Rubin Observatory LSST Project and encourages your membership in LSSTC as we focus on preparing the community to capitalize on this remarkable and unprecedented dataset.

Inter-institutional Laboratory of e-Astronomy (LIneA) was created in 2010 to support Brazilian participation in astronomical surveys generating large volumes of data, and since then, LIneA has provided data from many international astronomy and astrophysics collaborations to Brazilian scientists. LIneA was designed to develop an infrastructure of hardware and software to support the participation of Brazilian teams in projects, such as the Dark Energy Survey (DES) and the Sloan Digital Sky Survey (SDSS), and to be successful in the LSST Project. The Laboratory consists of researchers, technicians, students, postdocs, and professors from universities. Their programs are committed to training young researchers and preparing them to contribute to major international collaborations, and training computer scientists to deal with Big Data projects.

The Legacy Survey of Space and Time (LSST), to be carried out at the Vera C. Rubin Observatory (Rubin Observatory), is the most ambitious time-domain survey of the universe ever proposed. The Rubin Observatory is a \$1B project, funded by the U.S. National Science Foundation (NSF), U.S. Department of Energy (DOE), and private funding raised by the LSST Corporation (LSSTC). The facility is currently being constructed in Chile; survey operations are scheduled to begin in 2023. In just its first year of operations, the Rubin Obs. will survey more of the universe at optical wavelengths than all previous studies. LSST epitomizes the new era of Big Data in physics and astronomy, and in this new paradigm, learning how to analyze data in new ways will be the key to enabling science.

The LSST Corporation is a not-for-profit 501(c)3 corporation formed in 2003 to initiate the LSST Project and advance astronomy and physics. LSSTC is a key Rubin Observatory supporter in the development of non-federal funding sources to support Rubin science in the community. LSSTC represents over 30 U.S., Chilean, and European institutional members committed to enabling the utilization of Rubin Observatory LSST data by advocating for and supporting LSST's worldwide science community.

After LSST was selected the top priority of the U.S. 2010 Decadal Survey, the Ministry of Science, Technology and Innovation, a Brazilian Federal Agency, which includes scientists from different Brazilian institutions covering a wide spectrum of scientific topics, expressed a fundamental interest in the scientific mission of the LSST and indicated its commitment to support operations of the LSST.

In 2015, an agreement between the Brazilian consortium, whose membership includes the Laboratory of e-Astronomy (LIneA), National Astrophysics Laboratory (LNA), National Education and Research Network (RNP), Academic Network at São Paulo (ANSP), and Americas Pathways (AMPATH), and the LSST Corporation (LSSTC) and LSST Project Office (LSSTPO), committed Brazilian parties to provide in-kind contributions for certain networks and for Rubin Obs. use during ten years of operations. This agreement assured the successful transfer of digital data over the LSST/AURA 100 gigabit per second fiber optic networks from the Summit Site on Cerro Pachón, Chile to the Base Site in La Serena, Chile, and between Chile and the USA through Brazil. In addition, the ANSP and RNP contributions enabled fifty (50) specified Brazilian scientists to participate in the scientific exploitation of data and data products produced by LSST before and during its operations phase. This significant agreement was made possible by the strategic negotiations between LIneA and the LSST Directorate.

LSST is recognized as a leader in the new astronomical research paradigm of data intensive astronomy by pushing the envelope on all Big Data challenges. LSST's contributions to the advancement of computational systems, the fostering of the next generation of cross-disciplinary scientists, and investments in the developing world's cyber-infrastructure will contribute to narrowing the gap between awareness of increasingly massive data collections and understanding of the knowledge within them. With Rubin Obs. on the verge of commissioning, LSSTC is focused on preparing the scientific community to capitalize on this remarkable and unprecedented dataset. We are committed to fostering and building new modes of interdisciplinary collaboration at the interface of astronomy, physics, computer science, mathematics, and information science. Through graduate and postdoctoral fellowships, science schools, workshops, and support of science collaborations, LSSTC is enabling the training of a new generation of young scientists and researchers, and preparing the scientific community for the big data challenges that the Rubin Observatory LSST will bring.

As a key affiliate of the Rubin Obs. LSST, LSSTC is in a privileged position to enable the efforts of the LSST science community by developing non-federal funding sources to facilitate and support the science community to advance its full potential. LSSTC is committed to bringing added value to operations and to enabling science aspirations of our Member Institutions, the LSST Science Collaborations, and the broader worldwide Rubin Observatory community. LSST Corporation is the only private organization focused solely on the science the Rubin Observatory will enable.

The evolution of the LSSTC's mission from partnering in the construction of the Rubin Observatory to being a key affiliate of the Observatory in operations to support science in the community calls for a broader and more inclusive vision of institutional membership. LSSTC supports and emphasizes the need for collaboration in astronomy and data science between LIneA and LSSTC, and the integration and participation of LIneA in the LSST science community.

The Brazilian astronomical community has a strong interest in enabling the Brazilian participation in the LSST program. Access to the database and the LSST scientific products presents an excellent cost-benefit ratio, covering a wide range of research areas. Brazil has already made significant contributions to the functionality of the survey, but now is the time for LIneA, RNP, and Brazilian scientists to collaborate and contribute to the LSST science community.

June 30, 2020

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LSSTC endorses its support for LineA in its efforts to continue to develop and expand its capabilities in support of the Brazilian science community. LSSTC would be privileged to have LineA and Brazilian scientists joining forces with the LSSTC, the LSST science collaborations and the broader science community.

Sincerely,

A handwritten signature in black ink, appearing to read 'PEliason'.

Patricia Eliason

Patricia A. Eliason  
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# Astrophysical Research Consortium

*to design, construct, and operate the Apache Point Observatory*



Prof. Michael R. Blanton  
Department of Physics  
New York University  
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July 4, 2020

Dr. Luiz Nicolaci da Costa  
Diretor-geral, Coordenador do INCT do e-Universo  
Laboratório Interinstitucional de e-Astronomia  
Rua General José Cristino, 77  
Vasco da Gama  
Rio de Janeiro, Brasil

Dear Dr. da Costa:

I write in my role as the Director of the Sloan Digital Sky Survey IV (SDSS-IV), which is managed by the Astrophysical Research Consortium. SDSS-IV is scheduled to use the 2.5-m Sloan Foundation Telescope at Apache Point Observatory (APO) from mid-2014 through August 31, 2020 and the 100-inch du Pont Telescope at Las Campanas Observatory from early 2017 through September 8, 2020. The portion of the survey conducted at LCO is known as APOGEE-2 South.

The Laboratório Interinstitucional de e-Astronomia (LINeA) has provided crucial support to SDSS-IV as an in-kind contribution on behalf of the Brazilian Participation Group (BPG) to SDSS-IV. LINeA's contributions have been twofold. First, LINeA provides mirror servers for the SkyServer and Catalog Archive Server, the primary scientific interfaces to the SDSS-IV data set in its public data releases. Second, LINeA installed and provides system administration support for the servers at LCO that run the SDSS-IV telescope operations software and stages the APOGEE-2 South data as it is taken (see my previous memo from June 2016 regarding the successful installation of these servers).

The APOGEE-2 South operations were scheduled to end the night of September 8, 2020. However, due to COVID-19, LCO operations are suspended at present and no observations are being taken. SDSS-IV is considering an extension of APOGEE-2 South operations to as late as December 31, 2020 to mitigate these observing losses, should LCO re-open before that time.

I am writing to request that LINeA continue providing support for systems administration of the LCO servers through December 31, 2020 in order to support extended operations. This support is crucial to the successful completion of SDSS-IV.



We look forward to continuing to work with LINeA through the completion of SDSS-IV and to its provision of mirror services for the final public data release (Data Release 17), currently scheduled for July 2021.

After SDSS-IV ends, its facilities will be used by its successor, SDSS-V. SDSS-V is also managed by ARC, but as a separately led project and institutional collaboration. We encourage LINeA and the BPG to contact the SDSS-V leadership to negotiate membership in that project.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael Blanton", written in a cursive style.

Michael R. Blanton  
SDSS-IV Director



October 18, 2019

Dr. Luiz Nicolaci da Costa  
Coordenador do LIneA e do INCT do e-Universo  
Observatorio Nacional  
Rio de Janeiro, Brasil 140

Dear Luiz -

As you know, one of the most important legacies of the Dark Energy Survey (DES) will be the data products that will be available to scientists for analysis for many years to come. DES (with our partner DES-Brazil) is committed to producing a final comprehensive public data release that we call DR2. Your group at LIneA has played a key role in our efforts to validate the data products and to make them accessible, both within the DES Collaboration and more broadly.

In this letter I would like to describe, from the DES point of view, some of the ways LIneA can continue to contribute to this important effort from now until approximately 2022.

The Science Server at <https://desportal2.cosmology.illinois.edu/dri/apps/home/> now has 324 registered users and there have been 2300 visits since December of 2017. We would, of course, like to continue this success, having your group maintain and continue to develop the Sky Viewer, Target Viewer, and User Query components. As our data validation and analysis proceeds, we discover the need for new tools, and we appreciate the responsiveness of your group to such requests, for example as happened for tile inspection for the Year 6 coadd images. Besides creating tools used by others, your group has also contributed needed person-power to data validation and many other tasks. We look forward to these efforts being continued into the future.

LIneA has created a valuable catalog of all sources with spectroscopic redshifts within the DES footprint, something that is essential for our photo-z efforts. We would like you to continue to keep this catalog updated, something that can be done - by design - within the Science Portal.

We anticipate needing some of the on-demand services provided by the Science Portal, including:

- o training sets - matching coadd + spectroscopic sample
- o the all-sky HIPS file provided to NCSA and NOAO
- o systematic maps
- o some photometric redshifts
- o creating an alternative sample of clusters of galaxies
- o implementing code (FLASK, Namaster, Treecor) to compute the covariance matrix for the DES Theory and Combined Probes group.

Finally, it is worth noting that your group created and supported the Quick Reduce (QR) real-time data monitoring system for the Dark Energy Camera at the Blanco Telescope at Cerro Tololo Inter-American Observatory, providing experience and expertise with systems close to the instrument.

We all look forward to a productive next few years. Many thanks for your continuing contributions to our international scientific collaboration.

With best wishes,

A handwritten signature in black ink, appearing to read "Richard Kron". The signature is fluid and cursive, with the first name "Richard" and last name "Kron" clearly distinguishable.

Richard Kron  
Director, Dark Energy Survey