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Astrophysicists, social scientists to probe the Universe's deepest mysteries

First cross-disciplinary fellowship program to tackle data from massive sky survey

TUCSON, Az. — Just as an enormous influx of big data is poised to transform the field of astronomy and astrophysics, a new fellowship program is poised to revolutionize the field itself.

The LSST Corporation, a non-profit consortium of approximately 30 research institutions, has received $7 million to establish the LSSTC Catalyst Fellowship Funded by the John Templeton Foundation, which will support early-career researchers in astrophysics and in social sciences as they study big data generated from the soon-to-be-completed Vera Rubin Observatory in Chile.

Announced at the Rubin 2021 Program and Community Workshop this week, the program is the first fellowship of its kind. Researchers from disparate fields — including those from traditionally underrepresented groups and institutions — will converge to pursue an integrated, multidisciplinary approach to science.

The fellowship is a part of the LSST Interdisciplinary Network for Collaboration and Computing (LINCC) initiative, an ambitious program by LSST Corporation that will lead community efforts to build software infrastructure for big data astronomy.

The fellowship program will fund 10 new astrophysics fellows and several social science fellows, selected from institutions around the globe. One fellow from each cohort will be stationed at a historically underserved institution. Adding to the program's uniqueness, it also will include structured mentoring by teams of astrophysicists and social scientists as well as leadership training for all fellows.

"Big data is changing how we view the universe," said PI Jennifer "Jeno" Sokoloski, LSST Corp's director for science and an astrophysicist at Columbia University. "It's a perfect time to discover new ways of doing science. By training a diverse set of early-career researchers, Vera Rubin Observatory will be poised to make exciting scientific discoveries within its first few years."

"I am confident this prospect will be attractive to top fellows, who will be at the innovative core of an organically inclusive, equitable and forward-moving working environment, leading a deeper, wider exploration of fundamental scientific questions and creating a new model for best practices and accountability across disciplines,"

said Northwestern University astrophysicist Vicky Kalogera, who co-chairs of the program's steering committee with Columbia astronomy professor Kathryn Johnston.

The big data problem

Over the course of a decade, researchers at the Vera Rubin Observatory will create the first-ever deep, multicolor movie showing the southern sky as it changes over time. The project will generate dozens of terabytes of data per night, potentially holding answers to the universe's most elusive secrets, including the nature of dark matter and dark energy, the origin of the periodic table of elements and whether life exists beyond Earth.

Processing an unprecedented amount of astrophysical information presents an extraordinary challenge. Crunching the data from this sky survey could create new difficulties in data management, computing, and mathematics.

"LSST data will be so expansive that there is a need to have highly motivated postdoctoral fellows working with mentors and collaborating across research topics," said Pat Eliason, executive director of LSST Corporation. "This new program is not just timely, it will have a major impact on LSST science."

A critical role for social scientists

The fellowship recognizes the dawn of the Vera Rubin Observatory as a transformative moment in the astronomy and astrophysics community, with hundreds of astronomers from multiple countries tackling enormous data sets. By supporting social science fellows alongside astrophysicists, the fellowship aims to catalyze formal study of the many social questions that will arise when large, multi-national groups of scientists work together to collect and analyze large amounts (and new forms) of data.

"By supporting this cross-disciplinary fellowship, the foundation hopes to enable critical research, but also catalyze an exchange between astrophysicists and social scientists to understand and capitalize on this transformational moment in the astrophysics community," said Dr. Aamir Ali, program officer in mathematical and physical sciences at the John Templeton Foundation, and an astrophysicist by training.

Like their astrophysics counterparts, the social science fellows will be selected via a rigorous application process and will propose to conduct original research on the scientific work done at Vera Rubin Observatory, focusing on studying the social dynamics of the observatory from the unique vantage point afforded them by this fellowship.

Administrators of the program also hope that the social scientists' insights could lead to concrete recommendations during the lifetime of the program, helping them to improve the collaboration infrastructure and culture, and address barriers to success, particularly for minorities and underserved populations.

"I am very excited to be involved in the development of a such a unique, ground-breaking fellowship program and contributing to its design and launch. By integrating social science into the core of the program, the fellows will help change the nature of scientific activity and collaboration and will benefit from strong mentorship and professional development opportunities," said Kalogera.

The social science team includes scholars from Northwestern, University of Arizona, and University of Washington. They will help the program "identify barriers to success and lead to best practices for recruiting and retaining a diverse scientific workforce while influencing cross-disciplinary research," according to Lois Trautvetter, a member of the steering committee and professor of education and social policy at Northwestern.

Sharing with diverse communities

Although the Rubin Observatory is committed to making all of its data available to the public, not everyone will have the skills to interpret such data. Not even every lifelong astrophysicist — let alone student, schoolteacher or museum staff member — is trained to handle, analyze or interpret massive quantities of data, said Johnston.

The fellowship program is committed to financing and supporting fellows at low-resource institutions, to ensure that everyone has the tools they need to make use of the data.

"The program gives the fellows an opportunity to work as a cohort to deliberately explore and learn from the diverse communities they will encounter as scientists, in collaboration with social scientists who study those communities," Johnston said. "This combination aims to cross the divides between: the physical sciences and social science; engineering, data science and astronomy; large and small academic institutions; and those that have a long tradition of engaging in science and those that do not."

About the John Templeton Foundation

Founded in 1987, the John Templeton Foundation supports research and dialogue on the deepest and most perplexing questions facing humankind. The Foundation funds work on subjects ranging from black holes and evolution to creativity, forgiveness, and

free will. It also encourages civil, informed dialogue among scientists, philosophers, theologians, and the public at large.

With an endowment of $3.8 billion and annual giving of approximately $140 million, the Foundation ranks among the 25 largest grantmaking foundations in the United States. Headquartered outside Philadelphia, its philanthropic activities have engaged all major faith traditions and extended to more than 57 countries around the world.

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