Formal Education with LSST
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Surveying the deep and changing sky

LSST will conduct a decade-long wide, fast, and deep time-domain survey of the optical sky, beginning in 2022.

LSST EPO will enable public access to a significant subset of all data. Large data sets allow every student the option to investigate unique data.

![Fig. 1 LSST under construction on Cerro Pachón in Chile, Nov. 28, 2017. Image credit LSST Project/NSF/AURA](image)

Education Goals

LSST educational investigations will:
- Be intellectually engaging for novice learners
- Be easy for students and instructors to learn and use
- Leverage the unique aspects of LSST data sets
- Feature online data analysis
- Be customizable and flexible
- Be backed by sustained technical and educational support

![Online Jupyter Notebooks](image)

Instructional Design

Investigation components:
- Teacher and student versions of Jupyter notebooks
- Two instructional videos for engagement and assessment
- Teacher guide
- Next Generation Science Standards alignment and assessment tools
- Support materials including a forum, professional development training, and tutorial videos.

Flexible levels of challenge

Each primary investigation will provide options to go deeper into the topic or explore it with varying degrees of rigor.

![Fig. 2 Wireframe mock-ups of the Education Hub and a teacher notebook, created by Theresa Neil Strategy + Design](image)

Online Jupyter Notebooks

Jupyter technology: Work less, learn more

The online interactive computing design of notebooks provide opportunities for collaboration and are accessible anywhere with internet access.

They will circumvent firewall and bandwidth issues, and eliminate the need to download specialized software. Only a web browser is required.

Jupyter technology will run on any modern operating system and on tablets as well as computers.

Best of all, instructors and students don’t need to know how to write code. But if they choose to do so, the Python code can be customized to create more powerful investigations and tools.

![Fig. 4 Screenshot from H-R Diagram /Properties of Stars notebook now being developed by LSST EPO. Star cluster image from SDSS 9 survey data on Aladin Lite.](image)

Audiences

LSST Investigations will be developmentally appropriate for novice learners from advanced middle school through college. They may be used by:
- Astro 101 / General Education instructors
- Advanced middle school - high school teachers
- Home school instructors
- Independent study students

LSST EPO is committed to designing and testing investigations with diverse audiences in order to optimize accessibility and usability. All investigations will be available in English and Spanish.

Widgets

Embedded tools (widgets) process data, eliminating the need to use external spreadsheets for calculations and plotting software. This will shorten the time needed to conduct investigations and will shift the emphasis to understanding the underlying science themes.

![Fig. 5 Wireframe mock-up of a widget, created by Theresa Neil Strategy + Design.](image)

How can you get involved?

Scientists
Help with building and testing Jupyter notebooks and widgets
Share with us Jupyter notebooks that you have used for EPO
Provide access to design testing with diverse communities
Establish LSST science - education partnerships
Suggest ways to tie into NSF Broader Impacts
Review and give input to improve investigations
Supply precursor data for testing
Help with dataset curation

Educators
Review and give input to improve investigations
Provide suggestions for working with diverse communities
Offer to field test investigations
Help us spread the word!

Questions? Comments? Contact us:

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More Information

1. LSST EPO Design LEP-31: [http://ls.st/eiv](http://ls.st/eiv)
2. LSST EPO page on LSST website: [http://ls.st/ks0](http://ls.st/ks0)

Follow our progress on community.lsst.org

Investigation Topics

Investigations will align with the four science domains of LSST: The Milky Way, the changing sky, solar system objects, and dark matter and dark energy.

A sample of proposed investigations
Properties of stars (H-R Diagram, star cluster ages and distances)
Galaxies and the Milky Way
Solar system objects (orbits and characteristics of asteroids, comets, TNOs)
Variable stars (supernovae, standard candles, stellar evolution)
Properties of light (electromagnetic spectrum, blackbodies, luminosity)
Gravitational lensing and dark matter