The AAS WorldWide Telescope

Peter K. G. Williams (CfA, AAS)
@pkgw • https://newton.cx/~peter/

Hotwiring 6 – 2019 Aug 20

Chris Wiseman, NASA

The future of science is on the Web.

Datasets are getting too big to move ⇒ *remote access* is key.

Collaborations are bigger, more dispersed.

Fortunately, industry is pouring billions of dollars into the problem of building rich interfaces to remote assets: the Web browser.

Side benefit: systems built for scientific users can be adapted for public outreach relatively easily.

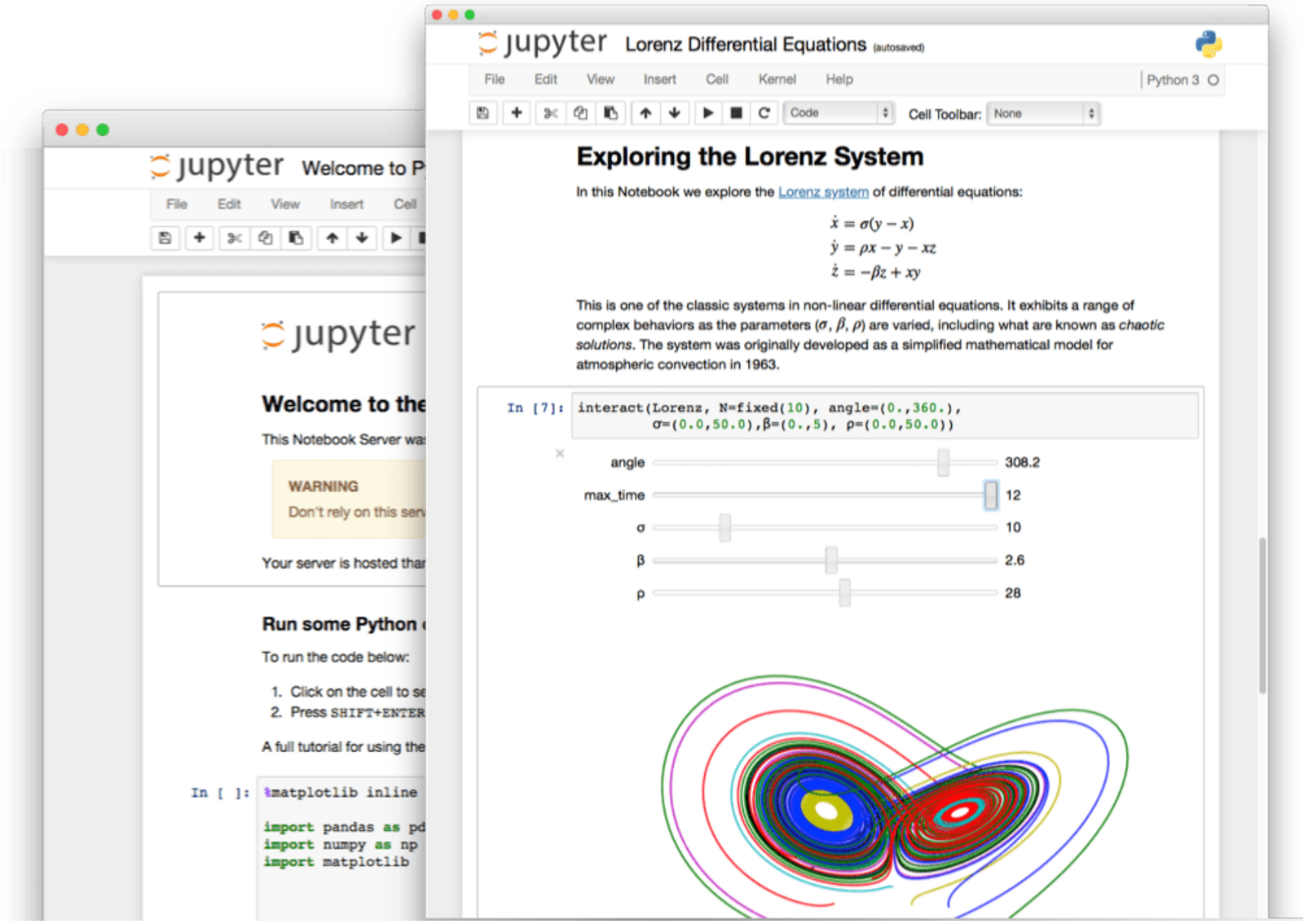
Time-domain science is an especially good fit for the Web: not just speed and agility, but standardization.

Lots of exciting work is happening in this space!

Jupyter Notebooks are innovative not just because of their user experience, but because they are delivered *through the browser*.

This is driving a long overdue Web-ification of astronomical data visualization tools.

Notebooks also provide a paradigm for remote computation — cf. NOAO DataLab, LSST Science Platform, etc.



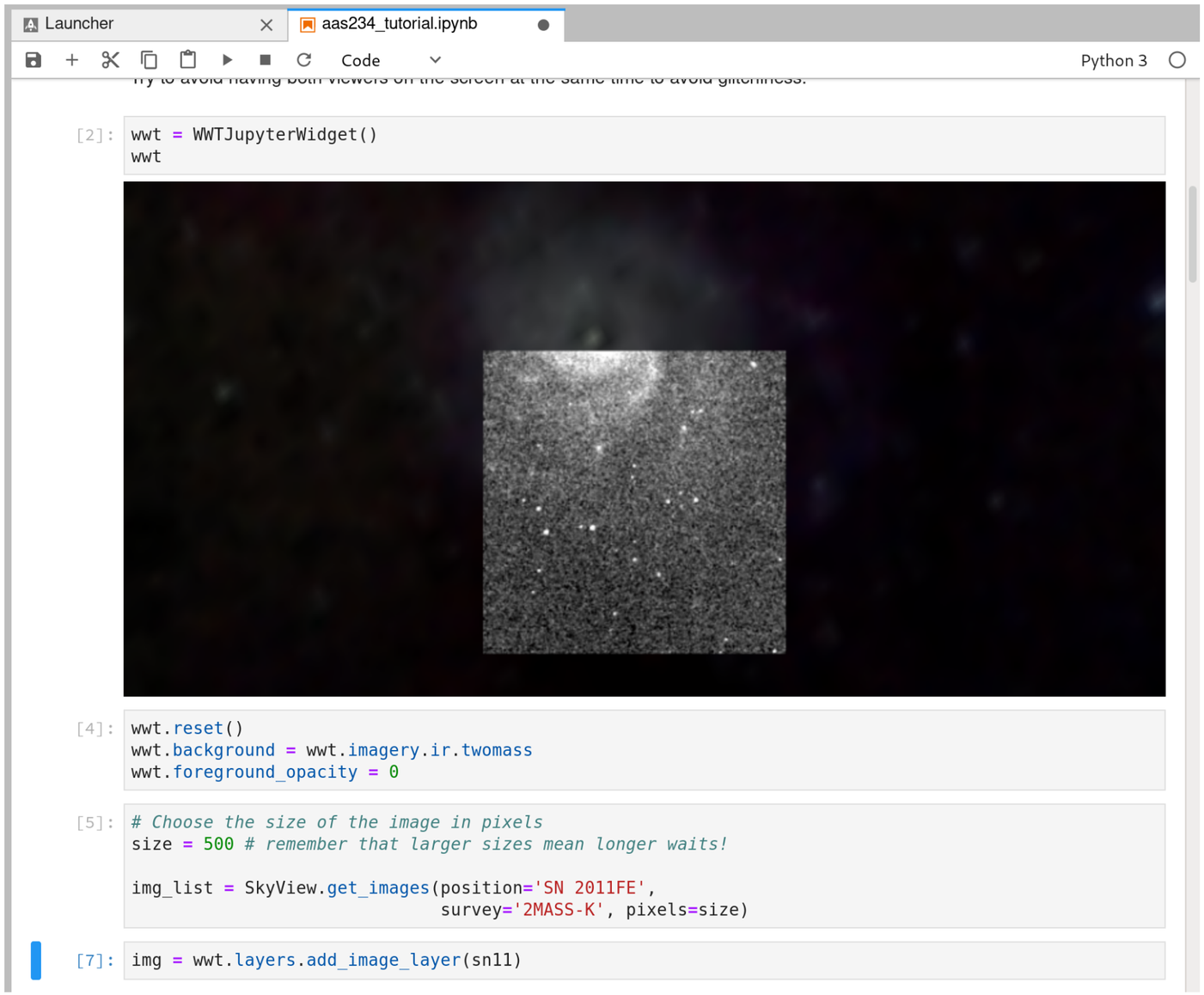
https://jupyter.org/

The AAS WorldWide Telescope is a platform for Web-based image data sharing and exploration.

(It's also a lot of other things, but this is what I'm focusing on today.)

Its basis is an embeddable JavaScript *WebGL engine* that renders imagery in the context of a 4D simulation of the known universe.

The *pywwt* package provides a Python interface and makes it easy to embed WWT in a Jupyter notebook.



WWT was built from the ground up to stream large datasets over the Web efficiently and with a smooth user experience.

Demo 1:

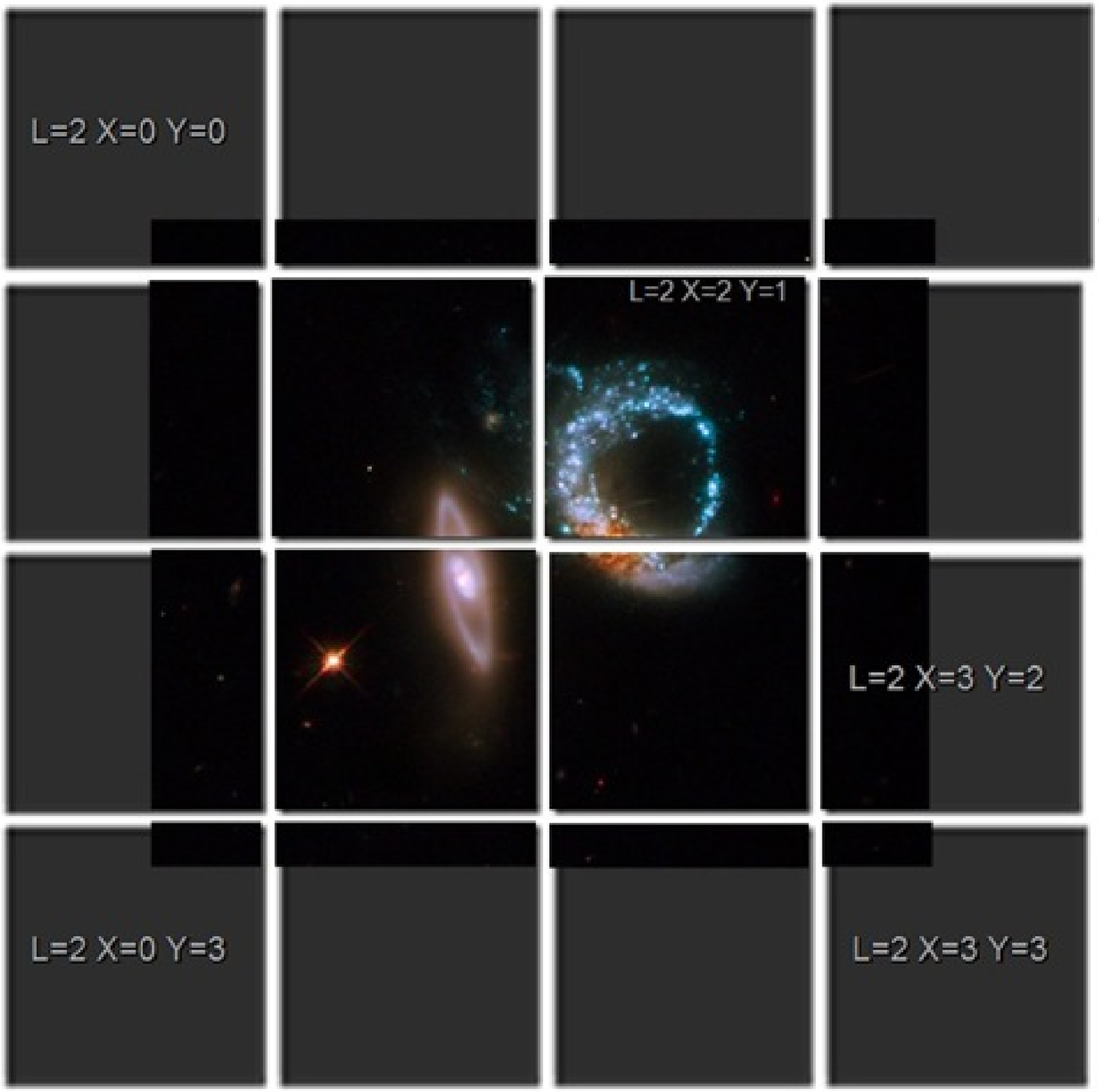
36,000 × 36,000 HSC image (link)

http://localhost:8888/ (local-only demo)

Demo 2: HSC image in WWT “web client” (link)

http://www.worldwidetelescope.org/webclient/default.aspx?wtml=http://newton.cx/~peter/files/toasty3/online.wtml

None of this works without data standards.



Astronomy has done pretty well on this front historically. Other fields are jealous of FITS!

New standards are needed — or new commitment to existing standards is needed — to deliver smooth Web-based user experiences. Can't just ship gigabyte FITS files around!

WWT uses a projection called TOAST and a "tile pyramid" architecture. The python package *toasty* provides tooling for creating the necessary datasets.

Demo 3:
“drop-in” exploration with pywwt (link)

http://bit.ly/wwt-binder03

Demo 4:
WWT as a data portal (link)

http://cxc.harvard.edu/csc2/wwt.html

Here's a summary.

- The future of science is on the Web — we need rich interfaces to datasets that are far too large to ship around.
- The AAS WorldWide Telescope is a tool for efficient Web-based image data sharing and exploration.
- WWT can be used for one-off investigations, portals to whole data archives, and E/PO applications.
- Regardless of the technology you use, new data standards are needed to enable *efficient* remote data access.

Thanks for your attention!

Peter K. G. Williams • @pkgw • https://newton.cx/~peter/

HTML talk info: https://tinyurl.com/htmltalk • *Design credits*: Hakim El Hattab ("white" theme), Julieta Ulanovsky (Montserrat font), Steve Matteson (Open Sans font) • *Tech credits*: git, reveal.js, KaTeX, Firefox developer tools, d3.js, WWT

Acknowledgments: this work was supported by the American Astronomical Society. We'd all go nuts without ADS and CDS.