astropy

A Community Python Library for Astronomy

The Astropy Project: Updates and Ramblings

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Astropy Coordinating Committee Member

Hubble Fellow

Astropy's Origin Story

Q. How do I use python to convert from Equatorial J2000 RA/Dec to Galactic coordinates (as of 2011)**?**

A. Use any of:

- pyast
- Astrolib
- Astropysics
- Kapteyn
- EphemPy
- PyAst
- PyAstro
- Probably more...

Lots of wasted effort!

Mutually incompatible!

Astropy's Origin Story

Everyone agreed this was bad.

> Do we as a community really need yet another separate python library for astronomy and yet another attempt at building a core set of routines ported from the IDL library?
>
> Marshall Perrin on "astropy" mailing list, June 2011

Astropy's Origin Story

Everyone agreed this was bad.

(Agreement ends up *crucial* to shared development.)

A grassroots discussion started in June 2011, followed by a series of votes (~100 astronomers).

The Result: astropy

Check out http://bit.ly/astropyvision for the original "vision"

The astropy Project and package

The Astropy Project is a community effort to develop a single core package for Astronomy in Python and foster interoperability between Python astronomy packages.

Core package “astropy” ≠ “Astropy project”

Core package is what’s in github repo *astropy/astropy*

Project includes all the affiliated packages and associated community

Three-member coordination committee: currently me, Tom R, Perry

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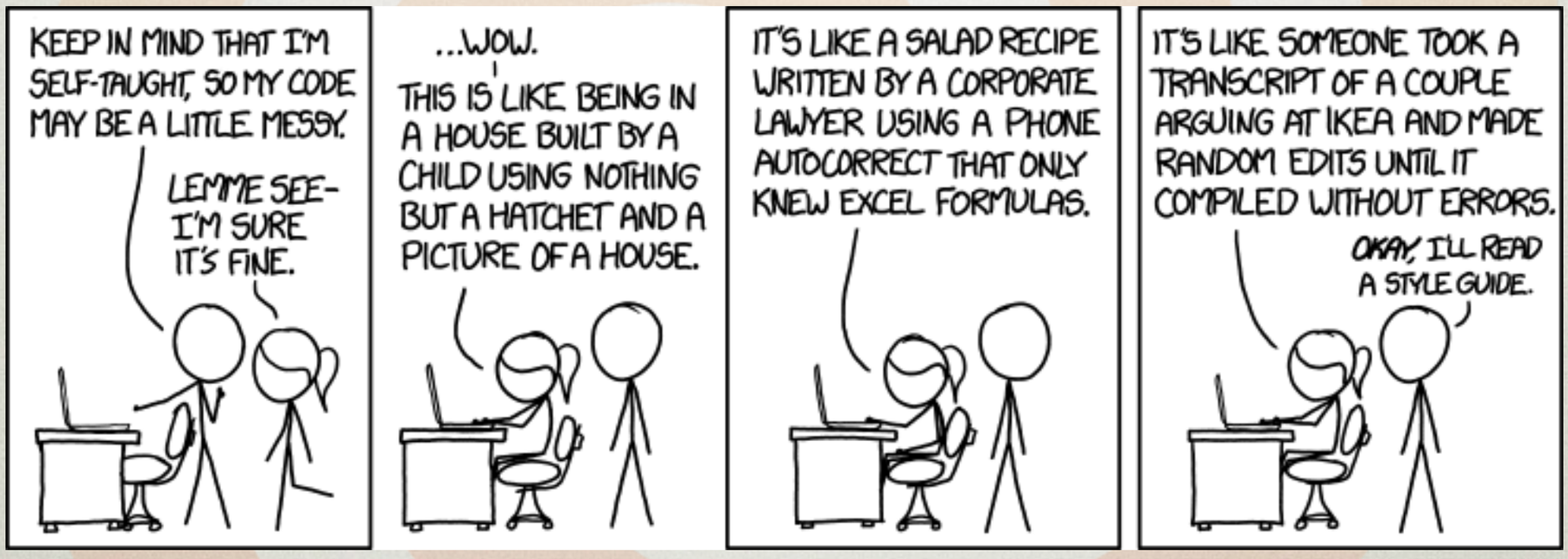
(Professional) Astronomers help write it

It should be familiar for them as part of their day-to-day work

What is the philosophy behind the code?

But at the same time, it should address this problem:



By showing how things *can* be done!

(Which means more collaboration with software folks, and pushing researcher's comfort zones)

What's in the Astropy Core Package

Best place to look is always

http://docs.astropy.org

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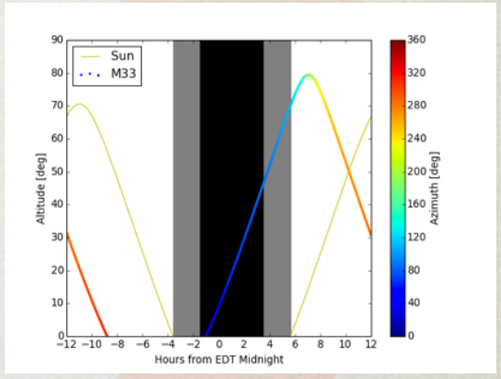
- Units and "Quantities" (arrays with units that act the way you'd expect). Integrated with comprehensive astro-appropriate physical constants.
- Date/time good to nanoseconds over a Hubble time.
- Celestial (and other astro) coordinates
- Image analysis and interoperability data structures.
- WCS
- FITS, VOTable, hdf5, extensible I/O
- Table manipulation, including many arcane astro formats
- Cosmology tools
- Astrostatistics convenience functions
- Data modeling and fitting
- Configuration and plumbing to make it all work

What was Big in v1.0?

Released February

- Promise of Long-Term Support (“v1.0”)
- Support for Celestial ⇔AltAz coordinate transformations



- Optimized table I/O, basically C-speed
- modeling is ready for prime-time
- tables columns can be arbitrary fancy things (“mixin columns”)
- 676 other enhancements!

What Will Be Big in v1.1?

July/August?

- Better Quantities (log/functional units? distributions? masked quantities?)
- Velocity support in coordinates?
- Support quantities and uncertainties in modeling?
- Ephemerides?
- You can help decide this week!

How do you learn More about Using Astropy?

<Cruz's talk!>

Talk to one of us this week
Astropy mailing list
astropy-dev mailing list
(The new facebook group?)

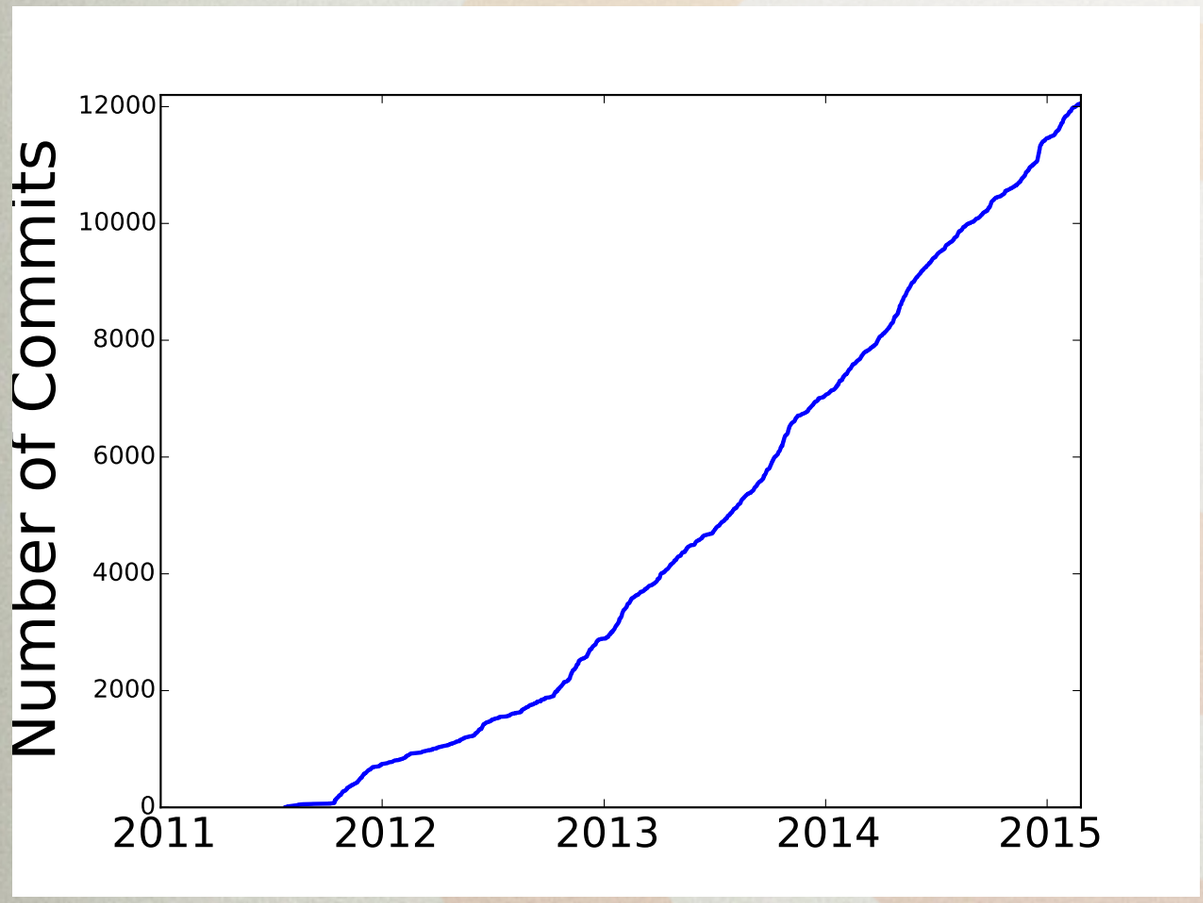
astropy Tutorials http://tutorials.astropy.org

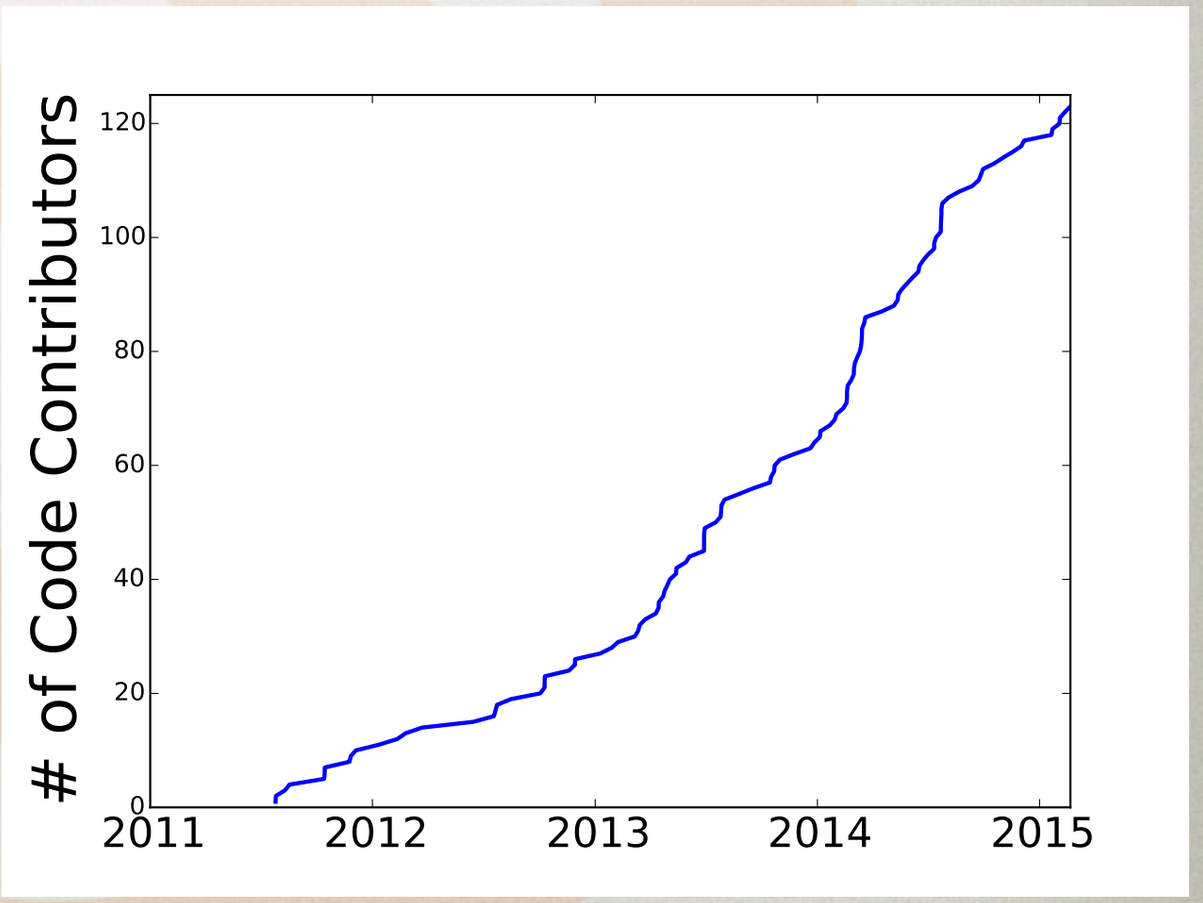
http://docs.astropy.org

The "By" part

The Astropy Project is a community effort to develop a single core package for Astronomy in Python and foster interoperability between Python astronomy packages.

Contributions are Growing





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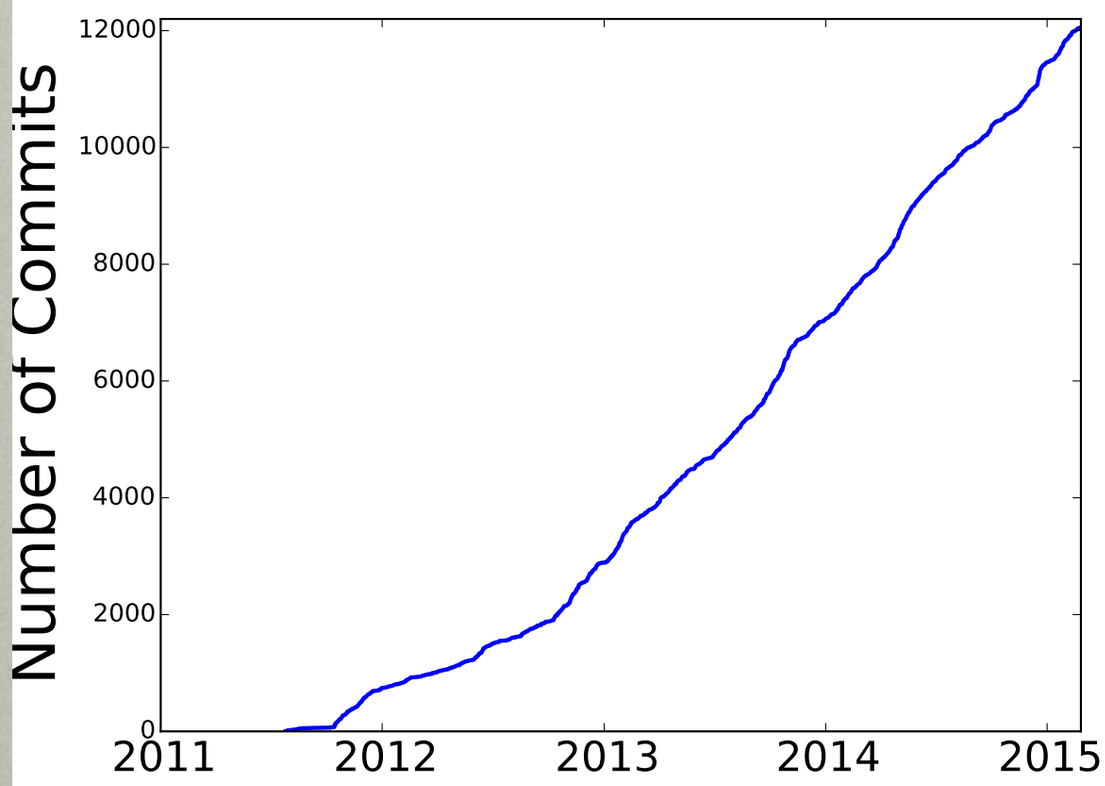

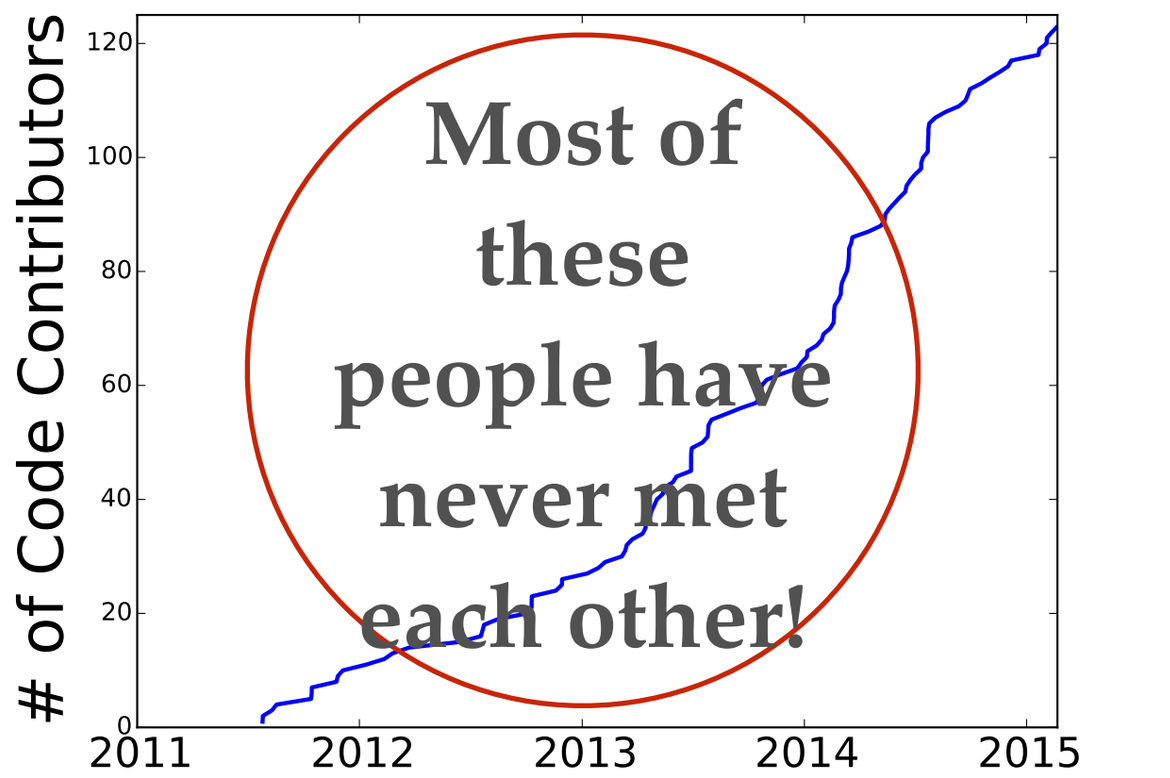

What are the Key Elements?

What are the Key Elements?

github
SOCIAL CODING

astropy / astropy

Unwatch 86 | Unstar 530 | Fork 375

Issue 3601 -- astropy.stats.funcs.bootstrap now accepts bootfuncs with multiple outputs #3628

Edit

Open **ezbc** wants to merge 7 commits into `astropy:master` from `ezbc:issue3601`

Conversation 8 | Commits 7 | Files changed 3 | +115 −6

ezbc commented 26 days ago

I have addressed Issue 3601. I implemented the option for users to supply a function with multiple outputs to `bootfunc`. They can control which `bootfunc` outputs to retain with `output_index`.

This function could be sped up if the `if` statements were moved outside of the loop.

ezbc added some commits 26 days ago

- `initial commit` 84afdce
- `fully functional, needs indices to be output_index` b69447d
- `bootstrap: reworked indices variable to be more pythonic` e7ac659
- `updated changes log` b7c1515
- `updated changes log for issue3601` ✖ 9e01308

embray added stats Affects-release labels 26 days ago

embray commented 26 days ago — Collaborator

@ezbc Your PR so far has the changelog entry and some tests which look good, but is missing the actual change to the function. Is it intentionally not implemented yet?

- `definite commit of funcs.py` ✖ 594ddd0

Labels: Affects-release, stats

Milestone: v1.1.0

Assignee: No one—assign yourself

Notifications: Unsubscribe

You're receiving notifications because you were mentioned.

5 participants

Lock pull request

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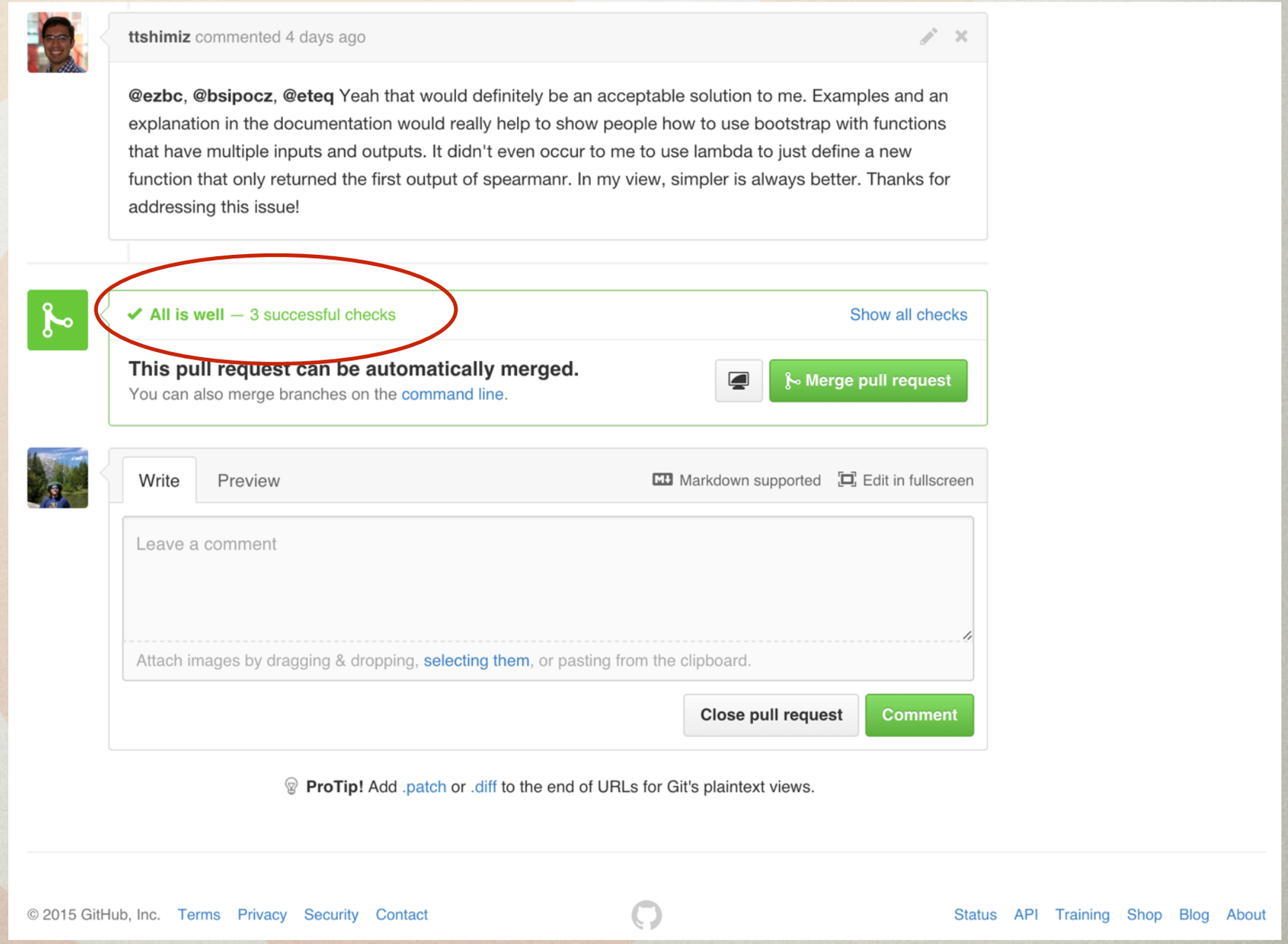

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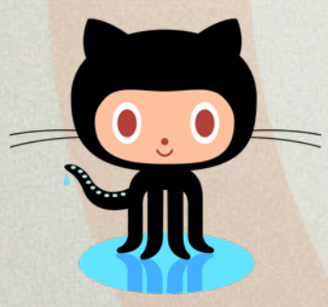

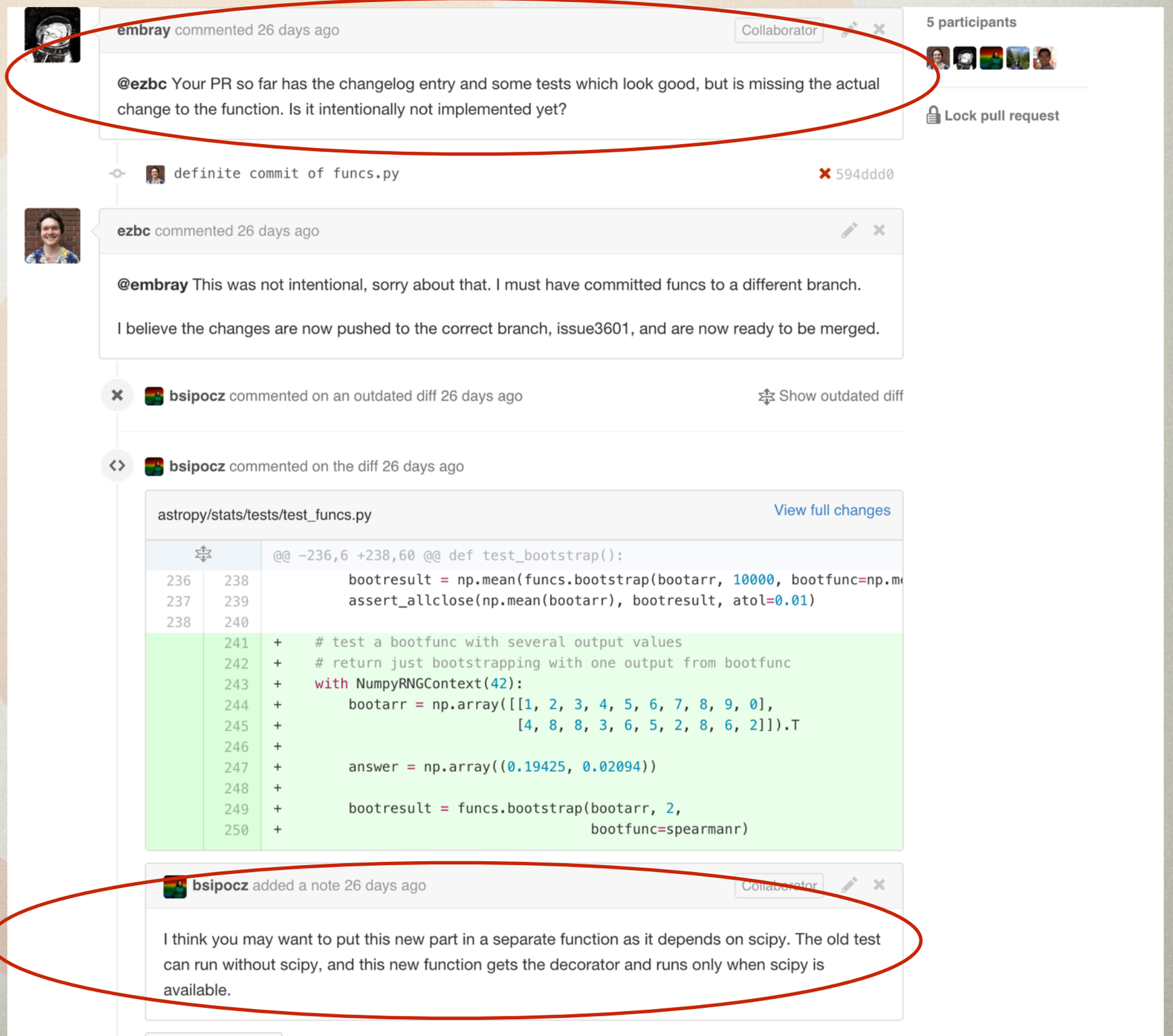

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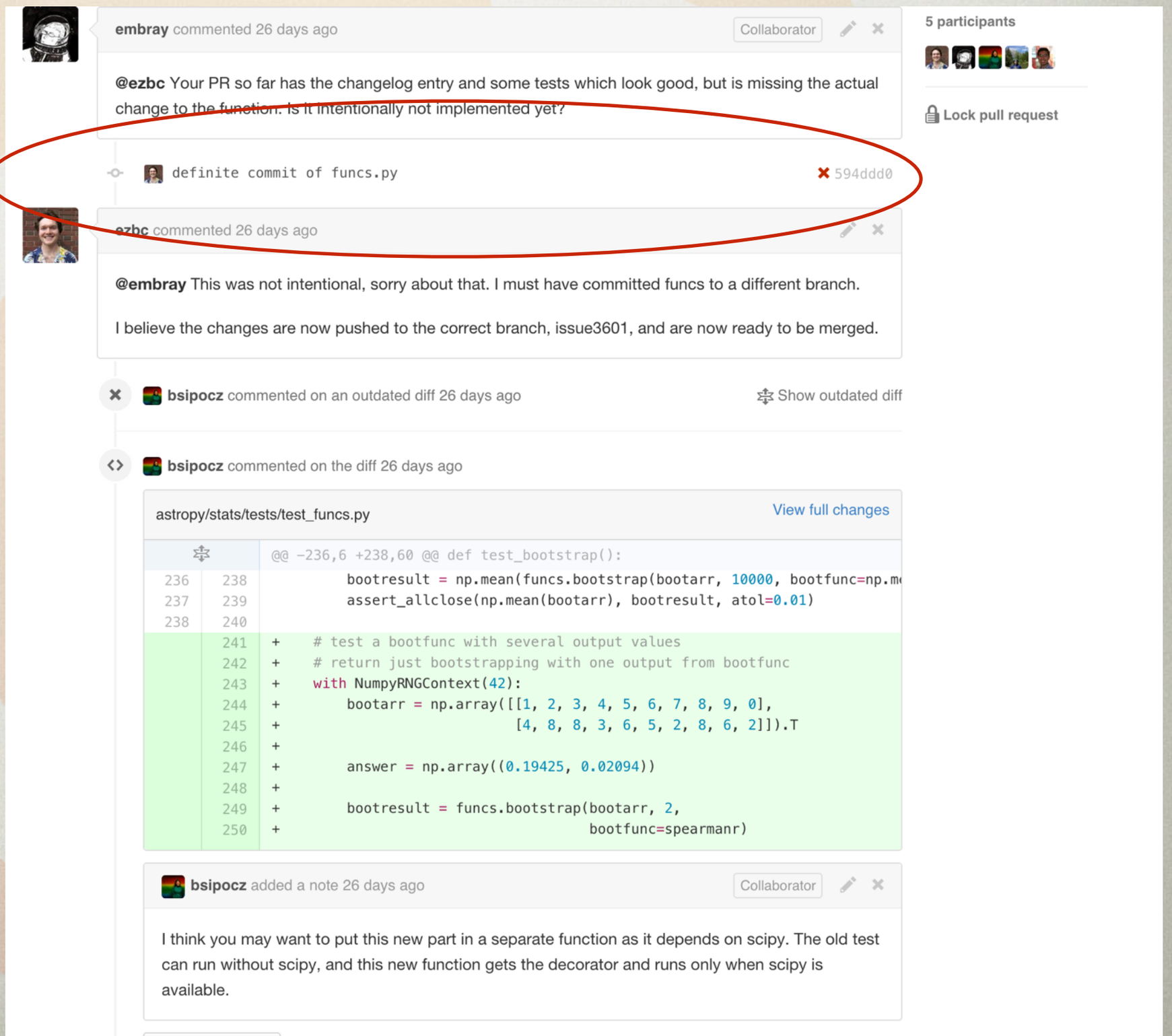

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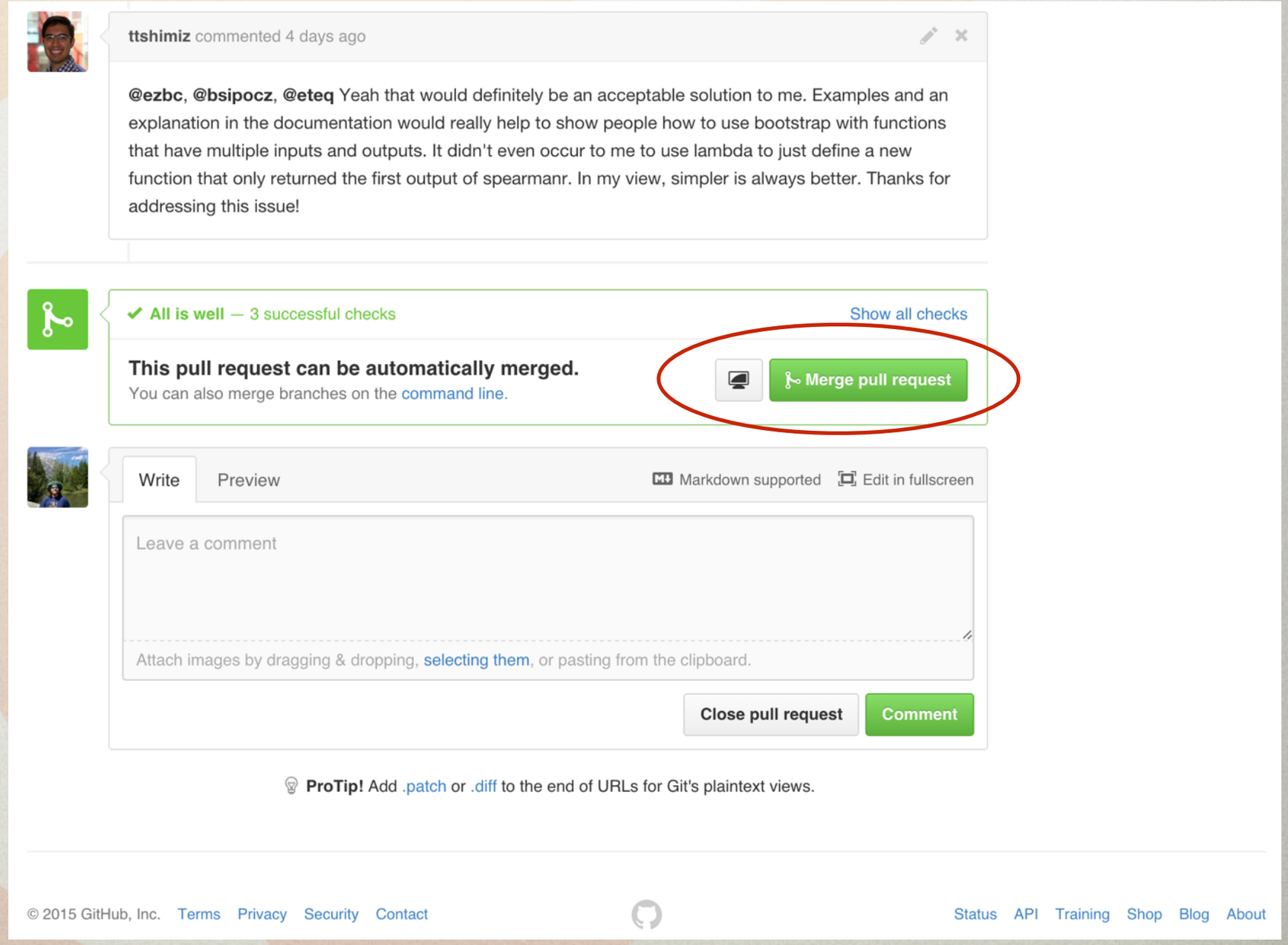
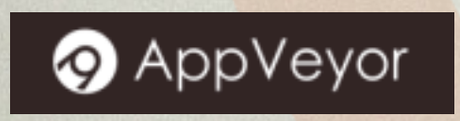
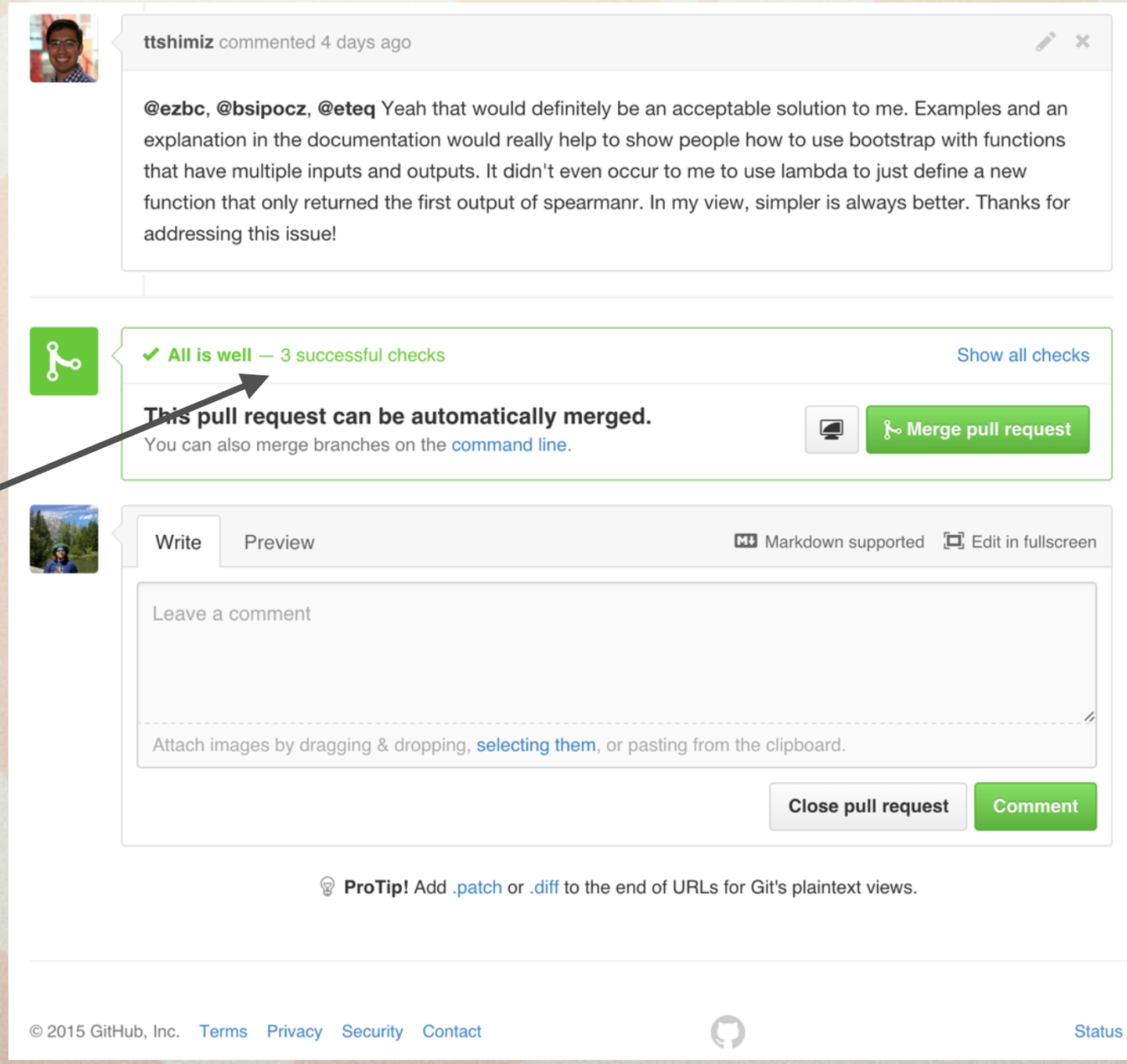


What are the Key Elements?

py.test

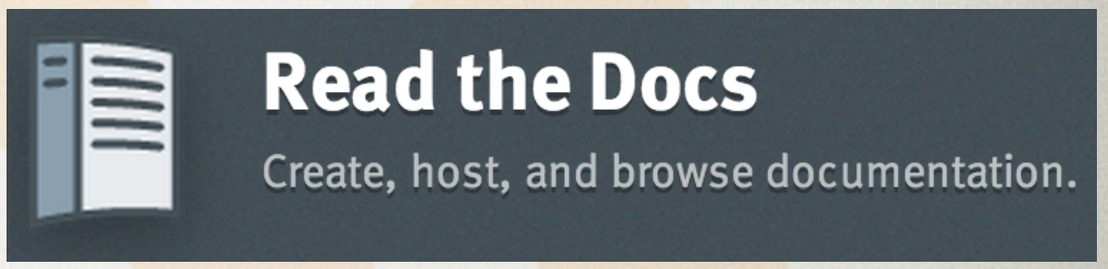


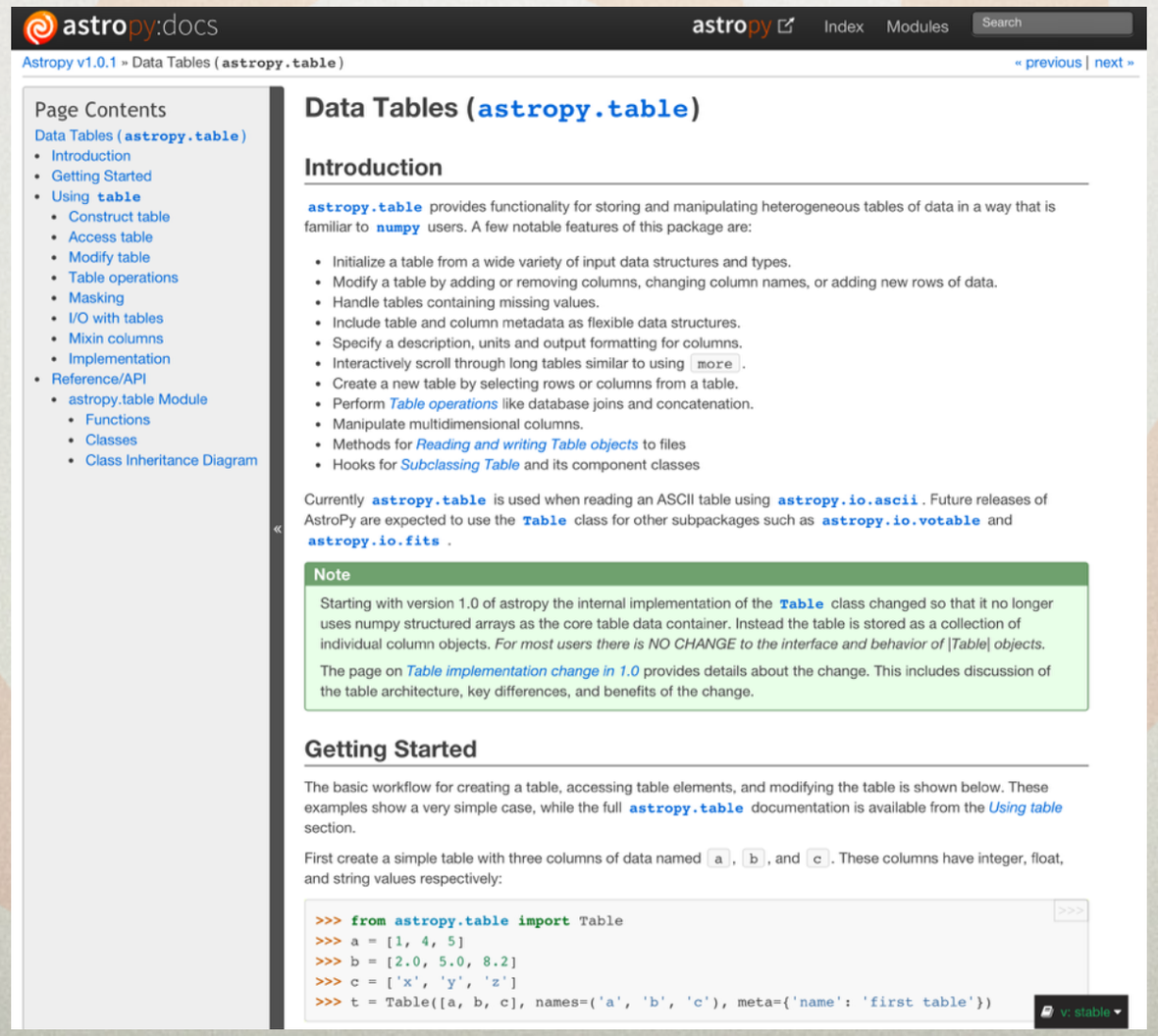


What are the Key Elements?

SPHINX

PYTHON DOCUMENTAT ON GENERATOR





What are the Key Elements?

python

SPHINX

PYTHON DOCUMENTAT ON GENERATOR

```python
class FLRW(Cosmology):
    """ A class describing an isotropic and homogeneous
    (Friedmann-Lemaitre-Robertson-Walker) cosmology.

    This is an abstract base class -- you can't instantiate
    examples of this class, but must work with one of its
    subclasses such as `LambdaCDM` or `wCDM`.

    Parameters
    ----------

    H0 : float or scalar `~astropy.units.Quantity`
        Hubble constant at z = 0.  If a float, must be in [km/sec/Mpc]

    Om0 : float
        Omega matter: density of non-relativistic matter in units of the
        critical density at z=0.  Note that this does not include
        massive neutrinos.

    Ode0 : float
        Omega dark energy: density of dark energy in units of the critical
        density at z=0.

    Tcmb0 : float or scalar `~astropy.units.Quantity`
        Temperature of the CMB z=0. If a float, must be in [K]. Default: 2.725.
        Setting this to zero will turn off both photons and neutrinos (even
        massive ones)

    Neff : float
        Effective number of Neutrino species. Default 3.04.

    m_nu : `~astropy.units.Quantity`
        Mass of each neutrino species. If this is a scalar Quantity, then all
        neutrino species are assumed to have that mass. Otherwise, the mass of
        each species. The actual number of neutrino species (and hence the
        number of elements of m_nu if it is not scalar) must be the floor of
        Neff. Usually this means you must provide three neutrino masses unless
        you are considering something like a sterile neutrino.

    name : str
        Optional name for this cosmological object.

    Ob0 : float
        Omega baryons: density of baryonic matter in units of the critical
        density at z=0.

    Notes
    -----
    Class instances are static -- you can't change the values
    of the parameters.  That is, all of the attributes above are
    read only.
    """
    def __init__(self, H0, Om0, Ode0, Tcmb0=2.725, Neff=3.04,
                 m_nu=u.Quantity(0.0, u.eV), name=None, Ob0=None):

        # all densities are in units of the critical density
        self._Om0 = float(Om0)
        if self._Om0 < 0.0:
            raise ValueError("Matter density can not be negative")
        self._Ode0 = float(Ode0)
        if Ob0 is not None:
            self._Ob0 = float(Ob0)
            if self._Ob0 < 0.0:
```

class astropy.cosmology. **FLRW**(*H0*, *Om0*, *Ode0*, *Tcmb0=2.725*, *Neff=3.04*, *m_nu=<Quantity 0.0 eV>*, *name=None*, *Ob0=None*) [edit on github][source]

Bases: **astropy.cosmology.core.Cosmology**

A class describing an isotropic and homogeneous (Friedmann-Lemaitre-Robertson-Walker) cosmology.

This is an abstract base class – you can't instantiate examples of this class, but must work with one of its subclasses such as **LambdaCDM** or **wCDM**.

Parameters:

H0 : float or scalar **Quantity**

Hubble constant at z = 0. If a float, must be in [km/sec/Mpc]

Om0 : float

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Temperature of the CMB z=0. If a float, must be in [K]. Default: 2.725. Setting this to zero will turn off both photons and neutrinos (even massive ones)

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name : str

Optional name for this cosmological object.

Ob0 : float

Omega baryons: density of baryonic matter in units of the critical density at z=0.

Notes

Class instances are static – you can't change the values of the parameters. That is, all of the attributes above are read only.

Attributes Summary

H0	Return the Hubble constant as an **Quantity** at z=0

v: stable

What are the Key Elements?

- Github for sharing
- Test *everything* (automatically)
- *Easy* documentation (⇒ thorough)

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- Test *everything* (automatically)
- *Easy* documentation (⇒ thorough)

Question for discussion: can we do this with "ordinary" research code/collaborations?

Affiliated Packages

An affiliated package is an astronomy-related Python package that is not part of the astropy core package, but has requested to be included as part of the Astropy project's community.

Affiliated Packages

Best place to look is always

http://affiliated.astropy.org

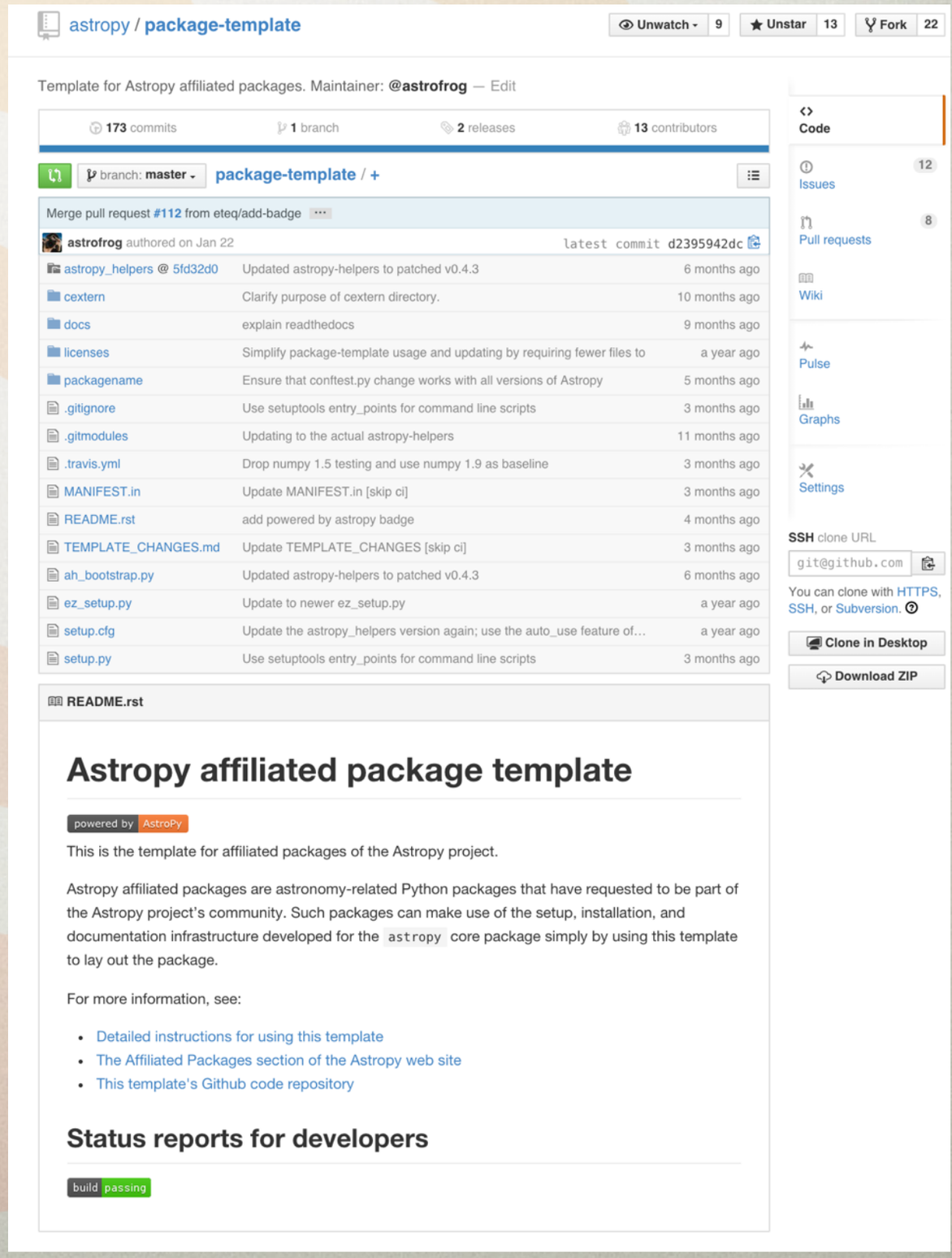
- APLpy: astronomical plotting
- astroML: astro machine learning (companion to a textbook)
- astroquery: access to internet resources <see Ginsburg talk>
- ccdproc: ccd reductions <see Crawford talk?>
- gammapy: gamma-ray astronomy
- ginga: interactive image viz
- imexam: quick image analysis
- montage-wrapper: image mosaicing
- photutils: photometry
- pydl: simple IDL ports
- pyregion: ds9 region files
- PyVO: VO access
- sncosmo: supernova light curves fitting/typing/etc
- specutils: spectroscopy
- spherical_geometry: spherical polygons/regions
- WCSAxes: WCS-aware matplotlib plots

What Unites them?

- A Common goal and vision: reducing duplication and embracing good coding practices (testing, docs)
- (For many) a package template

Affiliated Package Template

- Contains a ready-to-go "copy" of the astropy package layout. (Leans heavily on *astropy-helpers*)
- Provides documentation tools, testing framework, cython, configuration, etc.
- Docs on how to actually make it all work!



Affiliated Package Philosophy: Does it Work?

"Y'all's work is great! [the affiliated package template] has made our life so much easier."

Andrew Hearin, working on "halotools" affiliated package to-be, Feb 2015

"Huh? I don't get it. This is confusing."

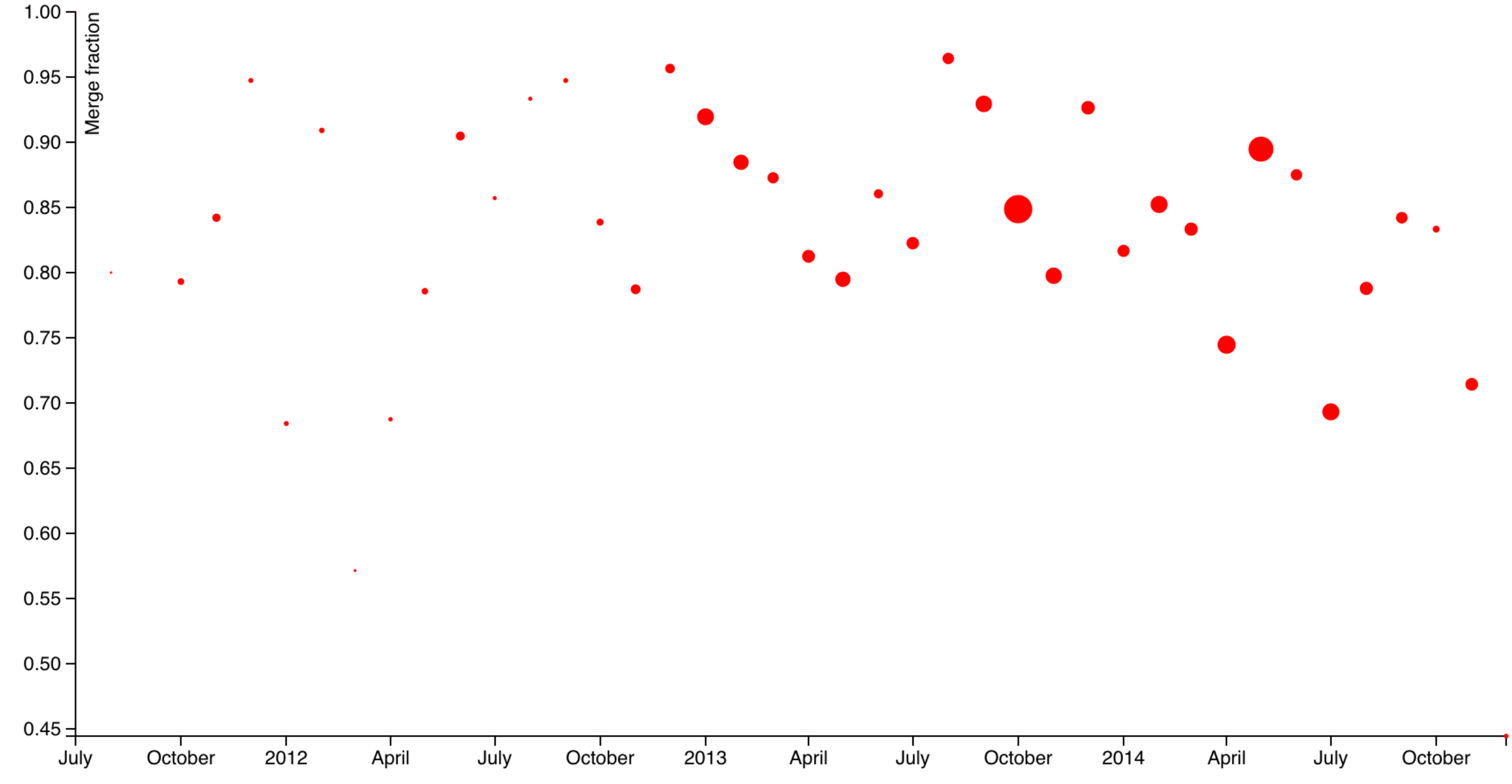
Probably wants to be anonymous, while attempting to adopt the template Dec 2014

"I don't see why I should care. My code doesn't have units."

Definitely wants to be anonymous, on using the template for a package (which does astrophysics) Jan 2015

What About Challenges?

Keeping Up with the PRs's



Giving Credit Where Credit Is Due

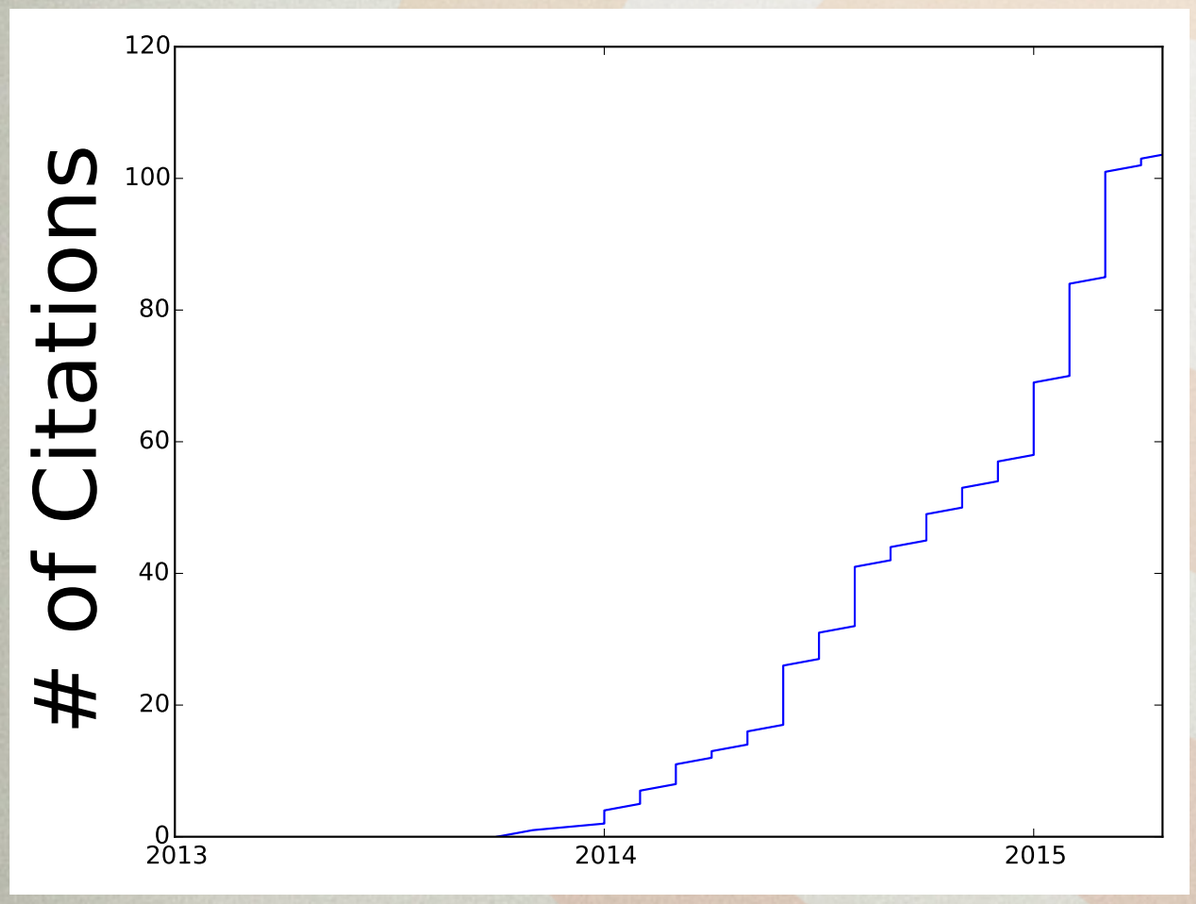
- Shailesh Ahuja
- Tom Aldcroft
- Kyle Barbary
- Geert Barentsen
- Paul Barrett
- Andreas Baumbach
- Chris Beaumont
- Daniel Bell
- Francesco Biscani
- Thompson Le Blanc
- Christopher Bonnett
- Joseph Jon Booker
- Médéric Boquien
- Azalee Bostroem
- Matthew Bourque
- Larry Bradley
- Gustavo Bragança
- Erik M. Bray
- Eli Bressert
- Hugo Buddelmeijer
- Mihai Cara
- Mabry Cervin
- Pritish Chakraborty
- Alex Conley
- Jean Connelly
- Simon Conseil
- Ryan Cooke
- Matthew Craig
- Steven Crawford
- Neil Crighton
- Kelle Cruz
- Daniel Datsev
- Matt Davis
- Christoph Deil
- Nadia Dencheva
- Jörg Dietrich
- Axel Donath
- Michael Droettboom
- Jonathan Eisenhamer
- Zach Edwards
- Thomas Erben
- Henry Ferguson
- Jonathan Foster
- Ryan Fox
- Lehman Garrison
- Simon Gibbons
- Adam Ginsburg
- Christoph Gohlke
- Perry Greenfield
- Dylan Gregersen
- Frédéric Grollier
- Karan Grover
- Kevin Gullikson
- Hans Moritz Günther
- Alex Hagen
- Michael Hoenig
- Emma Hogan
- Chris Hanley
- JC Hsu
- Anthony Horton
- Eric Jeschke
- Sarah Kendrew
- Marten van Kerkwijk
- Wolfgang Kerzendorf
- Lennard Kiehl
- Rashid Khan
- Dominik Klaes
- Kacper Kowalik
- Roban Hultman Kramer
- Arne de Laat
- Antony Lee
- Simon Liedtke
- Pey Lian Lim
- Joseph Long
- Aaron Meisner
- Serge Montagnac
- José Sabater Montes
- Michael Mueller
- Stuart Mumford
- Demitri Muna
- Prasanth Nair
- Bogdan Nicula
- Joe Philip Ninan
- Bryce Nordgren
- Miruna Oprescu
- Luigi Paioro
- Asish Panda
- Madhura Parikh
- Sergio Pascual
- Rohit Patil
- David Perez-Suarez
- Ray Plante
- Adrian Price-Whelan
- Xavier Prochaska
- David Pérez-Suárez
- QuanTakeuchi
- Tanuj Rastogi
- Thomas Robitaille
- Juan Luis Cano Rodríguez
- Evert Rol
- Alex Rudy
- Joseph Ryan
- Eloy Salinas
- Gerrit Schellenberger
- David Shiga
- David Shupe
- Jonathan Sick
- Leo Singer
- Brigitta Sipocz
- Shivan Sornarajah
- Shantanu Srivastava
- Ole Streicher
- Bernardo Sulzbach
- James Taylor
- Jeff Taylor
- Kirill Tchernyshyov
- Víctor Terrón
- Erik Tollerud
- James Turner
- Miguel de Val-Borro
- Jonathan Whitmore
- Lisa Walter
- Benjamin Alan Weaver
- Jonathan Whitmore
- Julien Woillez
- Víctor Zabalza

Giving Jobs Where Jobs Are Due

- We are facing a possible brain drain of pro-social software workers from astro (data science = $$$)
- Is the solution within the current system? E.g., Astropy Papers? Calling us "electronic instrumentalists"?
- Or more drastic? E.g., Formal altmetrics, new job tracks, accept perma-soft-money
- (A worthy unconference topic?)

Impact of Astropy

Astropy Collaboration et al. 2013
A&A 558 A33



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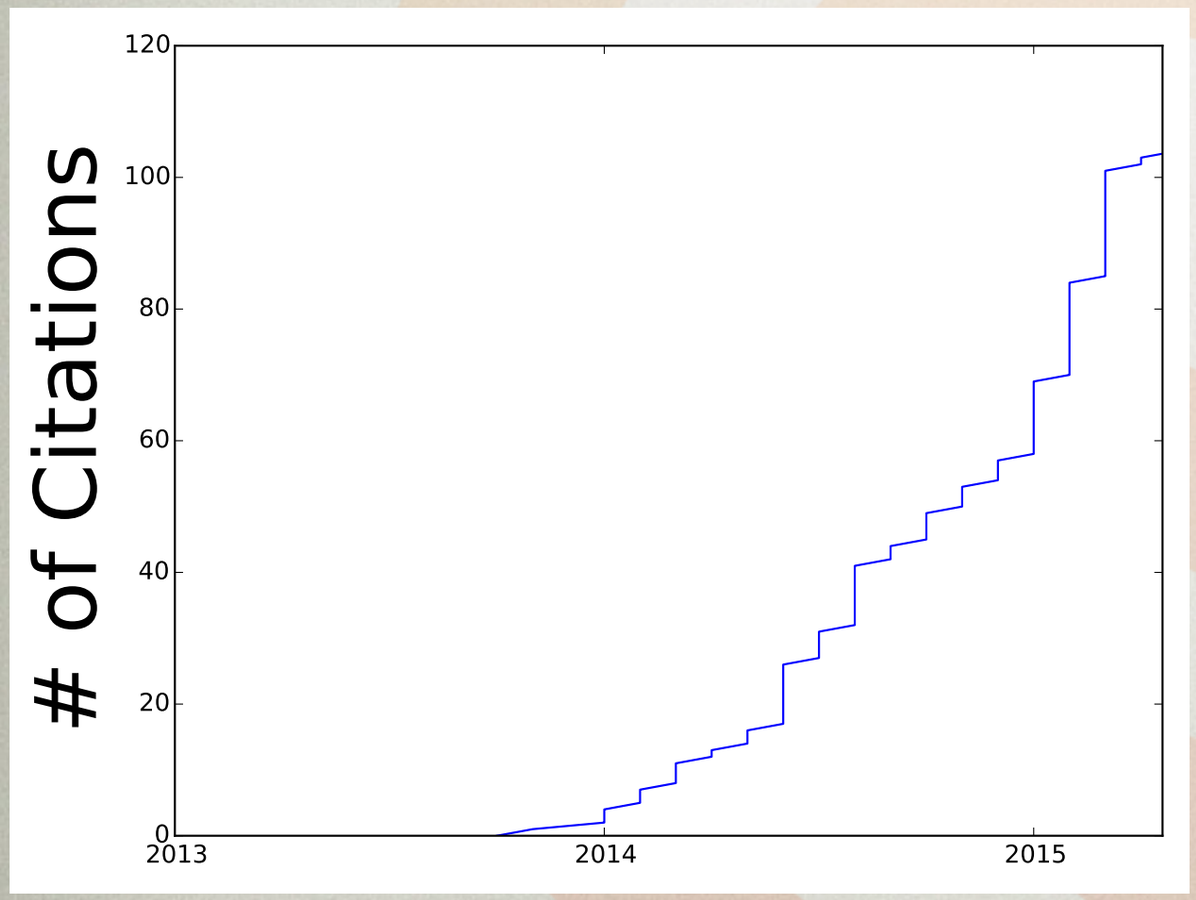

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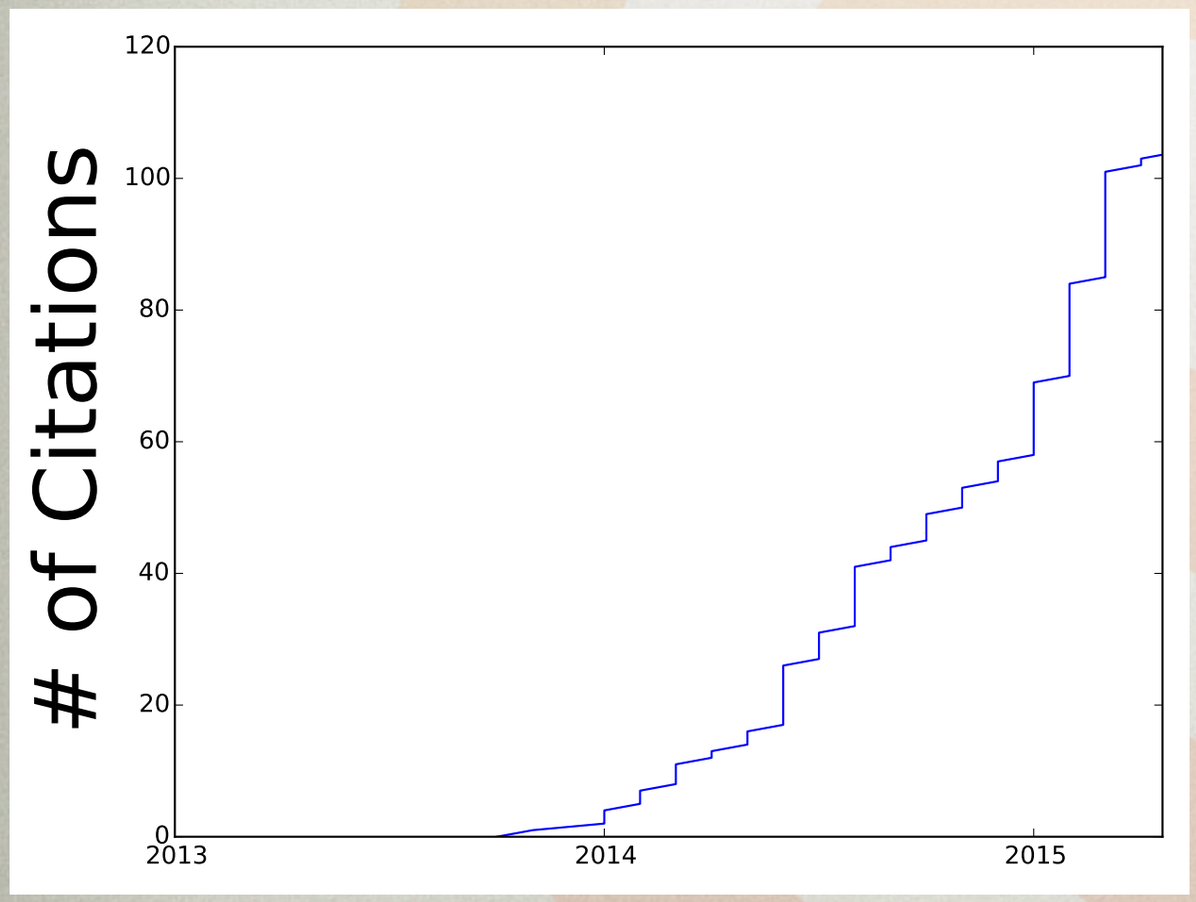

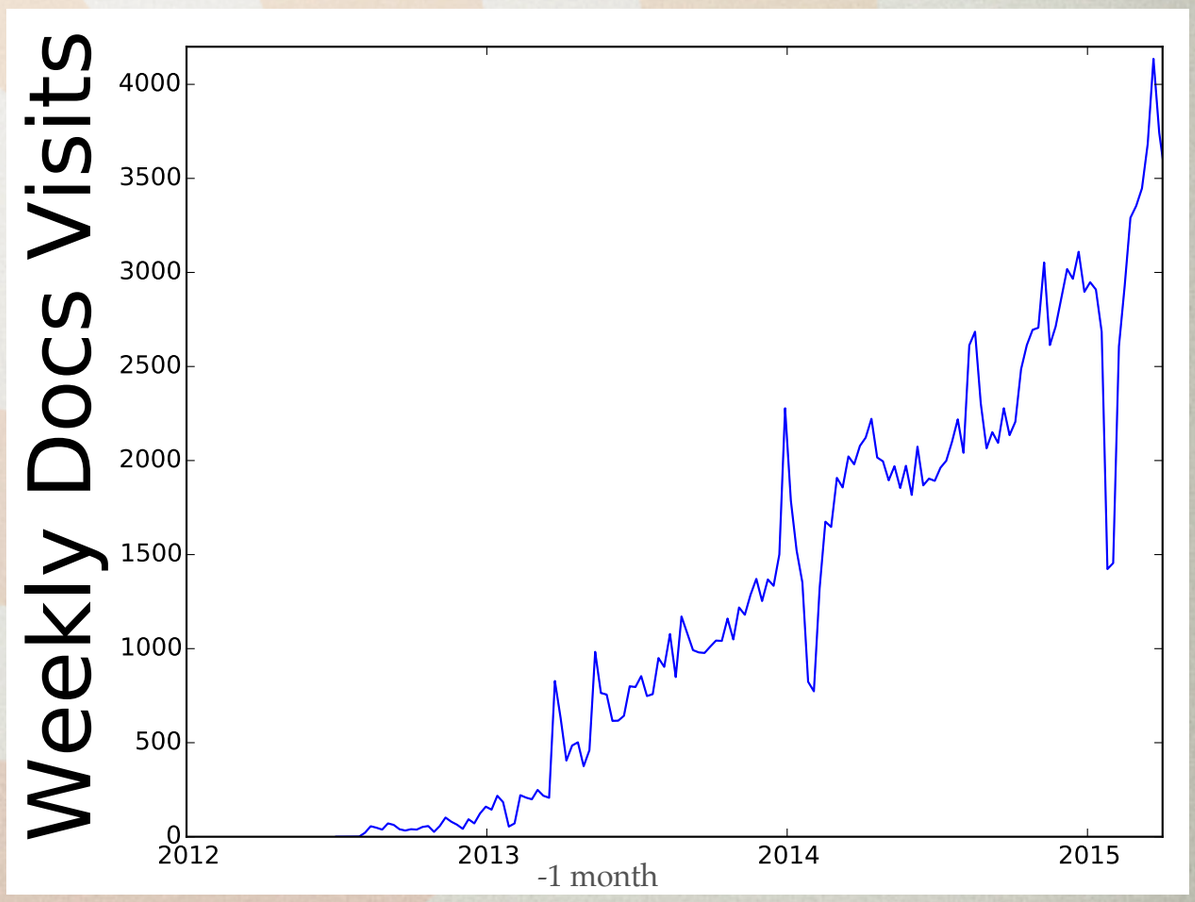

downloads 67.4k/month / 10-100 ?

Astropy's Development