Building a community of

TECH SAVVY ASTRONOMERS

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astronomy & tech | scientific computing | research & data strategy | RHoK Australia

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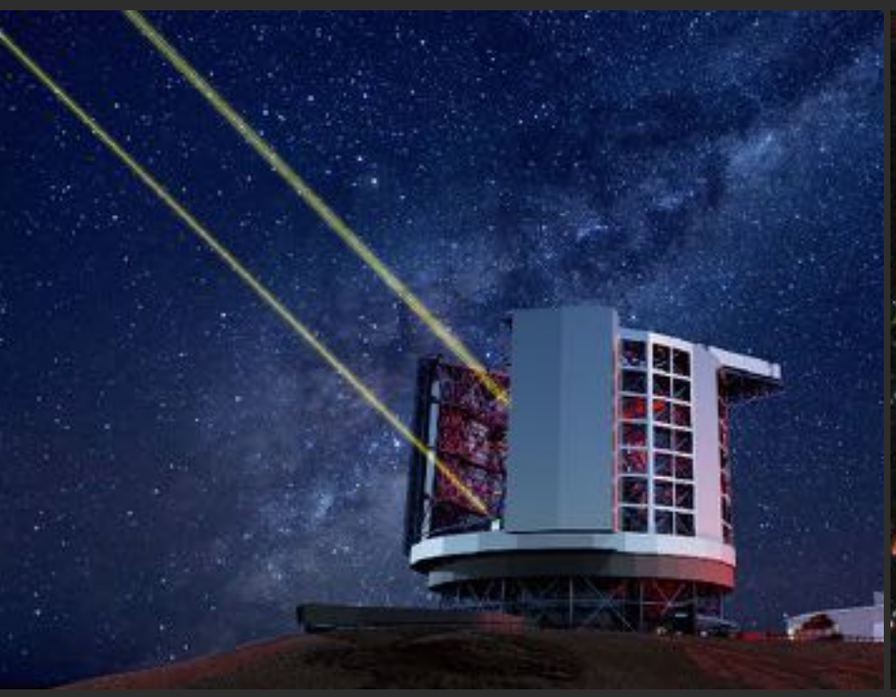
This talk is about building a community of tech savvy astronomers

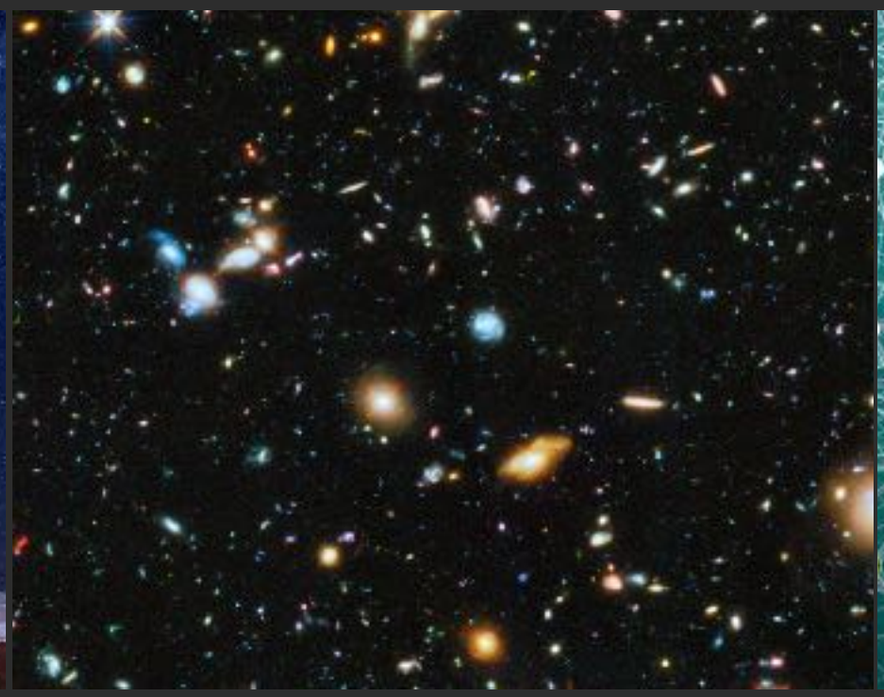
Why? In this new era of data-intensive astronomy there are many reasons. Here are just a few...

* TSA news



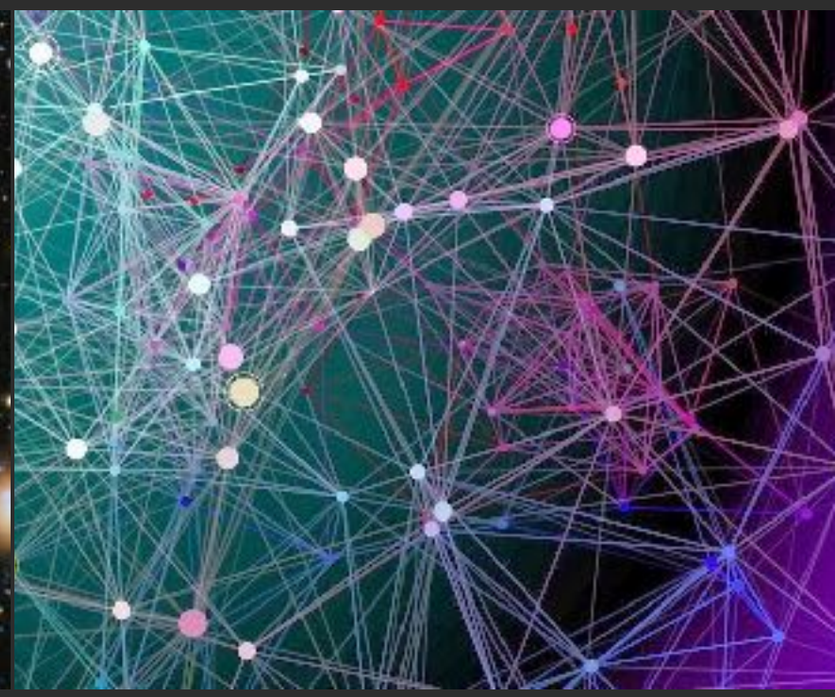
Managing the data deluge

LSST, SKA, JWST, GMT all have ridiculous data rates. Require scalable platforms & techniques for rapid science.



Blue-sky tools development

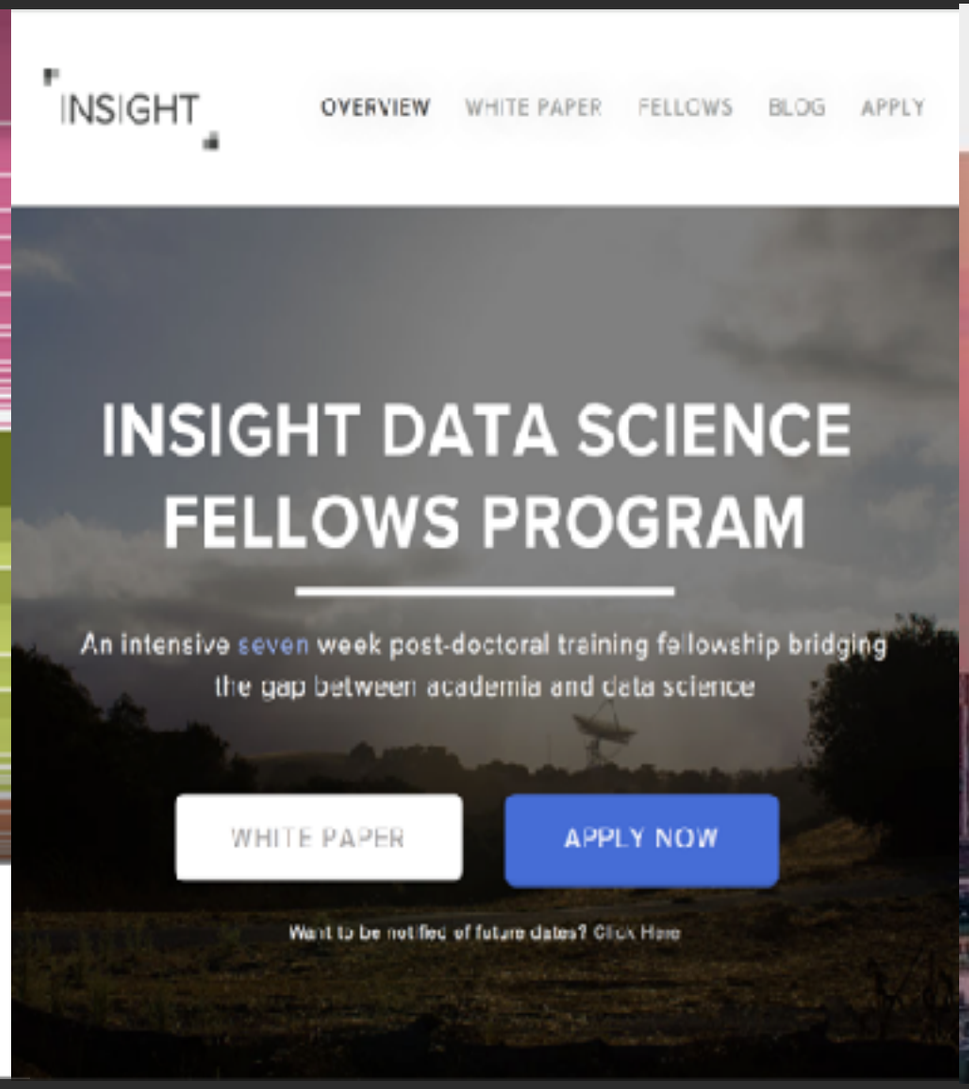
Developing new tools & data analysis techniques (e.g. MLA) are critical to success



Alternative careers

Dual science/tech positions* in astronomy (US mainly) and data science roles in the tech industry.

The rise of "data science" has created a generation of astronomers who want to be tech savvy. The Insight and S2DS fellowships facilitate transitioning to the tech industry, but these are becoming even more competitive. Being tech savvy is advantageous.



tech savvy astronomer

(noun)

- a researcher with tech-focussed and/or ad-hoc tools development skills in addition to their astronomy specific data analysis skills

    - a set of skills that enable them to effectively manage the complex (3D + temporal), "big" datasets anticipated from next generation telescopes & science-surveys;
    - the ability to contribute to open software and community tools development;
    - the ability to build simple tools for their research and others;
    - skills that enable them to transition easily into tech industry.

tech savvy arna

PhD Astronomy, University of Melbourne – Fornax Cluster
Post-doc @ Lawrence Livermore National Lab – UCDs in Clusters, GCs in M31
Post-doc @ ARI, LJMU - HST/ACS Coma Cluster Treasury Survey + Keck
Soft money @ University of Oxford – HST follow-up for Atlas 3D Galaxy Survey
Swinburne Research – Data Analyst / e-Research Consultant / Project Manager

Next stop. Tech industry + astro on the side...

Data Science Institutes | AAL AeRAC + ADACS | IAU WG Data-Driven Discovery |
DotAstro - Day Zero | Random Hacks of Kindness | Tech mentoring |
Faciliating software development | Agile, Lean, UX & BA processes | Web Design |
Automagic thinsgs | Interactive dataviz for the web | Machine Learning – NLP |
Start-up culture | Accelerators & Incubators | Space Science | Planet Labs

Tech savvy communities are built from the ground up

The US and Europe are leading the charge with various grassroots and data science initiatives. Australia is slowly catching up...

.astronomy

GORDON AND BETTY MOORE FOUNDATION

AH

SPACE TELESCOPE SCIENCE INSTITUTE

BERKELEY Institute for Data Science

eScience Institute
ADVANCING DATA-INTENSIVE DISCOVERY IN ALL FIELDS

ANITA
Australian National Institute for Theoretical Astrophysics

> {SciCoder;}

ADACS

The .Astronomy (DotAstro), Astro Hack Week, Python in Astronomy, SciCoder, Hacker Within, SPIE/NAM/AAS Hack Days, bring together a diverse community of astronomers – at all levels, instrument scientists, software developers, data wranglers, data scientists, educators, and science communicators.

They provide a forum for discussing best practices in scientific computing, skills sharing, and an opportunity for astronomers to create innovative research and outreach tools in a safe* and collaborative environment.

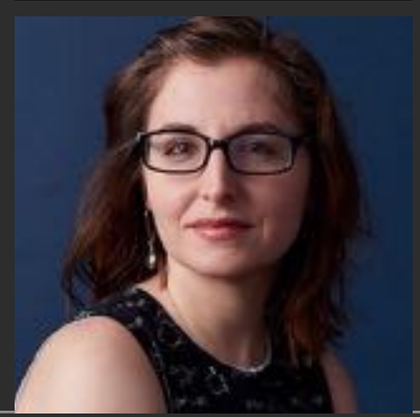
They are participant driven

*Imposter syndrome is rife – Motivation for creating DotAstro Day Zero

Recently, astronomers who moved into tech were often lost forever.

Those who were a part of the DotAstro & Astro Hack Week communities continue to be actively involved. Some have kickstarted tech collaborations*. Others have become data science mentors.

STScI managed to entice Arfon back to lead the new Data Science Mission Office



Microsoft Research

GORDON AND BETTY MOORE FOUNDATION

Google

The Astronomical Society of Australia

Microsoft New England Research & Development Center

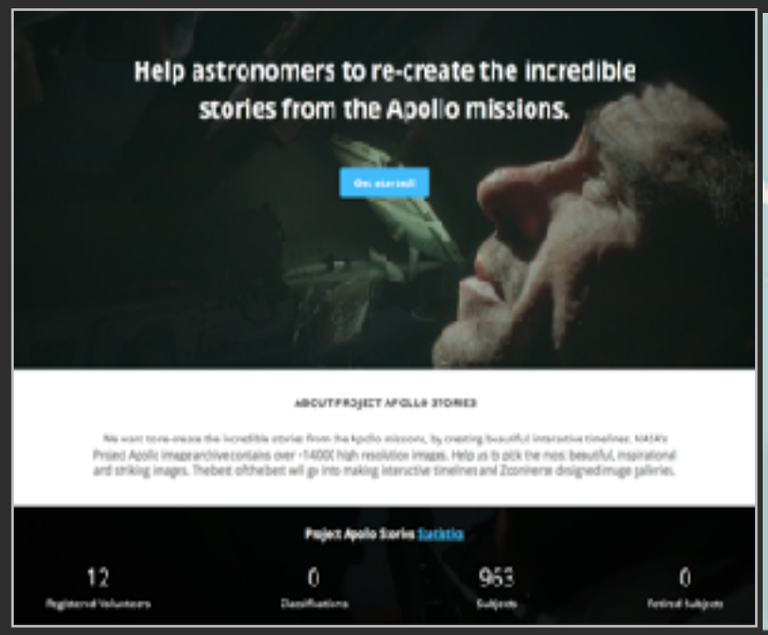
What actually happens?

Formal talks | Discussions/BoFs | Tutorials | Hacking

Which typically have this effect on participants...

Tutorials from “experts”
Software & data publishing: DOIs –> AAS policy
Collaborative coding & source control -> GitHub & BitBucket
Creating & embedding data visualisations: Aladin Lite
Interactive data visualisation with D3js & GlueViz
AstroPy & other open development projects
Hacking the literature & reproducible science
Django & Flask web-application frameworks
Building personal & project websites: HTML, CSS & Javascript
MLA – Fakespeare
Web scraping. Using & writing APIs
Mobile applications. Web design – wireframes
Sonification of Kepler, IFU, & multi-wavelength datasets
Visual data-storytelling & social media hacks (Twitterbots)
Code optimisation, machine learning, bayesian statistics, deep learning
Databases: SQLite, DB Browser, SQLAlchemy
Digital Ocean, Docker, IPython, Jupyter Notebooks, Binder, Discourse

At some point magic happens


Help astronomers to re-create the incredible stories from the Apollo missions.
ABOUTPROJECT APOLLO STORIES
Project Apollo Stories Statistics
12
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953
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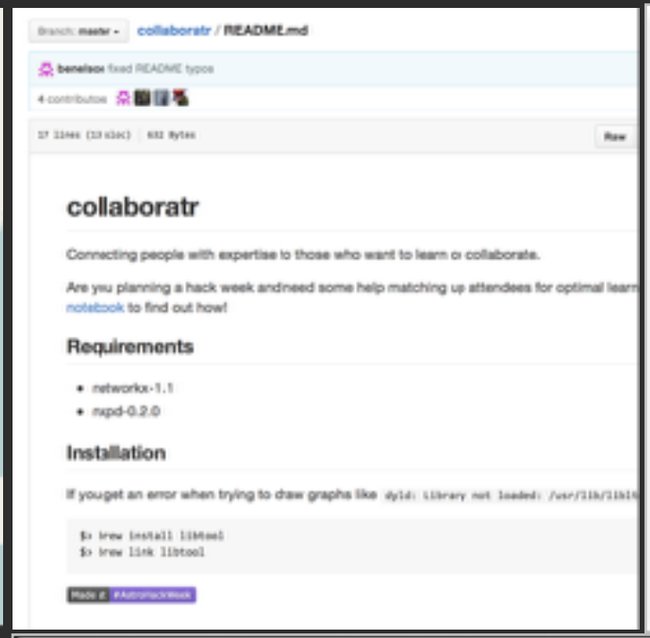
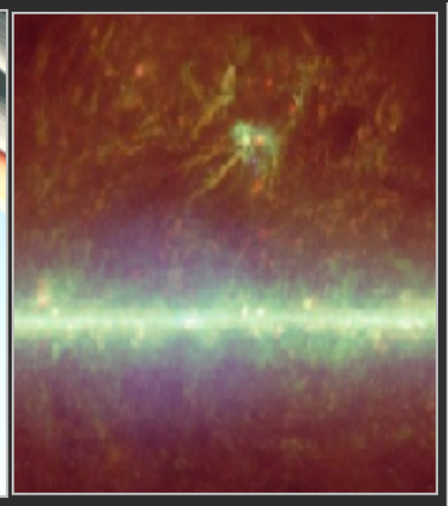
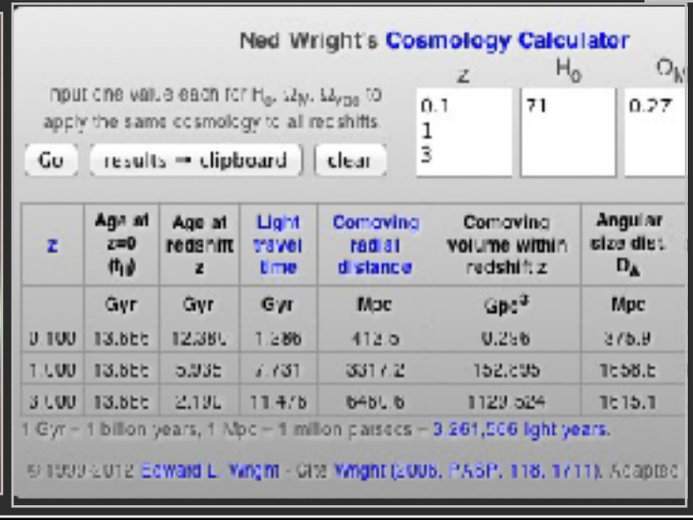
Faculty Positions (visiting and non-tenure)
Faculty Positions (tenure and tenure-track)
Other
Pre-doctoral/Graduate Positions
Post-doctoral Positions and Fellowships
Science Engineering
Science Management
Scientific/Technical Staff

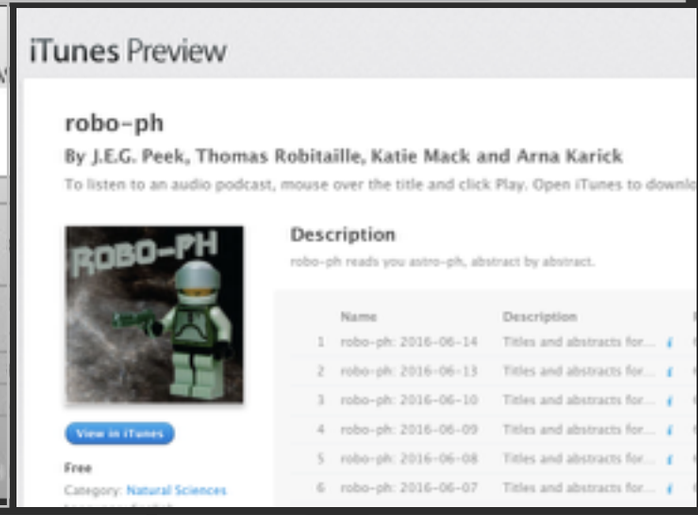

collaboratr
Connecting people with expertise to those who want to learn or collaborate.
Requirements
networkx-1.1
nxpd-0.2.0
Installation


StingRA
OVERVIEW
REVIEWS
RELATED


git going with .draft
Write papers on GitHub.
Automagically get PDFs highlighting differences between commits.
Be happy. Make your co-authors happy.




Ned Wright's Cosmology Calculator
Input one value each for H0, ΩM, ΩVAC to apply the same cosmology to all redshifts
Go
results → clipboard
clear
z
H0
ΩM
0.1
1
3
71
0.27
Age at z=0 (tH)
Age at redshift z
Light travel time
Comoving radial distance
Comoving volume within redshift z
Angular size dist DA
Gyr
Gyr
Gyr
Mpc
Gpc3
Mpc
0.100 13.666 12.386 1.286 412.5 0.256 376.9
1.000 13.666 5.858 7.731 3317.2 152.095 1658.6
3.000 13.666 2.196 11.476 6461.6 1129.524 1615.1
1 Gyr = 1 billion years, 1 Mpc = 1 million parsecs = 3,261,636 light years.
© 1999-2012 Edward L. Wright - Cite Wright (2006, PASP, 118, 1711) Acapbc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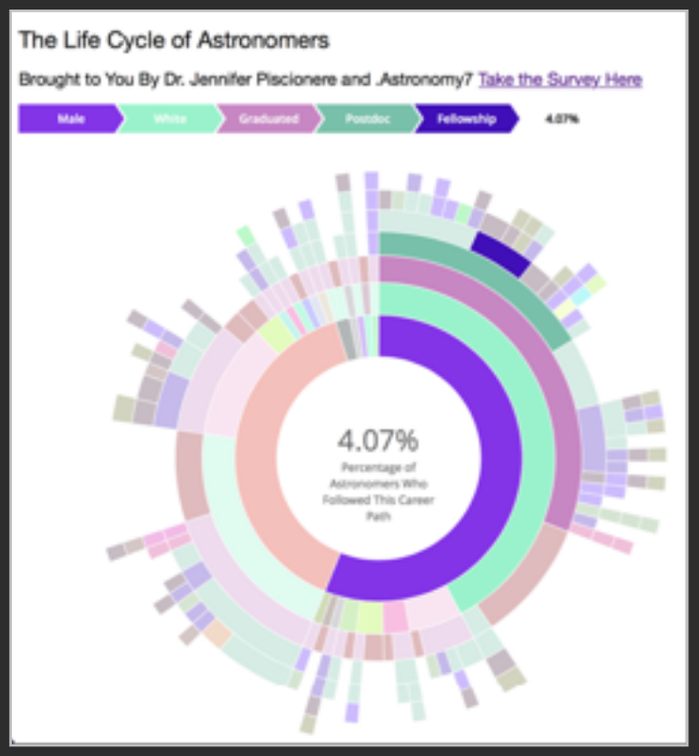
The Life Cycle of Astronomers
Brought to You By Dr. Jennifer Piscionere and .Astronomy7 Take the Survey Here
Male
White
Graduated
Postdoc
Fellowship
4.07%
4.07%
Percentage of Astronomers Who Followed This Career Path


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Marasco, Robert A. Crain, Joop
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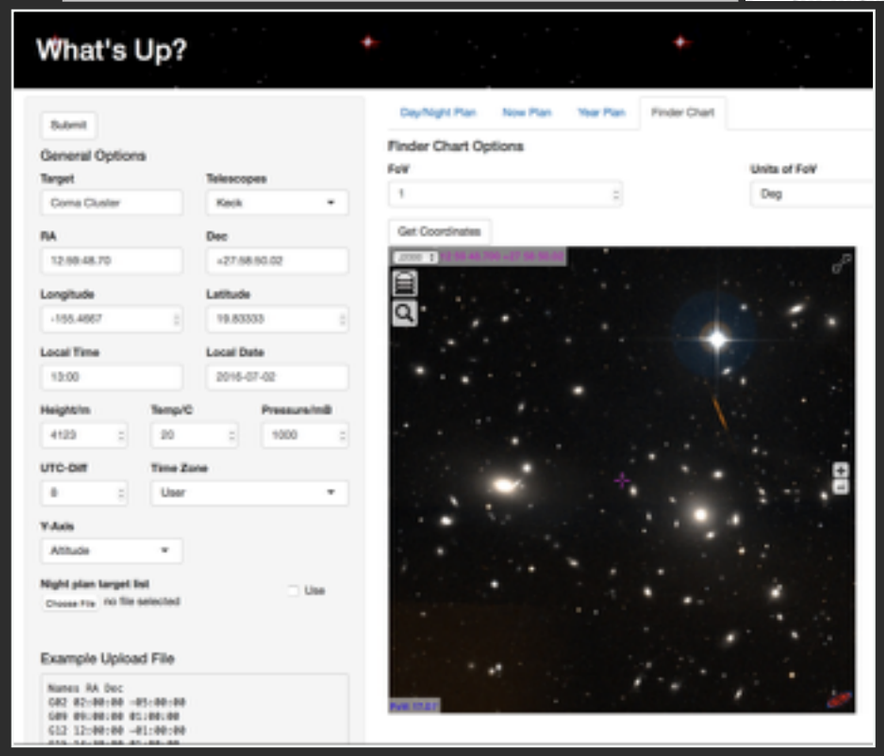
Dekel,
Mark R. Kru...
Info


What's Up?
Submit
General Options
Target
Coma Cluster
Telescopes
Keck
RA
Dec
Longitude
Latitude
Local Time
Local Date
Height/m
Temp/C
Pressure/mB
UTC-Diff
Time Zone
User
Y-Axis
Altitude
Night plan target list
Example Upload File
Day/Night Plan
Now Plan
Year Plan
Finder Chart
Finder Chart Options
FoV
Units of FoV
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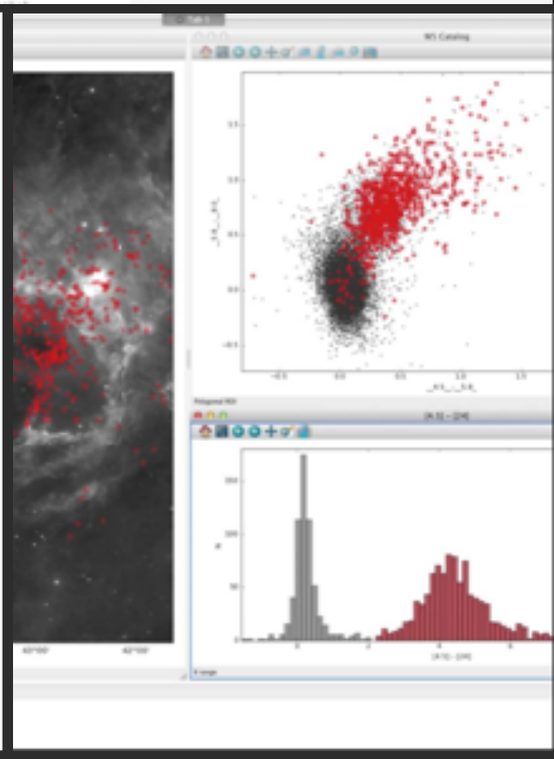
Get Coordinates



Unique opportunites




Astro Hack Week 2016 – BIDS & **GitHub**, San Francisco

Phil Marshall – Stanford: **How the LSST DESC uses GitHub for development**

Jonathan Whitmore – Silicon Valley Data Science: **Jupyter Notebooks**

Tour of HQ, dinner, and discussions with GitHub staff

Value to participants

Expanding your network. Identifying experts.	Learn about tech companies	Tech roles & skills required	Identifying your own abilities & where you can contribute	
Community Developed Tutorials (Jypyter)	Code optimisation	Best practises in scientific computing	Collaborative Coding & Version Control	Introduction to Code Testing
Conversations with software engineers & developers	Statistics/ Baysian Inference	Machine Learning	Getting involved in AstroPy	Building community and a network of experts
Sense of what can be achieved quickly – MVPs	Lean and Agile principles	Code documentation	Learn how languages and applications fit together	Kickstarting new collaborations
Appreciation of real development timelines	What is needed for a robust final product	Complexities of software development	Combining tools to build something entirely new	Discovering useful tools

The Tech Savvy Astronomer website was created
in response to DotAstro and Astro Hack Week.
Opens up resources and networks to a wider audience.

Lists of useful tools | Showcasing tutorials | Sharing news |
Finding experts

So how do we do build a tech savvy community in Australia?

ADACS + similar grassroots initiatives

Skills training/Hacky Hour programs:
Python, databases, HPC, cloud computing, tech tools, best practice etc.
e.g. SHW, CAS Code Review, ResBaz

More workshops and events:
that bring together astronomers at all levels, instrument scientists, software developers & engineers and data scientists.

Hack days focussed on tool building:
based around exisiting data portals (e.g. HST), early release datasets (e.g. SkyMapper), or new analysis techniques such as Machine Learning

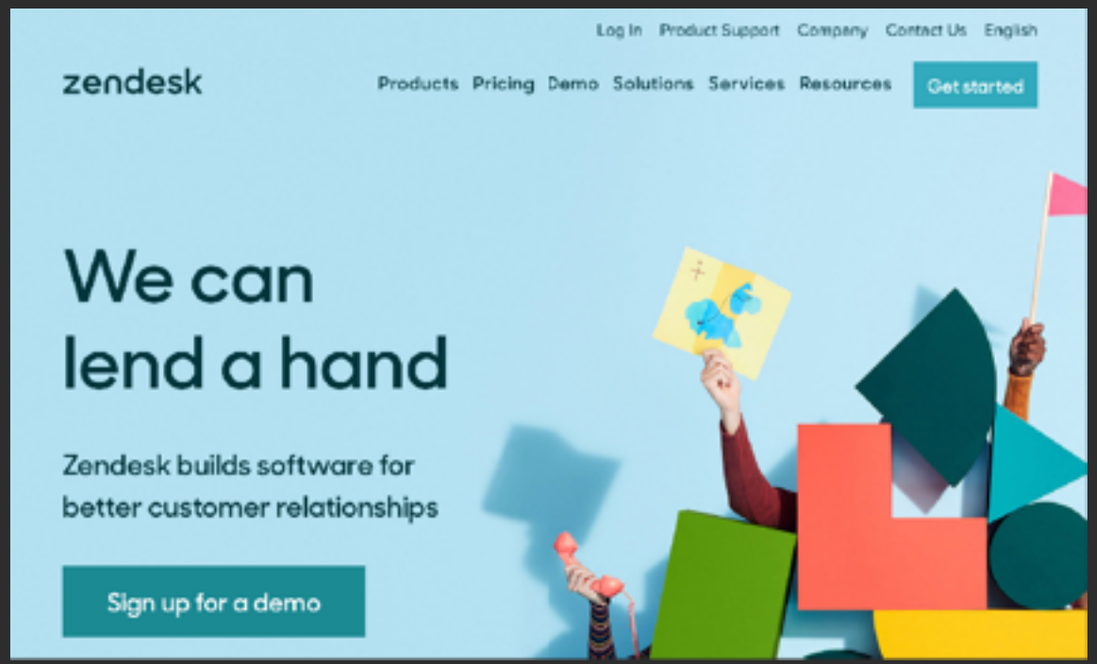
Collaborating with key people in the US/UK – visitor exchange?

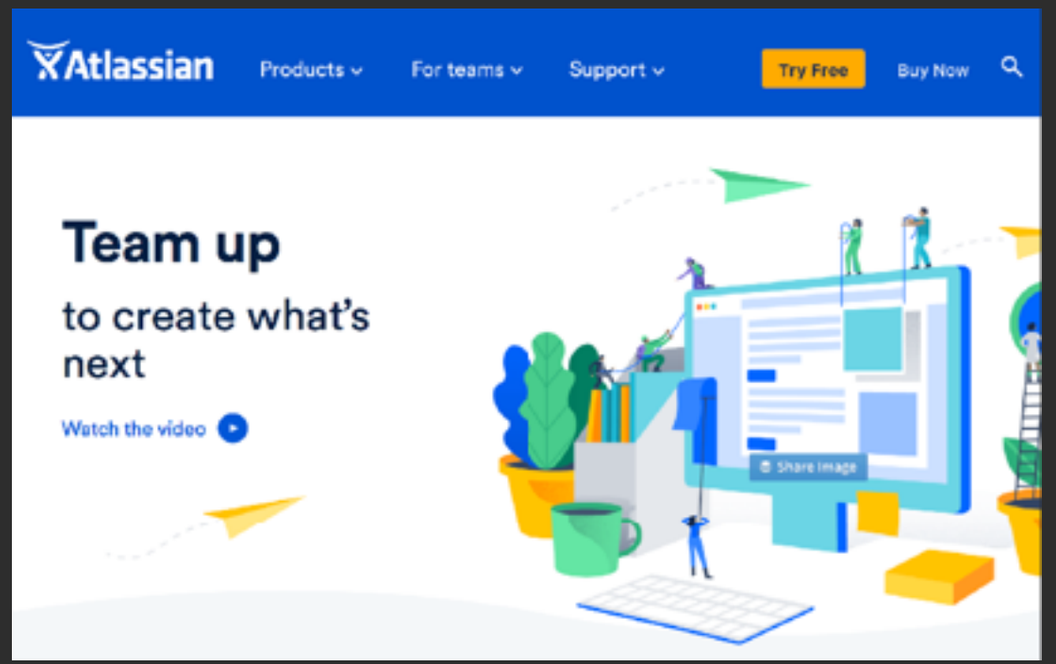
ENCOURAGE TECH TALKS

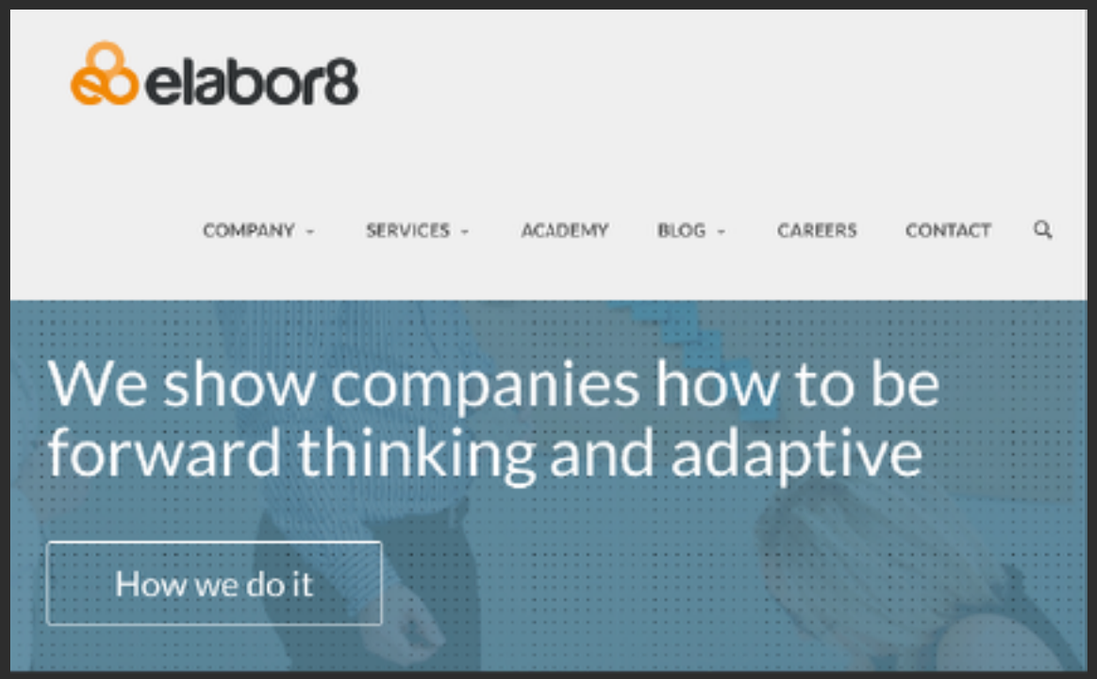
Benefits to the community

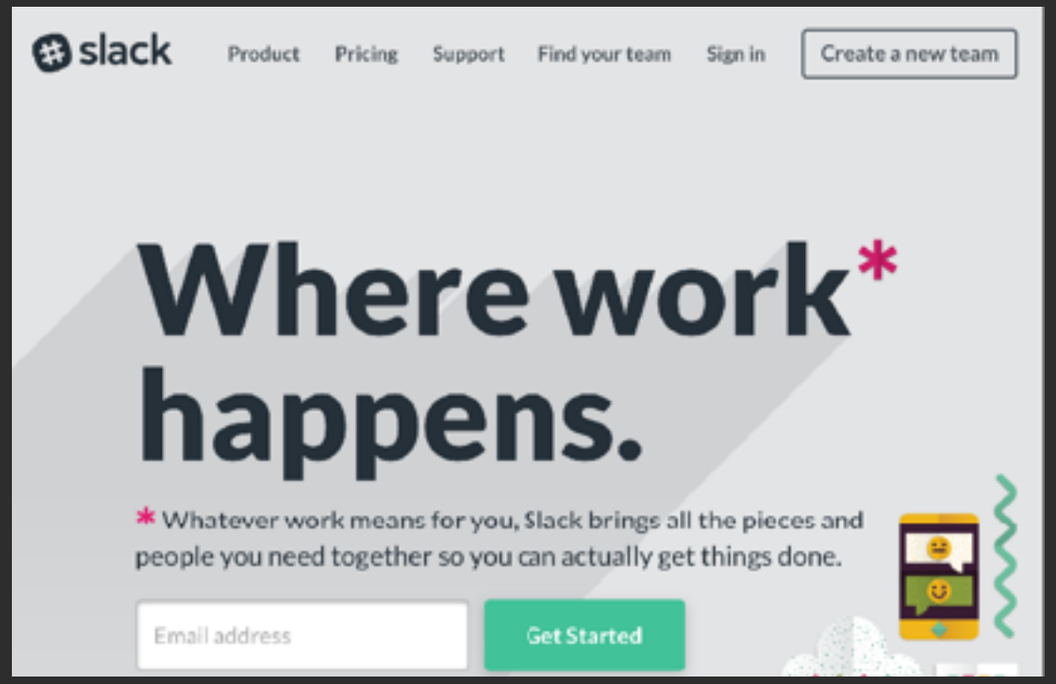
- **Increased collaboration:** between astronomers, instrument scientists, software developers & engineers, data archivists
- **Breaking down barriers:** between ADASS, Astroinformatics, DotAstro, AHW and other grassroots initiatives
- **Network of experts:** to contribute to the development of data portals, VO projects, software, data analysis & visualisation tools
- **Mentors:** for researchers seeking alternative career paths
- **Non-traditional research outputs:** impact & outreach
- Opportunities for industry engagement & collaboration
- Potential sources of **funding**
- **Start-ups & consultancies:** wise.io | onekilopars.ec | GROK Learning

Tech companies are our new best friends









Tech companies are our new best friends

People working in tech companies are genuinely excited by what astronomers do

Funding and space for events

Expertise & networking opportunities

Informal collaboration e.g. JOSS, MLA

DotAstro and Astro Hack Week have benefitted
enormously from having researchers at **all levels**,
software developers, engineers, data scientists from industry,
experts from the ADASS, CDS, AAO & HST communities.

Diversity is critical. **Get involved.**

Tell everyone what you think the Australian community needs.
Tell everyone what you want.
Become a tech mentor for others.

Upcoming Events

ADACS Data Intensive Astronomy Workshop
Swinburne University – early August

Astro Hack Week 2017
UW eScience Institute – late August

Astroinformatics 2017
Cape Town – early November

.Astronomy9
Cape Town – mid November

ADACS Astro Hack Week
Swinburne University – late November

THANK-YOU