

Building a community of TECH SAVVY ASTRONOMERS



Dr. Arna Karick

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

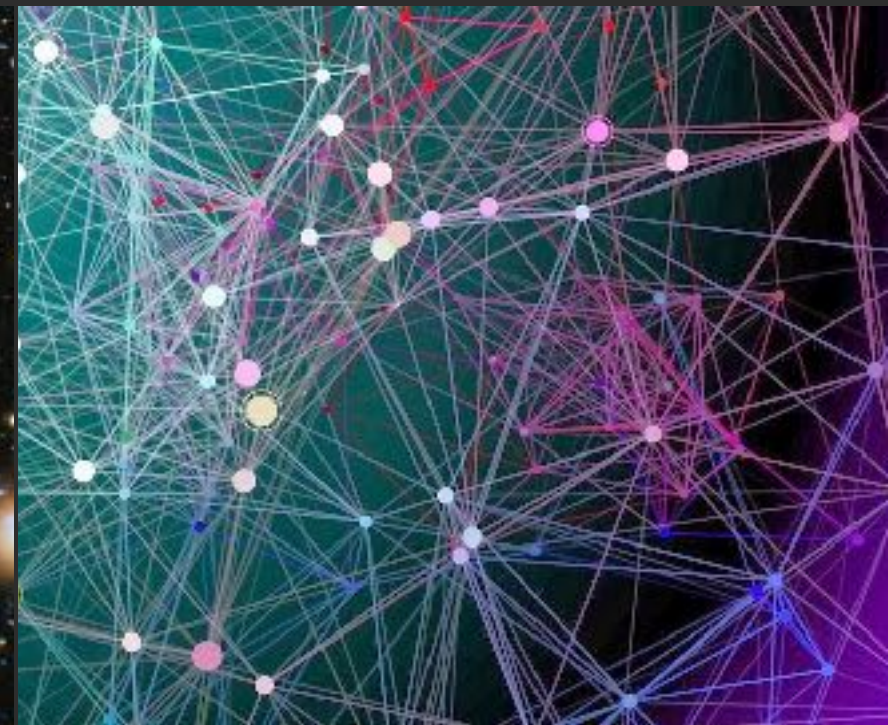
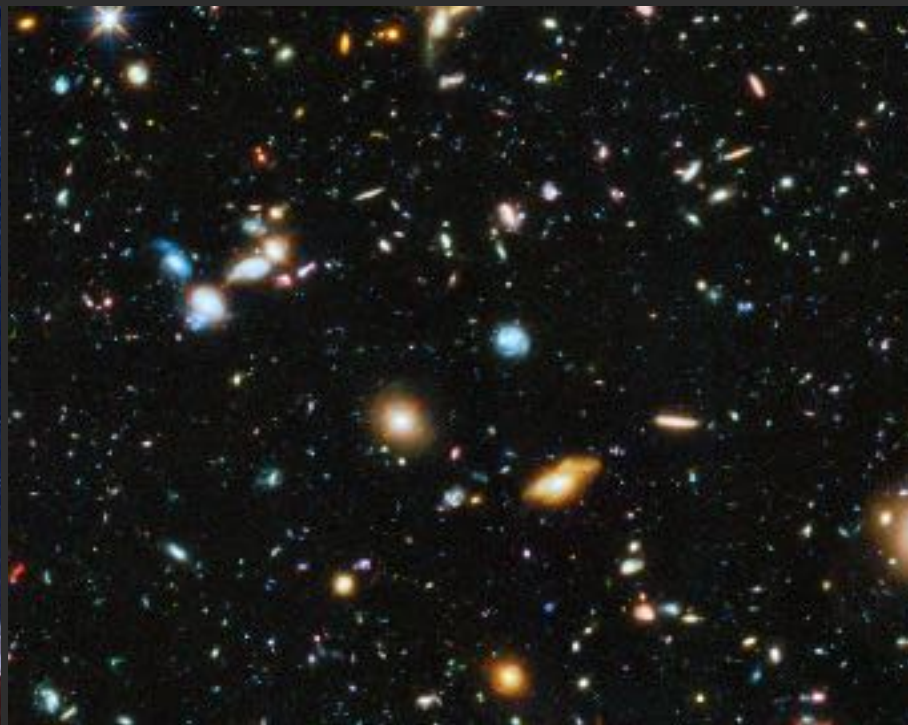
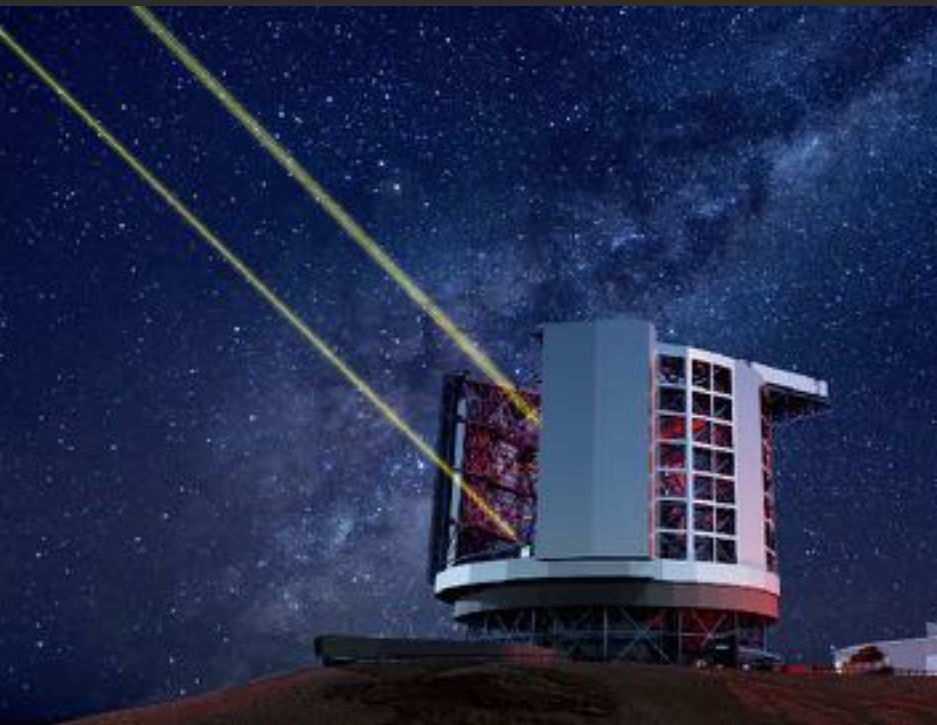
Melbourne, Australia  @drarnakarick  www.arnakarick.com | techsavvyastronomer.io

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.

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Data-Driven Discovery

Combining scientific expertise, computational
knowledge and statistical skills

Courtesy of well-formed.eigenFACTOR.org

Stimulating data science
innovation for research

INSIGHT OVERVIEW WHITE PAPER FELLOWS BLOG APPLY

INSIGHT DATA SCIENCE FELLOWS PROGRAM

An intensive **seven** week post-doctoral training fellowship bridging
the gap between academia and data science

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S²DS
Science to Data Science

Science to Data Science

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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 |

Facilitating software development | Agile, Lean, UX & BA processes | Web Design |

Automagic things | 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

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AH



SPACE TELESCOPE SCIENCE INSTITUTE



eScience Institute

ADVANCING DATA-INTENSIVE DISCOVERY IN ALL FIELDS



Australian National Institute for Theoretical Astrophysics

BERKELEY

Institute for
Data Science

> {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.

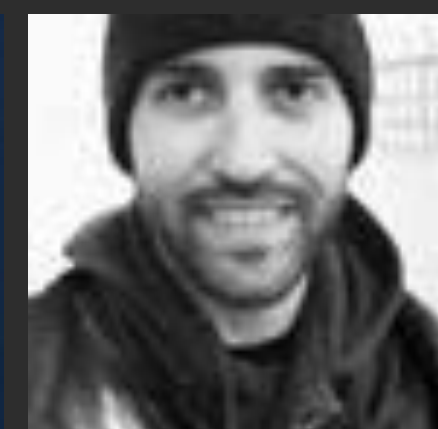
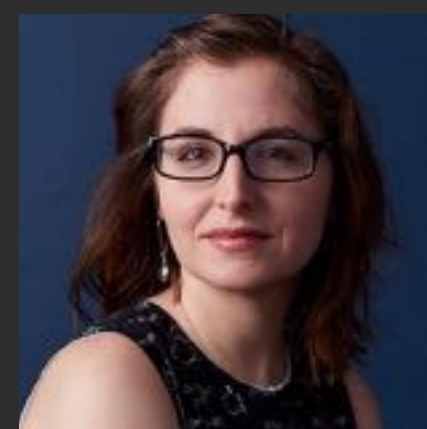
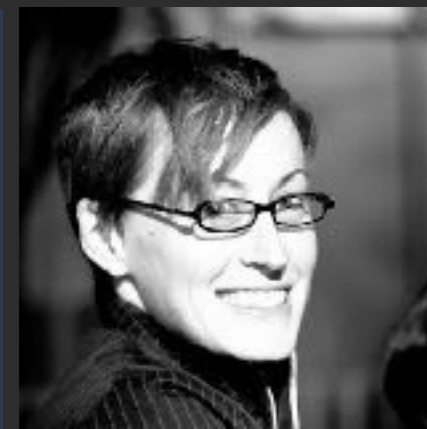
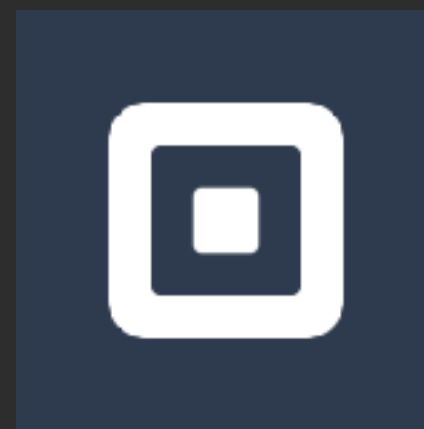
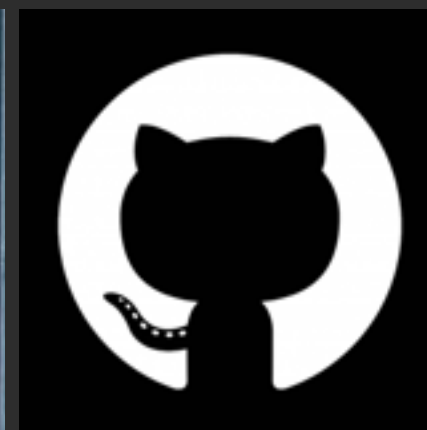
They are participant driven

*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





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Google



**SEAMLESS
ASTRONOMY**
Linking scientific data, publications, and communities



mozilla
Science Lab



The Astronomical
Society of Australia



Astronomy
Australia
Ltd.



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.

ABOUT PROJECT APOLLO STORIES

No want to re-live the incredible stories from the Apollo missions, by creating beautiful interactive timelines, NASA's Project Apollo image archive contains over 14000 high resolution images. Help us to pick the most beautiful, inspirational and striking images. The best of the best will go into making interactive timelines and Zoomers designed image galleries.

Project Apollo Stories **Satista**

12 Registered Volunteers 0 Distributions 953 Subjects 0 Featured Subjects

- 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 / README.md

Connecting people with expertise to those who want to learn or collaborate.

Are you planning a hack week and need some help matching up attendees for optimal learn notebook to find out how!

Requirements

- networkx-1.1
- nxpd-0.2.0

Installation

```
$ brew install libnxpd
$ brew link libnxpd
```

StingRA

Overview Reviews Related

Searching for Scattered High-Contrast Imaging of Young Stars

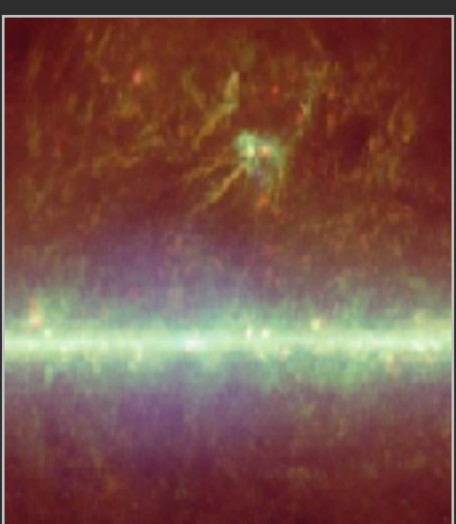
We have conducted an angular differential imaging survey with NIRC2 on Keck II to find exoplanets in the vicinity of the young stars in the Pleiades cluster. These stars represent a unique opportunity for searching for exoplanets because of their relative proximity to Earth, their young ages, and their high contrast against the background of the cluster stars. We have analyzed the images of NIRC2 to detect exoplanets. We have found a total of 11 exoplanets with masses between 1.5 and 10 Jupiter masses. The detection of these planets is a significant step towards understanding the formation and evolution of exoplanets in the vicinity of young stars.

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 H_0 , M_p , M_{D25} to apply the same cosmology to all redshifts.

Go results clipboard clear

z	Age at z=0 (Myr)	Age at redshift z (Gyr)	Light travel time (Gyr)	Comoving radial distance (Mpc)	Comoving volume within redshift z (Gpc ³)	Angular size dist. D _A (Mpc)
0.100	13.666	12.986	1.286	412.0	0.246	376.8
1.000	13.666	0.935	7.731	3317.2	152.005	7658.6
3.000	13.666	2.194	11.476	6461.6	1129.624	7615.1

1 Gyr = 1 billion years, 1 Mpc = 1 million parsecs = 3.26156 light years.

iTunes Preview

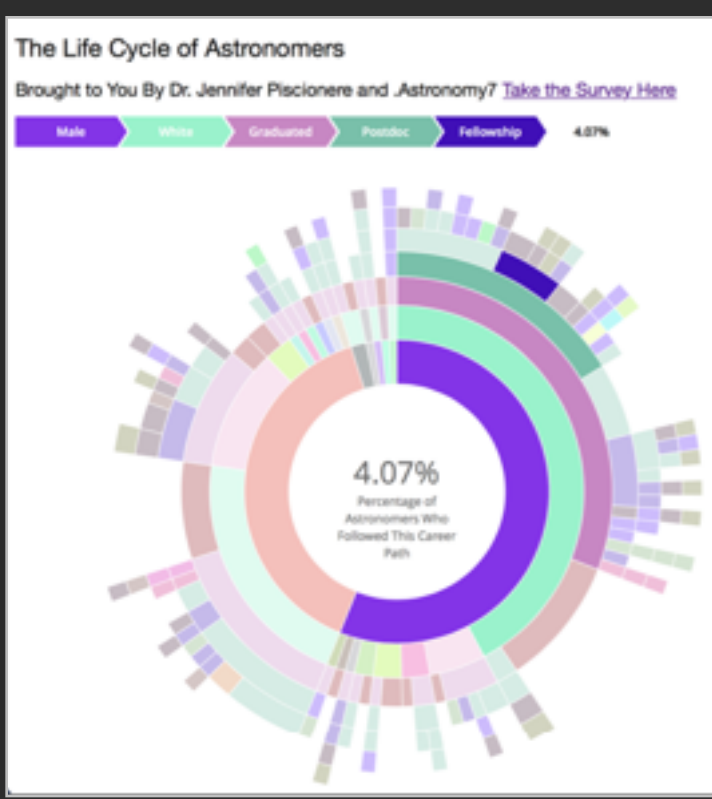
robo-ph

By J.E.G. Peek, Thomas Robitaille, Katie Mack and Arna Karick

To listen to an audio podcast, mouse over the title and click Play. Open iTunes to download.

Description
robo-ph reads you astro-ph, abstract by abstract.

Name	Description
1 robo-ph: 2016-06-14	Titles and abstracts for...
2 robo-ph: 2016-06-13	Titles and abstracts for...
3 robo-ph: 2016-06-10	Titles and abstracts for...
4 robo-ph: 2016-06-09	Titles and abstracts for...
5 robo-ph: 2016-06-08	Titles and abstracts for...
6 robo-ph: 2016-06-07	Titles and abstracts for...



Environmental dependence of HI Masses in the EAGLE simulations

Chai Dekel, Jark R. Kravtsov, Robert A. Crain, Joop van der Hulst, Nick M. Bahé, Thijs van der Hulst, ...

we use a suite of cosmological simulations to study how the HI content of galaxies depends on their environment. EAGLE reproduces observed HI masses very well, while semi-analytically overpredicts the average HI masses in environments. The environmental processes act in/on/off switch for the HI content of stellar mass $M_{\text{star}} \sim 10^{10} M_{\odot}$. At a fixed ion of HI-depleted satellites increases host halo mass M_{200} in response to environmental effects, while at a fixed M_{200} increasing satellite M_{star} as the gas is per gravitational potentials. HI-depleted mostly, but not exclusively, within the of their host halo. We investigate the ends by focusing on three

What's Up?

Submit

General Options
Target: Telescopes:

RA: Dec:

Longitude: Latitude:

Local Time: Local Date:

Height/m: Temp/C: Pressure/mB:

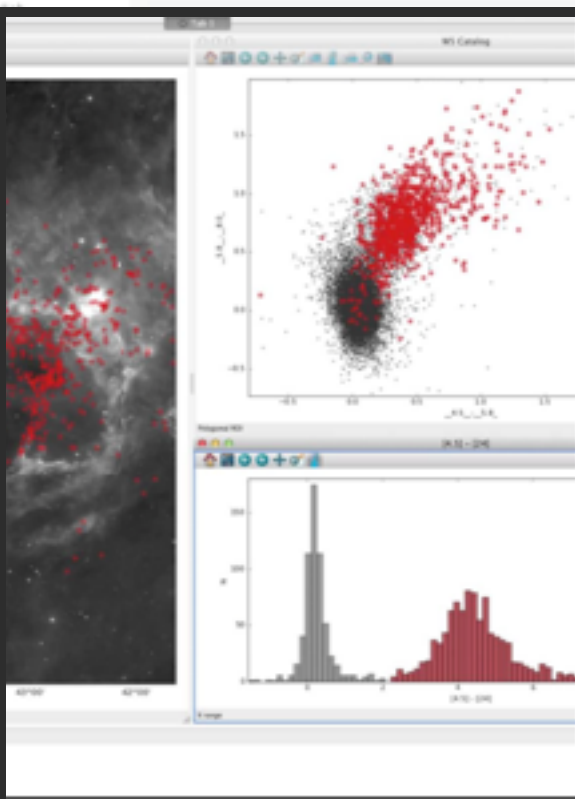
UTC-Off: Time Zone:

Y-axis:

Night plan target list: Use

Example Upload File

Name	RA	Dec
G02	02:00:00	-01:00:00
G09	09:00:00	01:00:00
G12	12:00:00	-01:00:00



Unique opportunitites



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 (Jupyter)

Code optimisation

Best practises in scientific computing

Collaborative Coding & Version Control

Introduction to Code Testing

Conversations with software engineers & developers

Statistics/
Bayesian 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 existing data portals (e.g. HST), early release datasets (e.g. SkyMapper), or new analysis techniques such as Machine Learning

The poster is titled "Detecting the Unexpected" and is part of a "Discovery in the Era of Astronomically Big Data" series. It is scheduled for February 27 to March 2, 2017, at the Space Telescope Science Institute in Baltimore, MD. The poster features a grid of topics: "The Galaxy Beyond 3D", "Big Spectroscopy", "Transients and Time Domain", "Machine Learning", "Data Integrated Visualization", and "Citizen Science". Each topic is accompanied by a small circular image. Below the grid, there are two columns of names: "CONFIRMED SPEAKERS" and "ORGANIZERS".

CONFIRMED SPEAKERS

- Arjun Dey
- Chris Lintott
- Melissa Ness
- Umaa Rebbapragada
- Thomas Robitaille
- Lucianne Walkowicz
- Gail Zasowski

ORGANIZERS

- Joshua Peek (Chair)
- Sarah Kendrew (Co-Chair)
- Flory Hill (Coordinator)
- Molly Peeples
- Erik Tollerud
- Garyn Bailor-Jones
- Tamas Budavari
- Michael Fall
- Alyson Goodman
- Mario Juric
- Ted Lauer
- Armin Rest
- Rick White

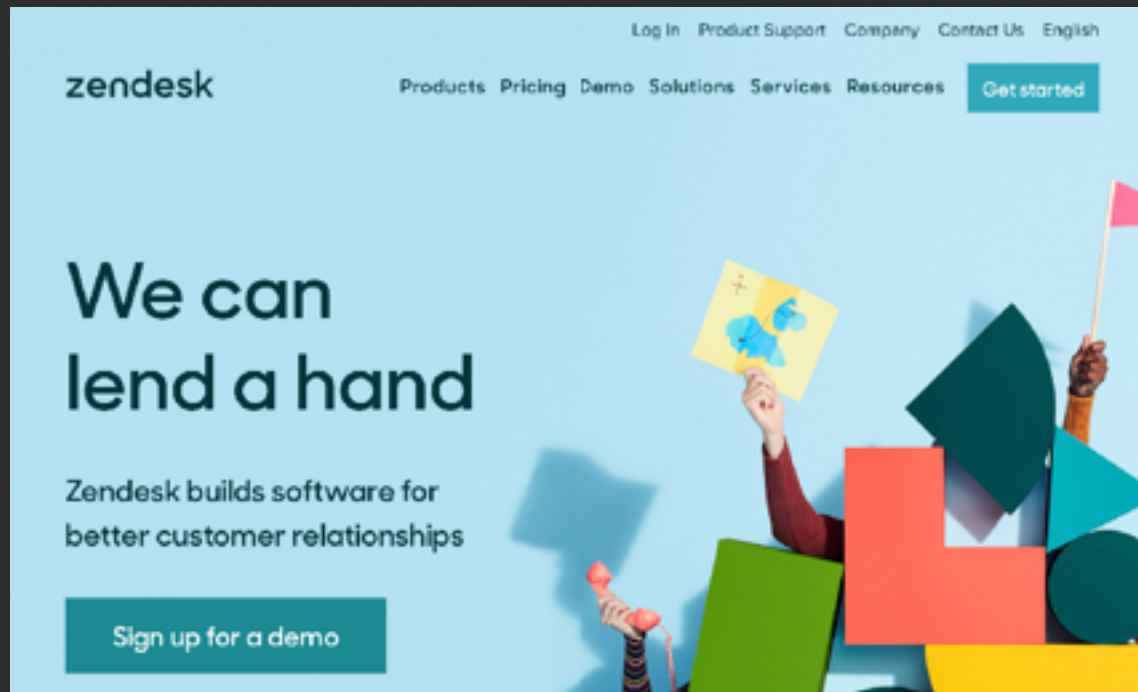
Collaborating with key people in the US/UK – visitor exchange?

ENCOURAGE TECH TALKS

Benefits to the community

- **Increased collaboration:** between astronomers, instrument scientists, software developers & engineers, data archivists
- **Breaking down barriers:** between ADASS, Astrominformatics, 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



zendesk

Log In Product Support Company Contact Us English

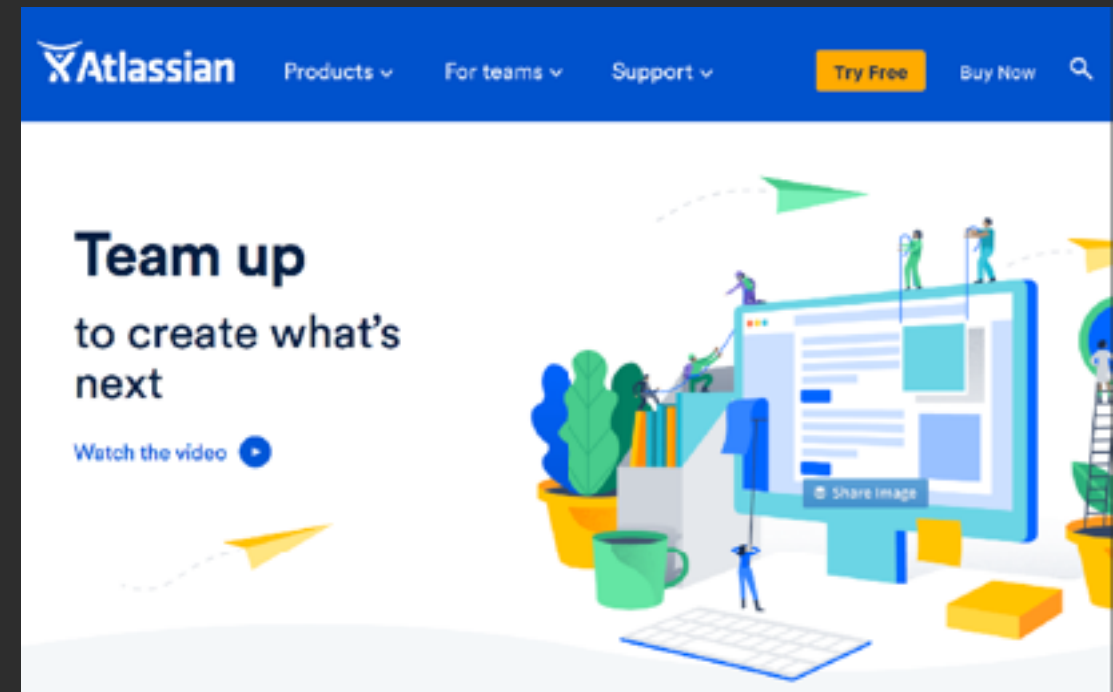
Products Pricing Demo Solutions Services Resources [Get started](#)

We can lend a hand

Zendesk builds software for better customer relationships

[Sign up for a demo](#)

The Zendesk website features a light blue background with a central illustration of hands holding various colorful geometric shapes and a map of the world. The navigation bar includes links for Log In, Product Support, Company, Contact Us, and English, along with a 'Get started' button.



Atlassian

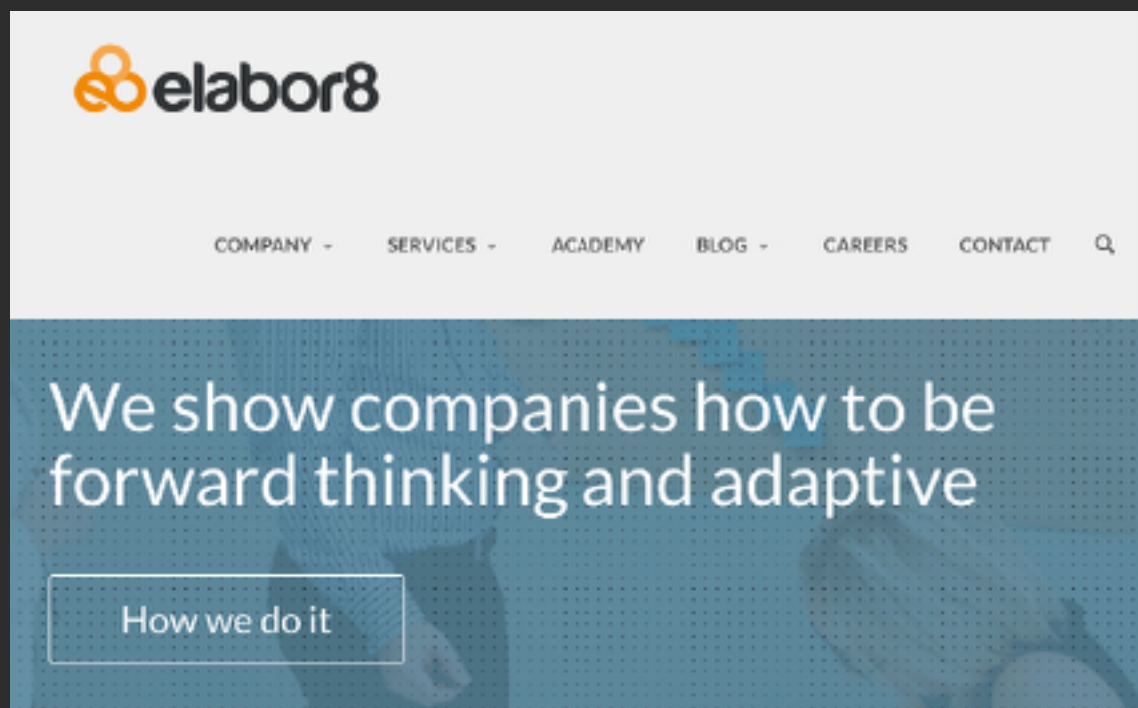
Products For teams Support [Try Free](#) [Buy Now](#)

Team up to create what's next

[Watch the video](#)

[Share Image](#)

The Atlassian website has a blue header with the company logo and navigation links for Products, For teams, and Support. A prominent 'Try Free' button and a 'Buy Now' link are also present. The hero section features a white background with a colorful illustration of people working together around a large computer monitor, with a paper airplane flying nearby.



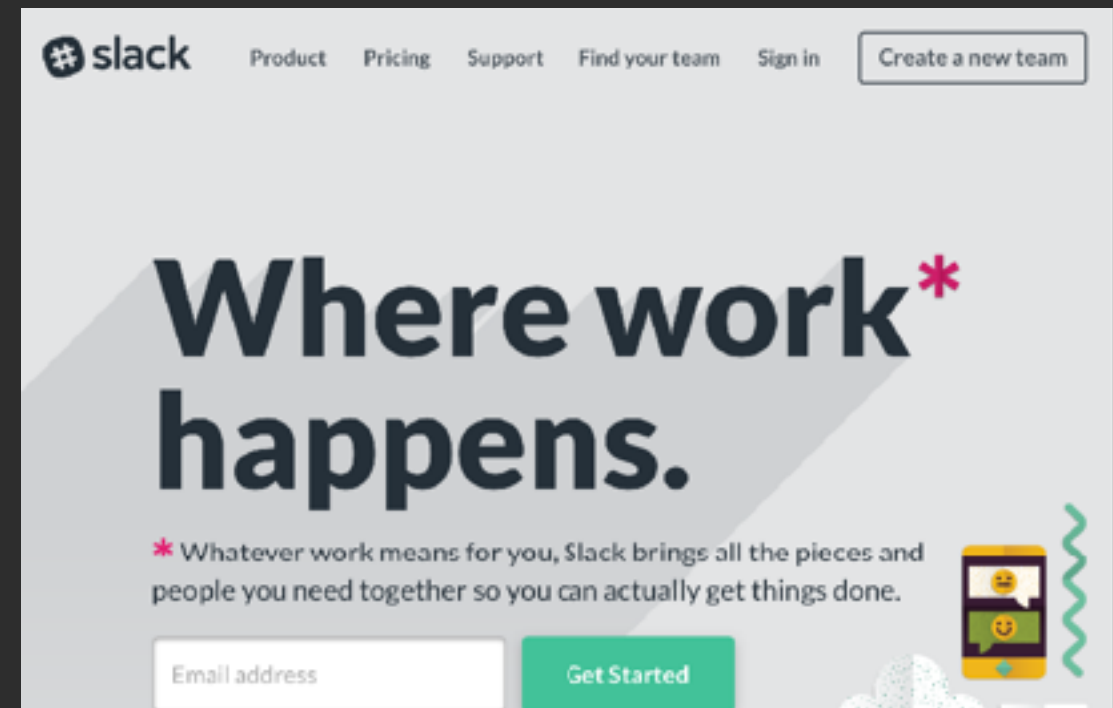
elabor8

COMPANY SERVICES ACADEMY BLOG CAREERS CONTACT

We show companies how to be forward thinking and adaptive

[How we do it](#)

The elabor8 website has a white header with the company logo and a navigation menu with links for COMPANY, SERVICES, ACADEMY, BLOG, CAREERS, and CONTACT. The hero section has a dark blue background with a pattern of small white dots and a central illustration of hands holding a globe.



slack

Product Pricing Support Find your team Sign in [Create a new team](#)

Where work* happens.

* Whatever work means for you, Slack brings all the pieces and people you need together so you can actually get things done.

[Get Started](#)

The Slack website features a grey header with the company logo and navigation links for Product, Pricing, Support, Find your team, and Sign in. A 'Create a new team' button is also visible. The hero section has a white background with a large, bold headline and a central illustration of a smartphone displaying a Slack chat interface.

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