



Conference

ESCAPE to the Future | 25-26 October 2022

Royal Belgian Institute of Natural Sciences | Brussels, Belgium

25 October 2022, 15:40 - 16:35

ESCAPE Citizen Science to enhance scientific research



Stephen Serjeant
Open University



Gwenhaël de Wasseige
KM3NeT



JIVE
Joint Institute for VLBI
ERIC



Martin Hardcastle
University of Hertfordshire



James Pearson
Open University



Hugh Dickinson
Open University





ESCAPE to the Future

25-26 October 2022
Brussels, Belgium

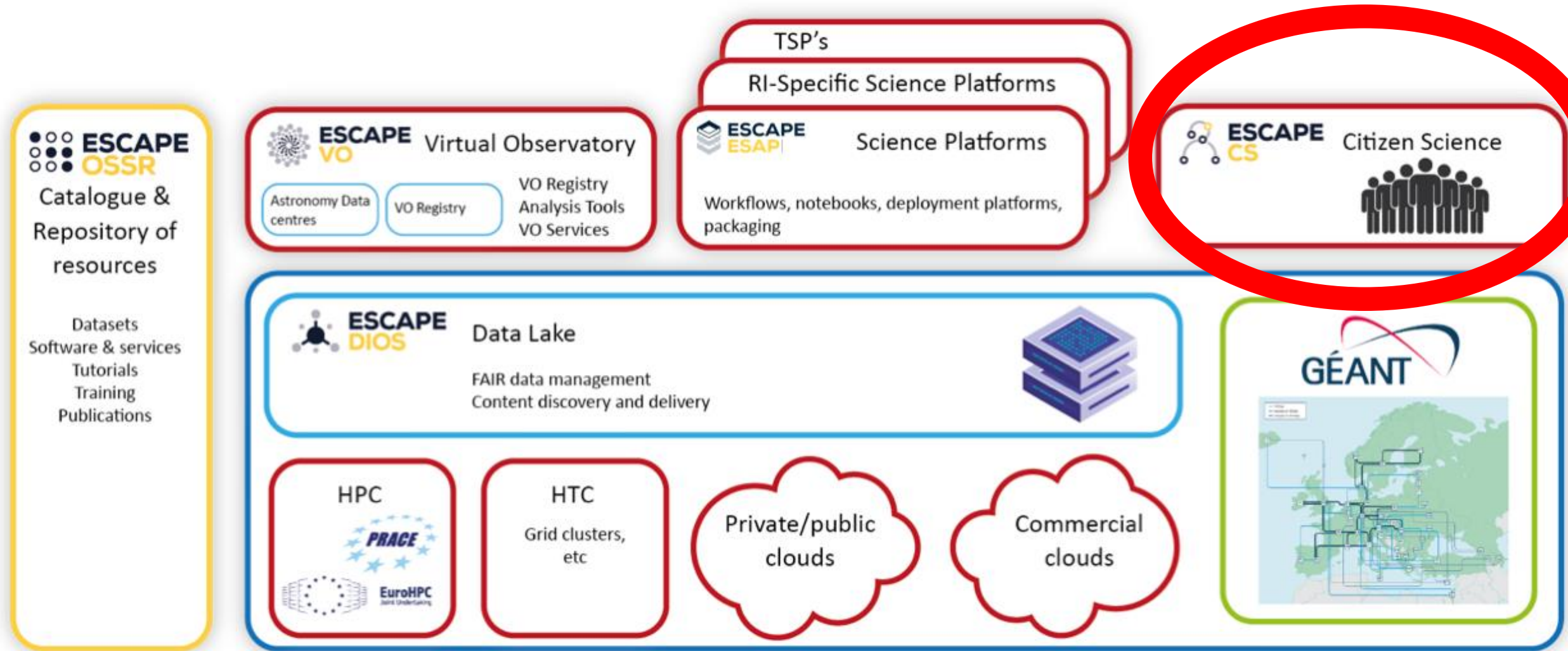
ESCAPE to the Future: Citizen Science

Stephen Serjeant, for: Rita Meneses, James Pearson, Hugh Dickinson, Luigi Colucci, Maud Coppel

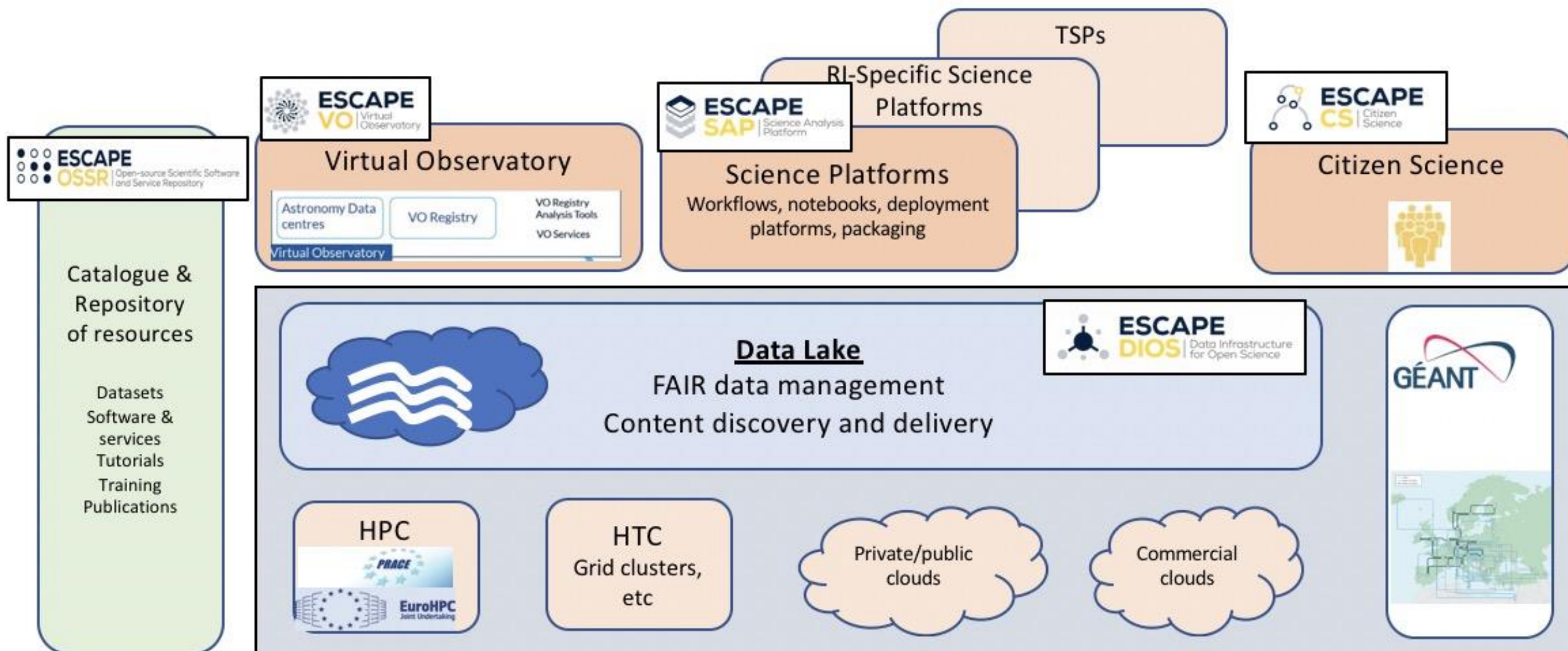
ESCAPE Final Event, Brussels, 25th Oct 2022

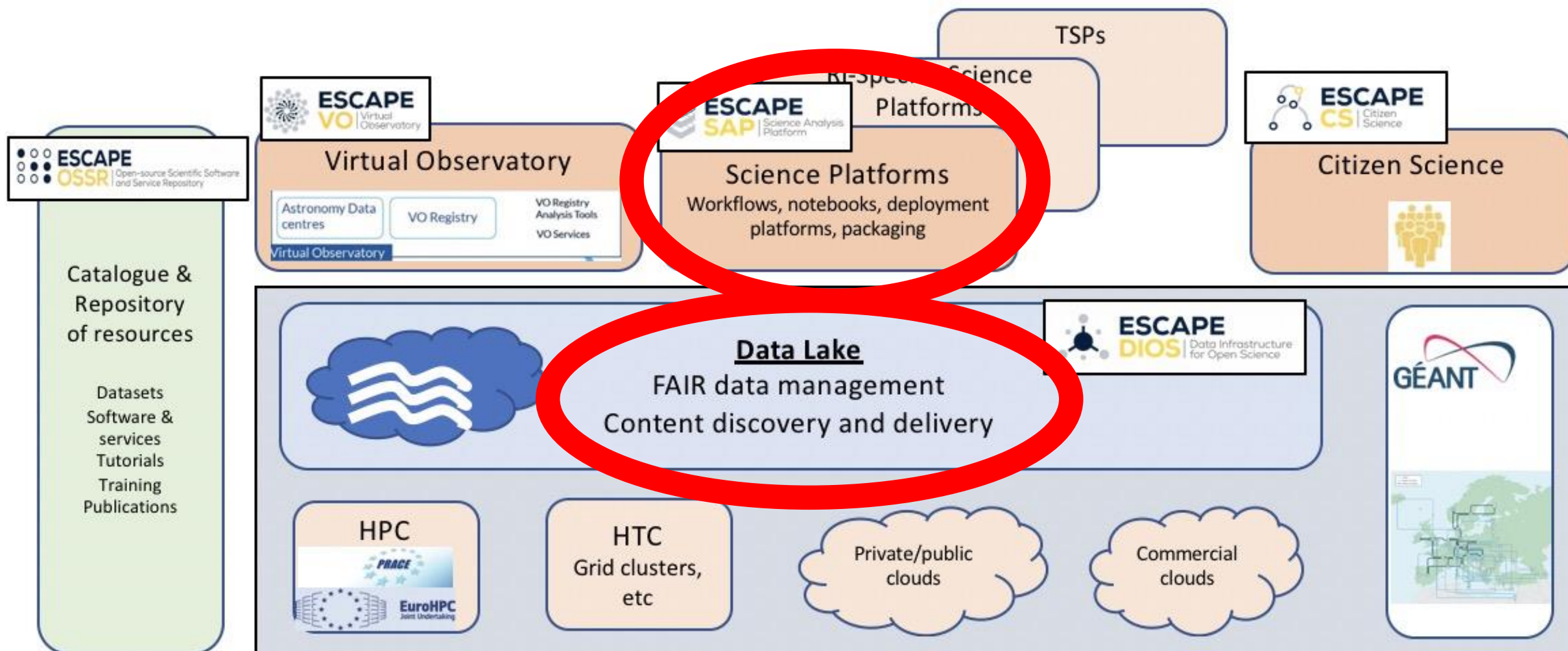


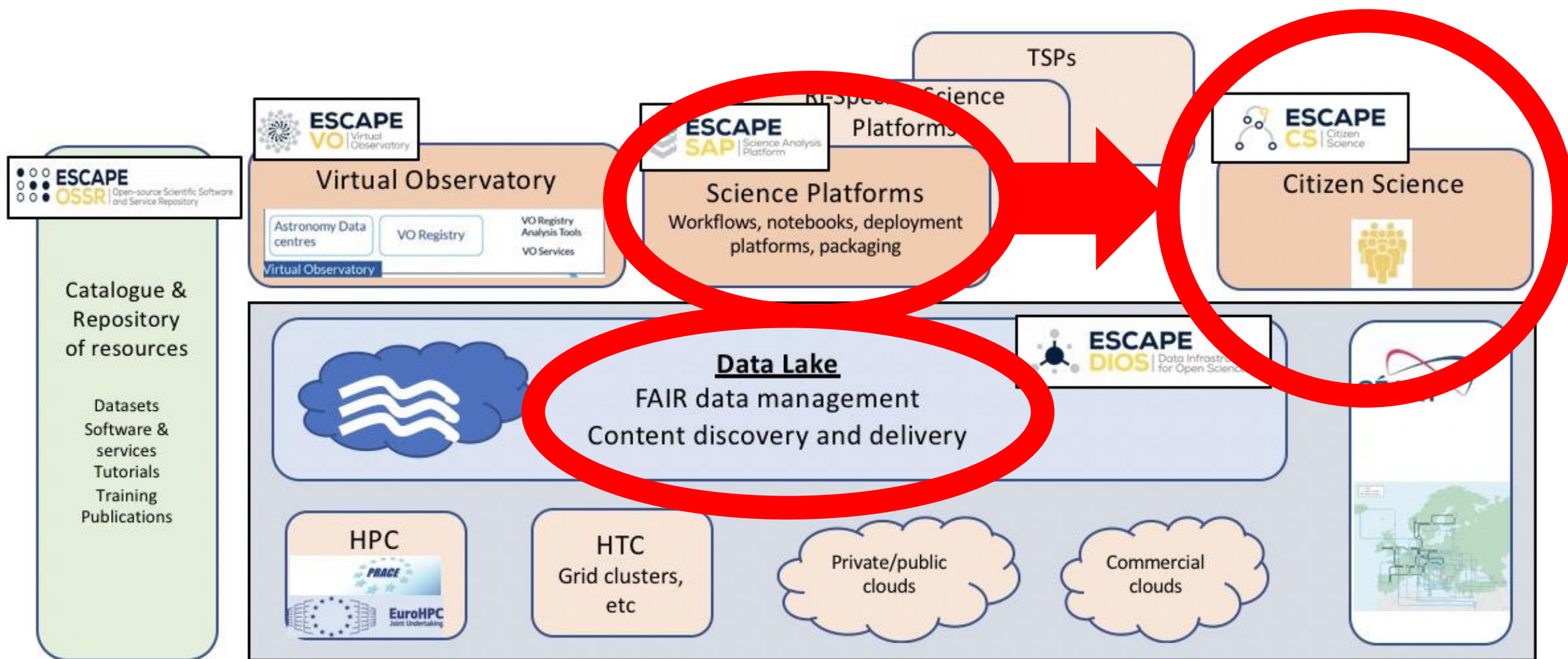
Improve access to data and tools through citizen science crowdsourcing experiments for most of the facilities in the ESCAPE remit.

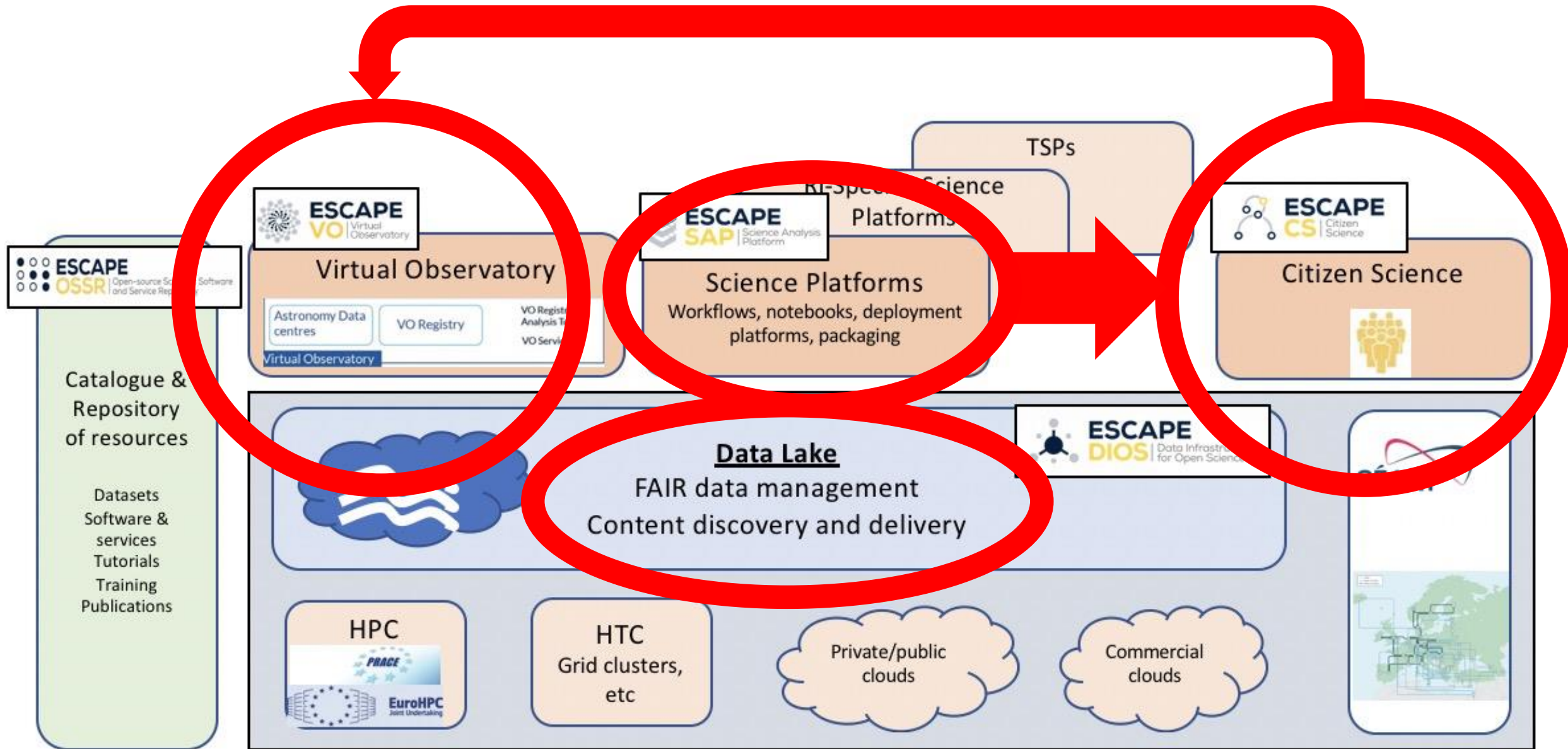












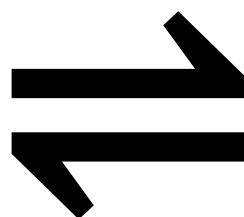
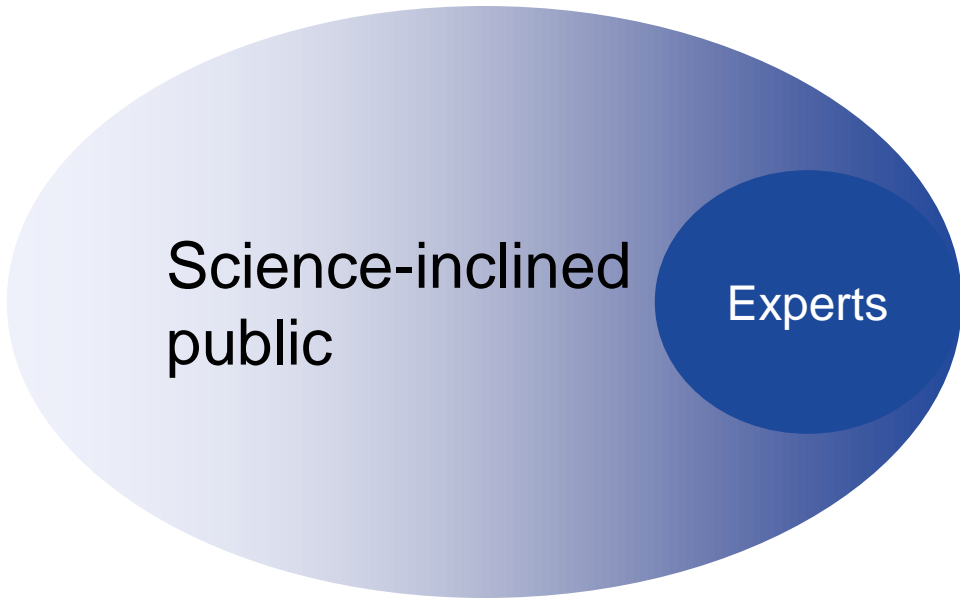
ESCAPE Citizen Science Roadmap:

● Citizen Science Demonstrators:

- Open the science related ESFRIs (and their pathfinders/precursors) to the general public by creating, managing and operating a harmonised suite of mass participation experiments for these facilities
- Develop/adapt machine-learning tools for deciding when subjects are well characterised and for volunteer classification reliability
- Create embedded educational resources
- Create online forums for two-way dialogue with professional scientists, for participant volunteers to take their interest further, improving transparency of the scientific process.

ESCAPE Citizen Science Roadmap:

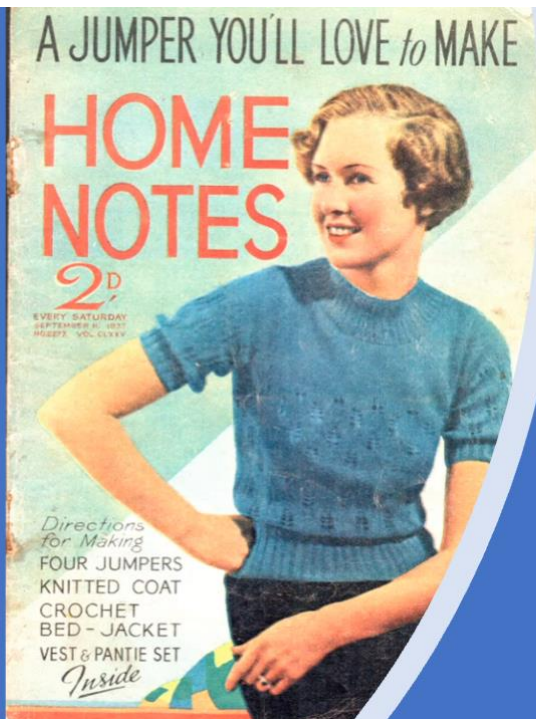
- Legacy resources:
 - Notebook and documentary materials demonstrating web-interface based and programmatic (scriptable) Zooniverse project management including project and workflow creation, subject creation and upload, adding training and feedback to subjects,
 - Notebook and documentary materials demonstrating integration with the Zooniverse's Caesar engine for advanced aggregation and efficient subject retirement.
 - Notebook demonstrating how to integrate Zooniverse projects with existing machine learning frameworks and combine volunteer classifications with machine learning predictions.
 - Notebook and documentary materials demonstrating how to set up an active learning framework to continuously train machine learning models using volunteer classifications of optimally selected subjects.



**EUROPEAN OPEN
SCIENCE CLOUD**



- KM3NeT:
 - REINFORCE project, Gwenhaël de Wasseige
- SKA: Pathfinder LOFAR:
 - Radio Galaxy Zoo LOFAR, Martin Hardcastle
- Vera Rubin LSST:
 - Precursor Subaru HSC: Galaxy Zoo Comic Dawn, James Pearson
 - Precursor SuperWASP: SuperWASP Black Hole Hunters, Hugh Dickinson
 - Precursor SDSS: Galaxy Zoo Clump Scout, Hugh Dickinson
- Managing citizen science from ESAP:
 - Hugh Dickinson and James Pearson



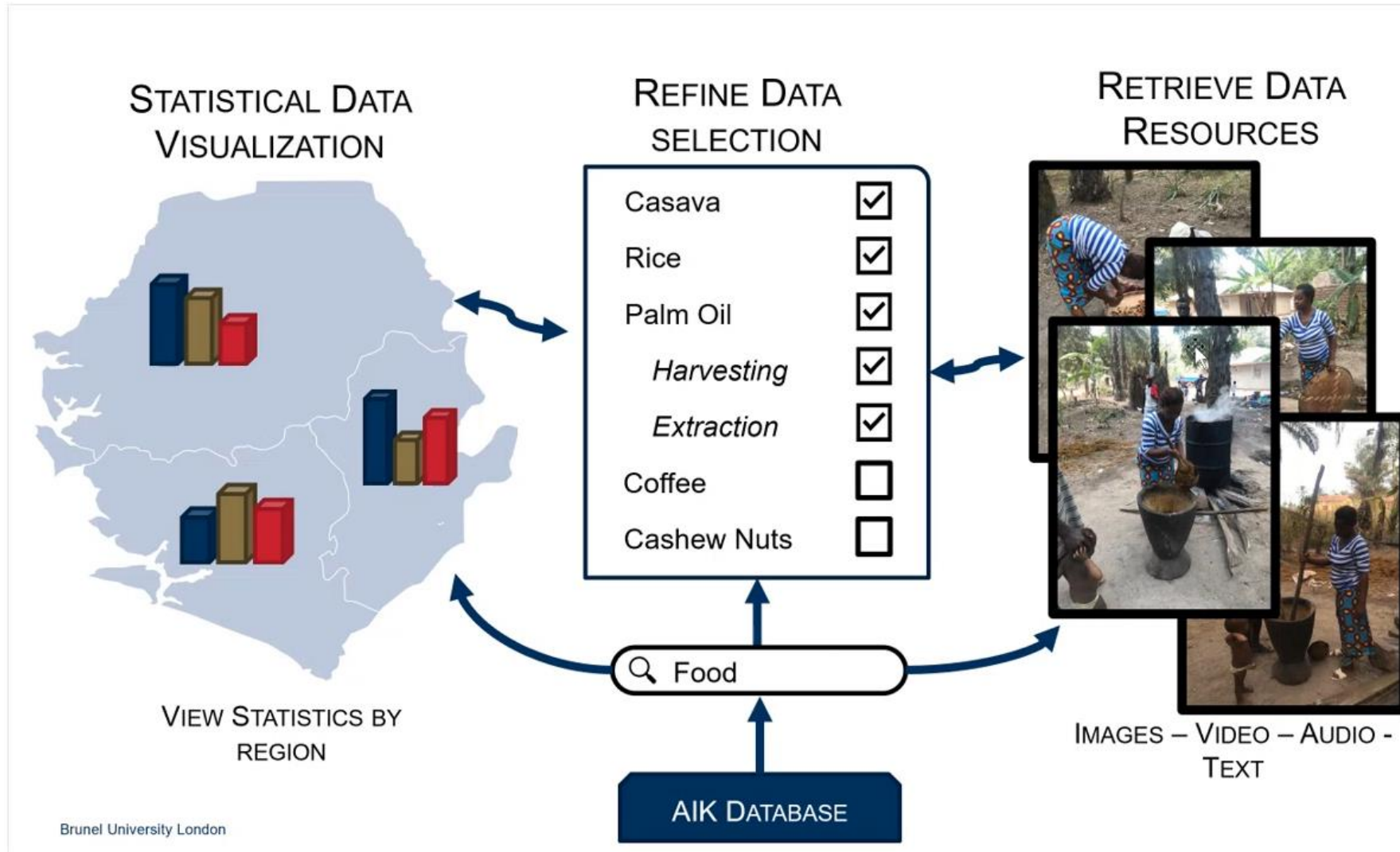
Knitting Patterns in Domestic Magazines



African Indigenous Knowledge (AIK) for Resilient Food Systems



African Indigenous Knowledge (AIK)



Brunel University London

Knitting Patterns in Domestic Magazines

Domestic magazines present researchers with a challenge!

How do we collect and analyse data from archives too big for one person to read/process in their entirety?

Digitisation and digital reading methods support new approaches to addressing this challenge, e.g. keyword searches – but these are not suitable for domestic magazines.



Knitting Patterns in Domestic Magazines

Completed
item

Materials



Title

The information
needed to answer the
questions can be
found in these boxes.

With thanks to: Hugh Dickinson, James Pearson,
Rita Meneses, Luigi Colucci, Maud Coppel

ESCAPE to the Future

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Deep Sea Explorers

cnrs

UCLouvain

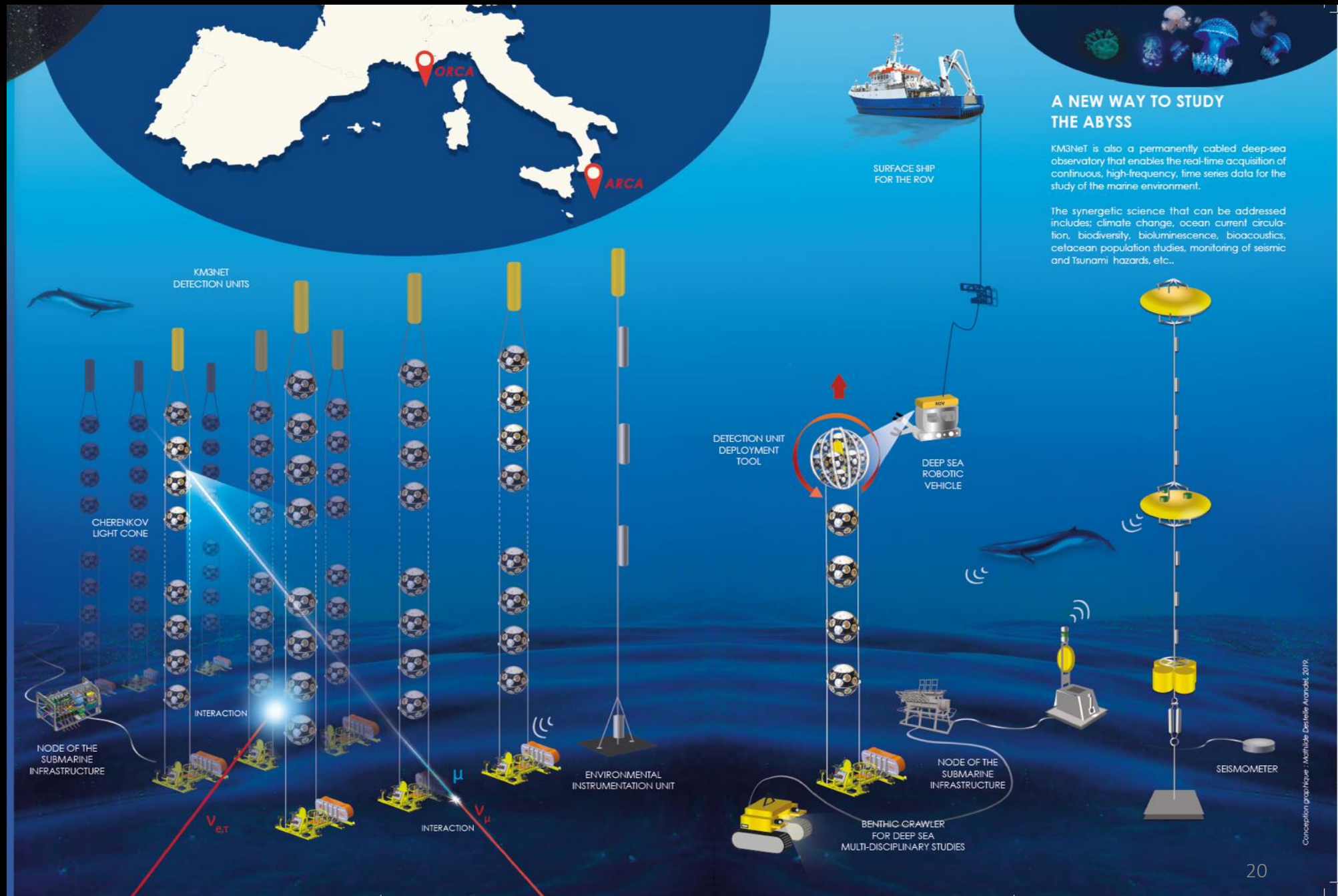


Paschal Coyle and Gwenhaël de Wasseige
On behalf of WP4

<https://www.zooniverse.org/projects/reinforce/deep-sea-explorers>



KM3NeT Neutrino Telescope



In REINFORCE, we hunt for what *is not* a neutrino

2 different workflows:

Bioluminescence



Light curves

Bioacoustics



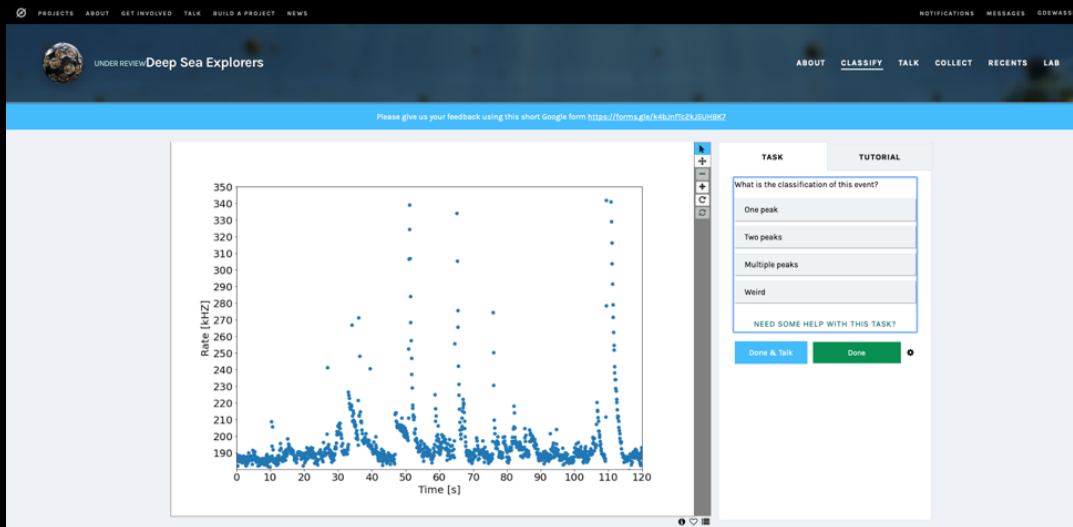
Acoustic time/frequency
spectrograms

classify the characteristic emission patterns and their variations

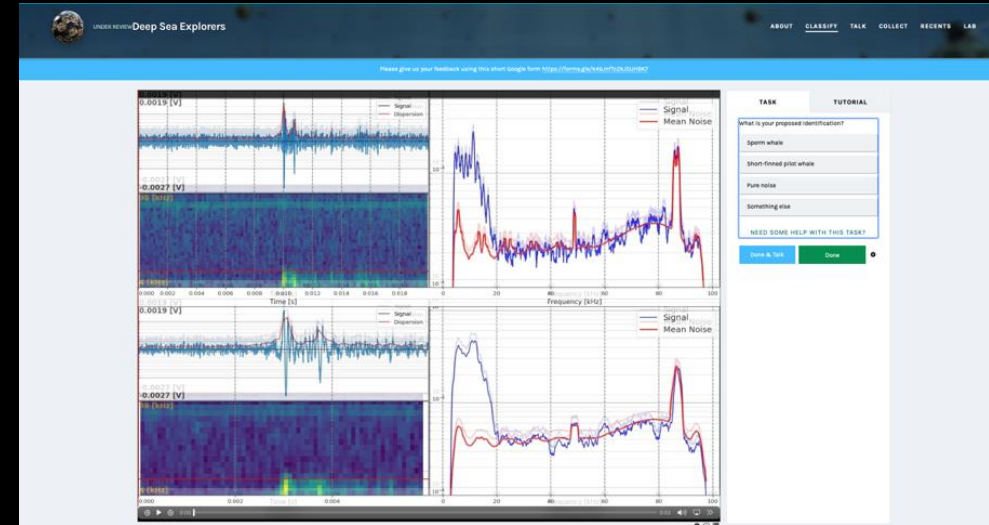
In REINFORCE, we hunt for what *is not* a neutrino

2 different workflows:

Bioluminescence



Bioacoustics



A few facts

08/2021

09/2021

01/2022

03/2022

07/2022

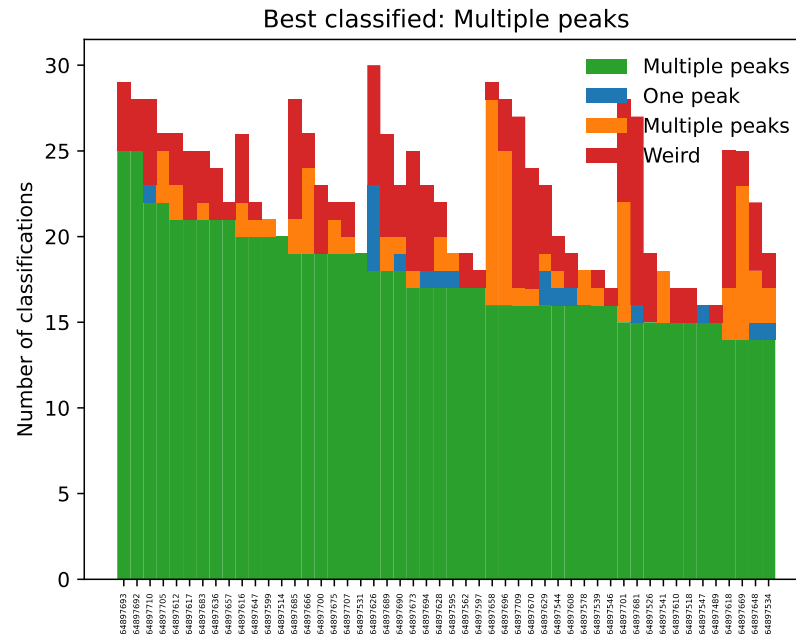
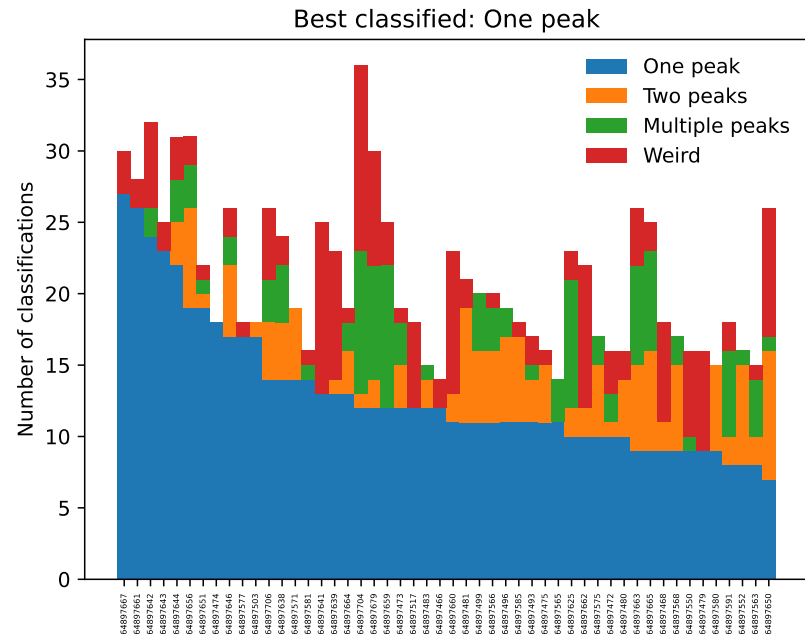
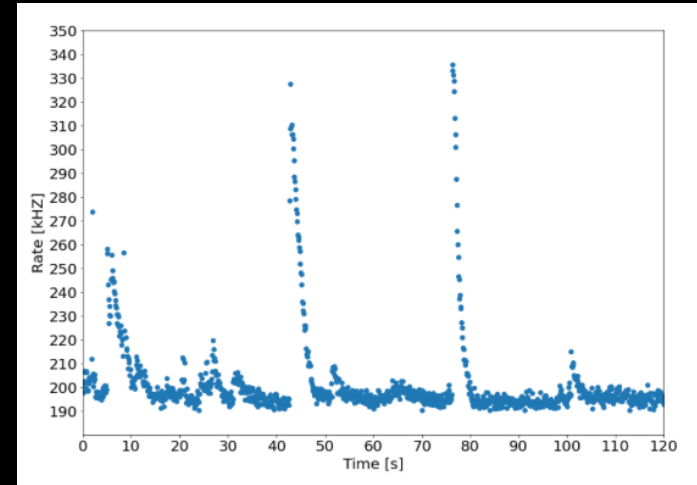
t

| <u>Beta test by the Zooniverse community</u> | <u>Official launch Phase 1</u> | <u>Phase 2</u> | <u>Last deliverable</u> |
|--|--|---|---|
| <ul style="list-style-type: none">- Several comments on the demonstrator, especially on the 'About' pages and tutorial- End of Rémy Le Breton's contract (permanent position at CEA)- Start of Gwen at UCLouvain as academic | <p><u>1 month after:</u></p> <ul style="list-style-type: none">- 15215 classifications of 577 subjects by 752 classifiers- Mean number of classifications per user: 20.23- Project 100% complete | <ul style="list-style-type: none">- New events added to both workflows- Beginning of Phase 2- First results shared with CS- Outreach activities at UCLouvain- Start of Enzo Oukacha (APC) | <ul style="list-style-type: none">- Measure of the impact of Citizen Science for KM3NeT data classification- Unretirement of events to get more classifications in the biolum. workflow- End of Enzo's contract |

Bioluminescence for illustration

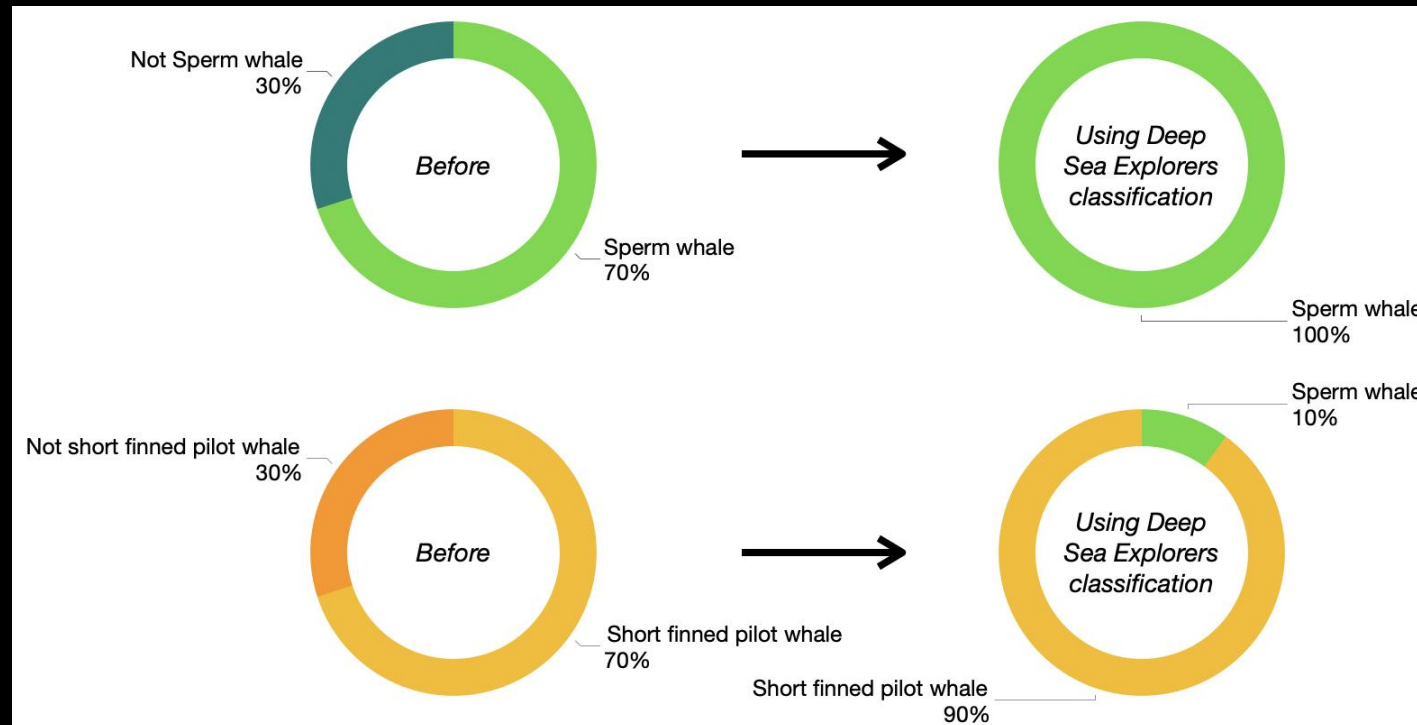
Results Phase 1

- Some events clearly identified as belonging to one of the four categories available to volunteers on Zooniverse
- Some events not classified unanimously by the participants. Example of a “Two peaks” or “Multiple peaks” event (55%-42% of the classifications in the Zooniverse demonstrator, respectively).



Fifty Phase 1 events preferentially classified as “One peak” (left) and “Multiple Peaks” (right) in the bioluminescence workflow. The x-axis indicates the arbitrary name for the events.

- The events used in Zooniverse were classified **with less than 70%** accuracy by a Convolutional Neural Network (CNN) trained on data from hydrophones located at the surface.
- Only the events classified in Zooniverse by at least **two different participants** and with an accuracy of **at least 65%** used in the validation and test sets to retrain the CNN
- The precision for each species (**90% and 100%**) should be compared to the less than 70% previously obtained for the same events without the contribution of citizen scientists.



Bathysphere deployment



- Fall 2022: Exhibition at Center for Crafts, Asheville NC
- Spring 2023: Exhibition in Europe



Thank you



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Radio Galaxy Zoo LOFAR: Citizen Science with an SKA precursor

Martin Hardcastle
University of Hertfordshire, UK

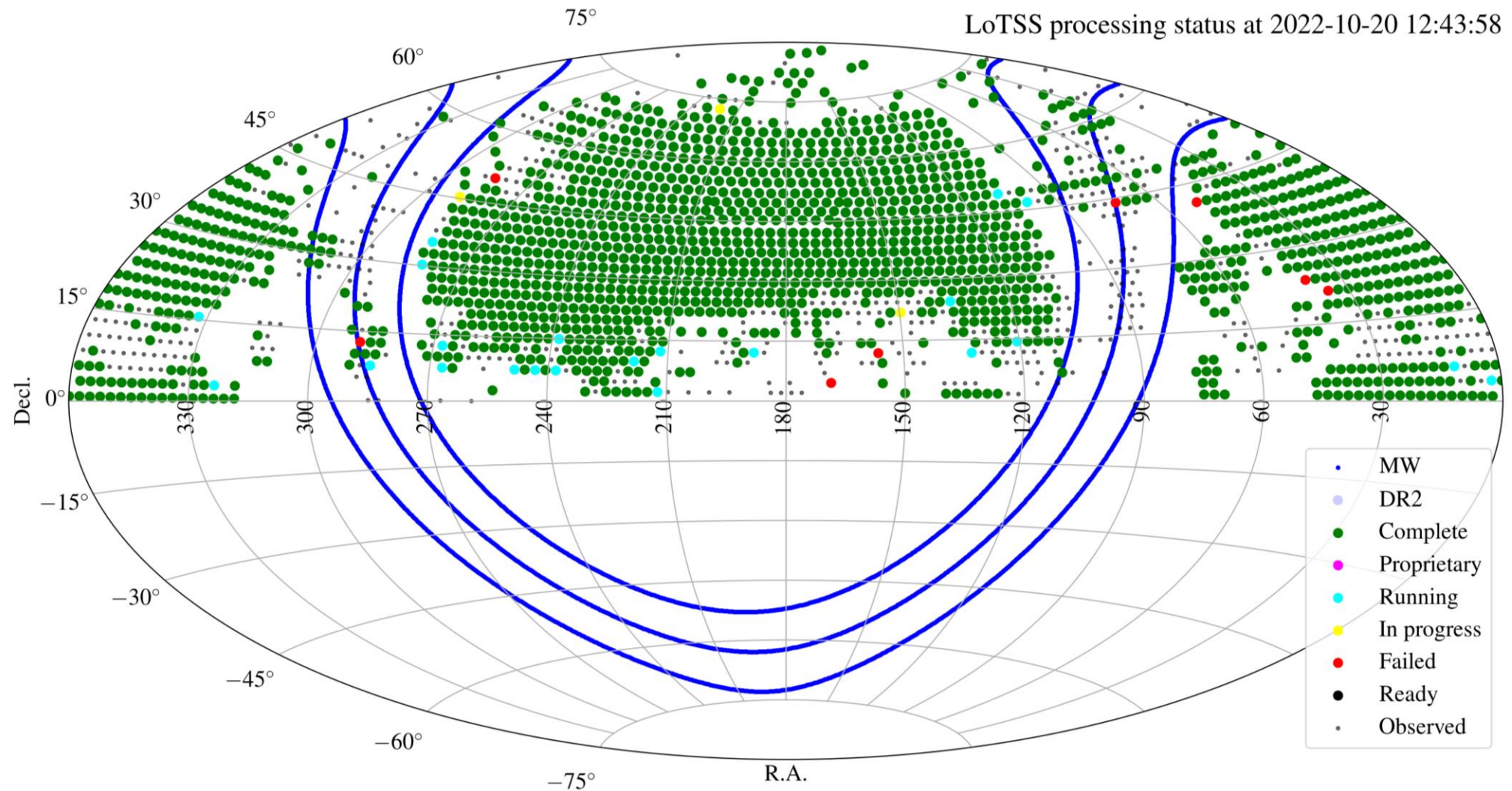


ESCAPE - The European Science Cluster of Astronomy & Particle Physics ESFRI Research Infrastructures has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 824064.

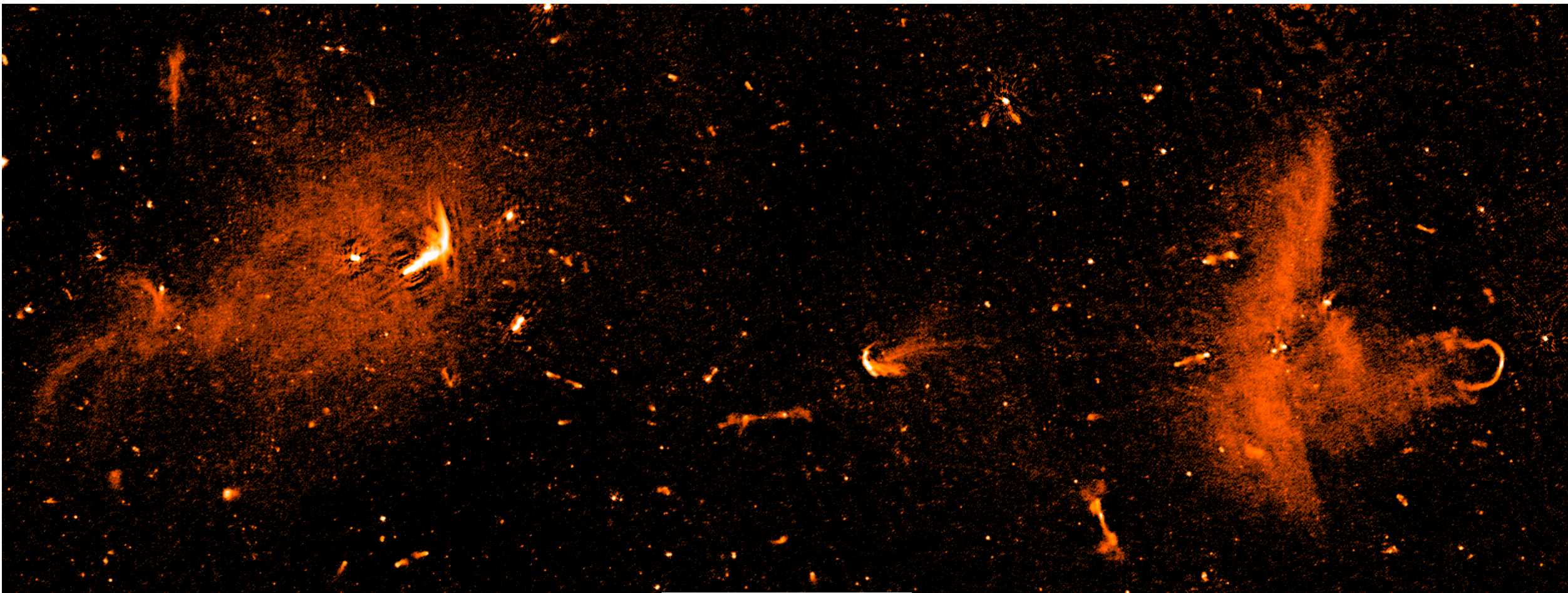
LOFAR introduction



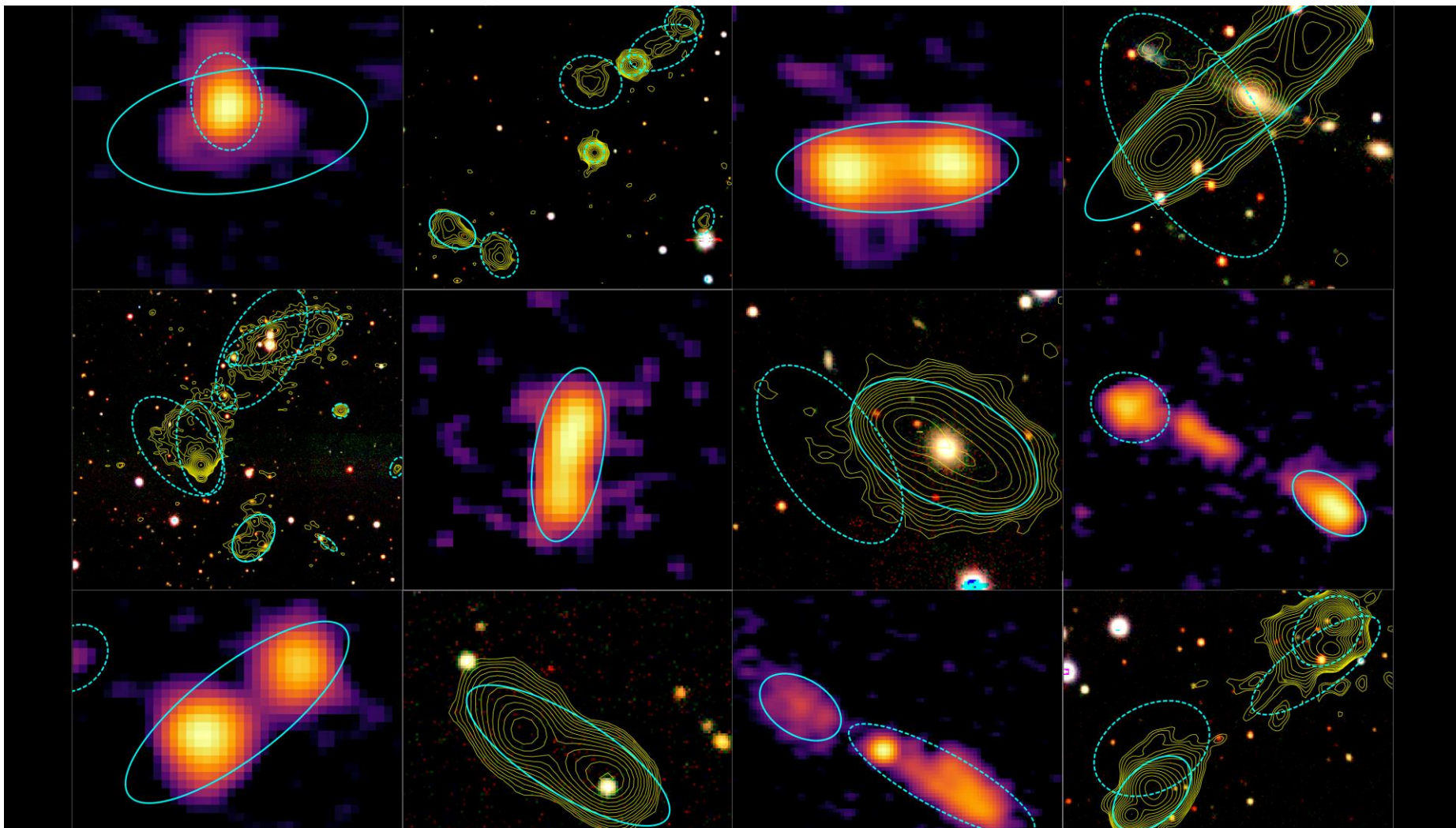
LoTSS introduction: sky coverage



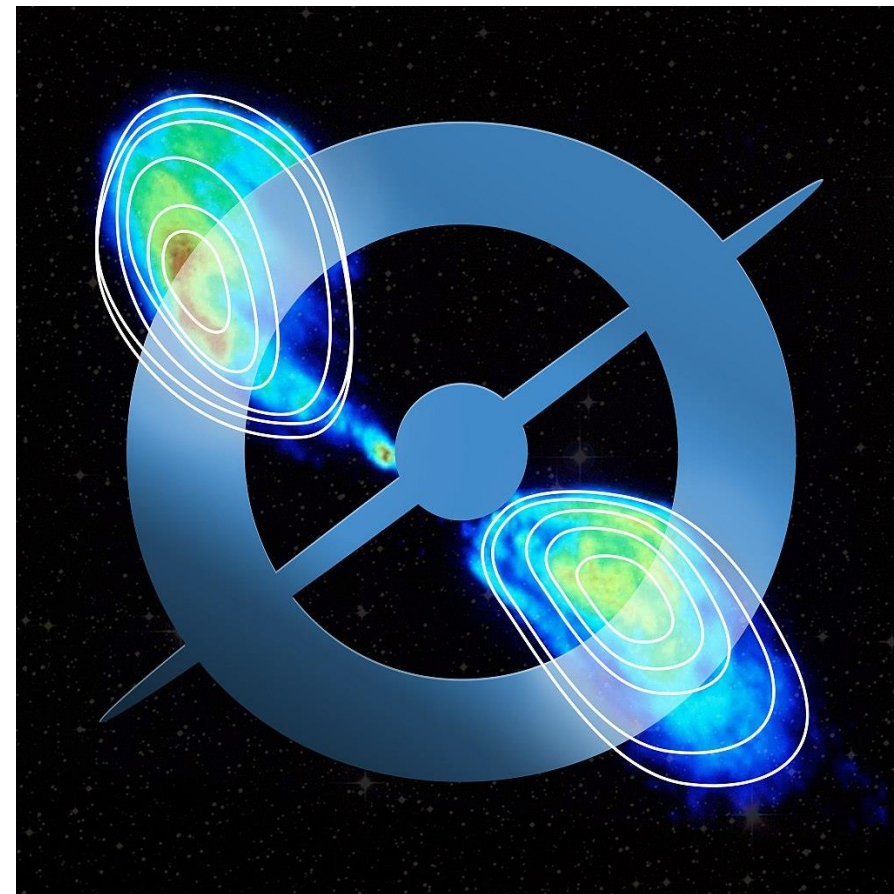
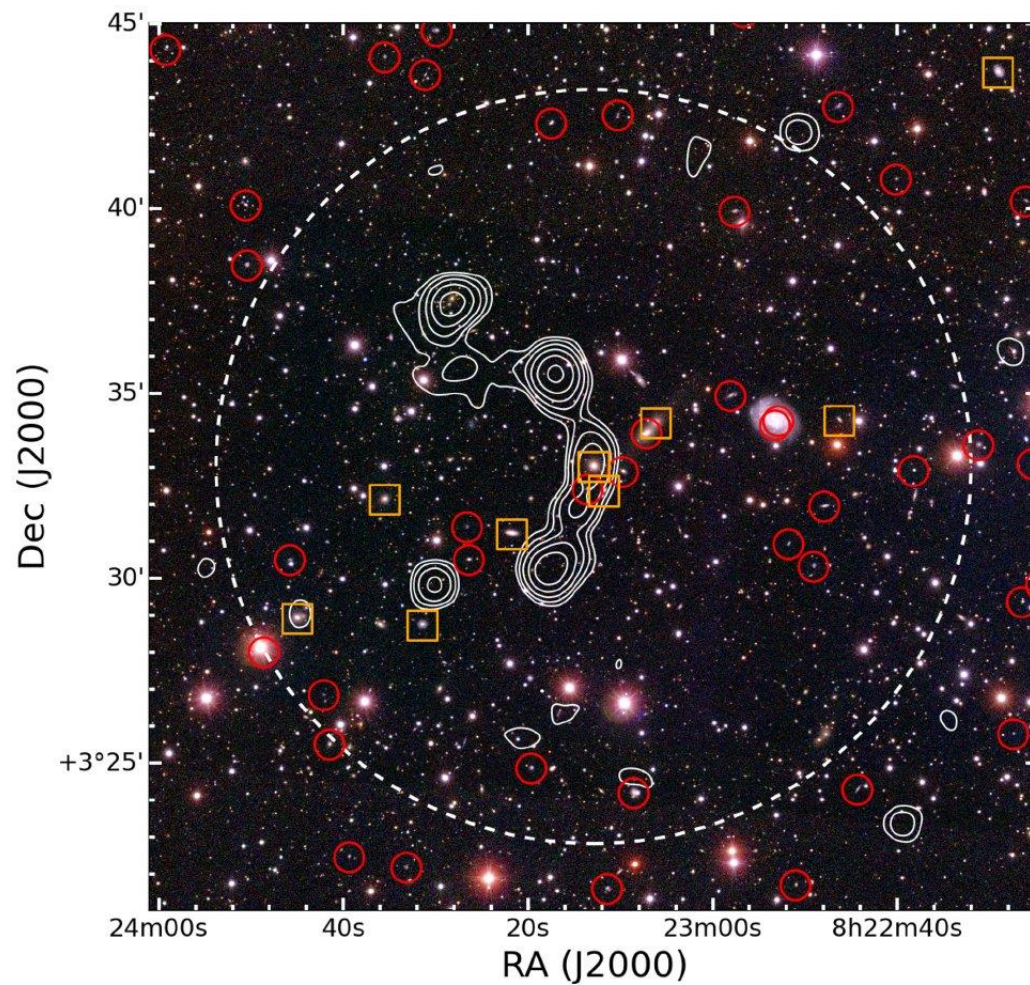
LoTSS introduction: complexity of radio sky

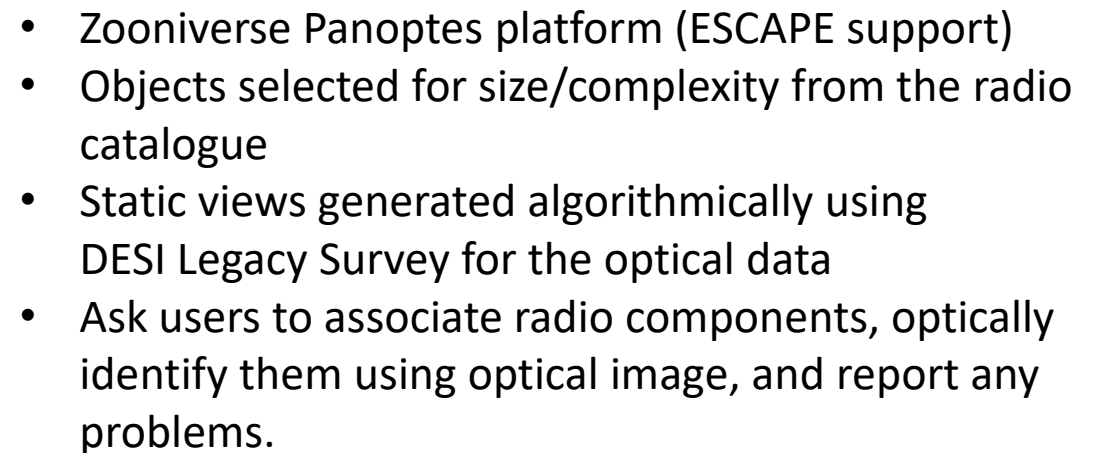


The optical ID problem



Radio Galaxy Zoo concept





The LOFAR Two-Metre Sky Survey (LoTSS)

VI. Optical identifications for the second data release

M.J. Hardcastle^{1*} and key LoTSS contributors, other LoTSS contributors, citizen scientists

Centre for Astrophysics Research, Department of Physics, Astronomy and Mathematics, University of Hertfordshire, College Lane, Hatfield AL10 9AB, UK

October 20, 2022

ABSTRACT

The second data release of the LOFAR Two-Metre Sky Survey (LoTSS) covers 27% of the northern sky and a much larger fraction of the extragalactic sky with $|b| > 10^\circ$, with an areal coverage of $5,700 \text{ deg}^2$. The high resolution of LOFAR with Dutch baselines (6 arcsec) allows us to carry out optical identifications of a large fraction of the detected radio sources without further radio followup; however, the process is made more challenging by the many extended radio sources found in LOFAR images as a result of its excellent sensitivity to extended structure. In this paper we present source associations and identifications for sources in the second data release based on optical (Legacy Survey) and near-infrared (WISE) data, using a combination of a maximum-likelihood cross-match method developed for our first data release, our citizen science project Radio Galaxy Zoo (LOFAR), and new approaches to algorithmic optical identification, together with extensive visual inspection. We also present spectroscopic or photometric redshifts for a large fraction of the optical identifications. In total x,xxx,xxx radio sources lie in the area with good optical data, of which $xx\%$ have an optical or IR identification and $xx\%$ have a good redshift estimate. We investigate the quality of the dataset by (doing some early science).

Key words. galaxies: jets – galaxies: active – radio continuum: galaxies

1. Introduction

The LOFAR Two-Metre Sky Survey¹ (LoTSS; Shimwell et al. 2017) aims to survey the entire northern sky using the Low-Frequency Array (LOFAR; van Haarlem et al. 2013) at a central frequency of 144 MHz. When complete, the survey will provide an unrivalled resource for wide-area low-frequency selection of extragalactic samples, both of star-forming galaxies (hereafter SFG) and of radio-loud AGN (hereafter RLAGN). It will be complemented by a number of other surveys, including, within LoTSS itself, the study of a number of deep fields of particular interest, including the Lockman Hole, Boötes (Tasse et al. 2021) and ELAIS-N1 (Sabater et al. 2021) fields, but also a counterpart survey at lower LOFAR frequencies, the LOFAR LBA Sky Survey (LoLSS; de Gasperin et al. 2021). Key to the science goals of the project is accurate redshift information for the host galaxies of the radio sources. This information will be provided in part by more than one million optical spectra that will be obtained using the WEAVE (William Herschel Telescope Enhanced Area Velocity Explorer) instrument as part of the WEAVE-LOFAR project (Smith et al. 2016), and for the remaining LOFAR sources by state-of-the-art photometric redshifts (Duncan et al. 2021). Although LoTSS is currently largely generating images using only the Dutch baselines of LOFAR, with a typical resolution of 6 arcsec, a stretch goal of the project is to exploit the much higher resolution provided by the full International LOFAR Telescope (ILT), which can be $\sim 0.3 \text{ arcsec}$ at 144 MHz (Morabito et al. 2021), over large areas of the sky.

In order to exploit the full potential of deep extragalactic radio surveys, we need optical identifications, and the photomet-

ric and/or spectroscopic redshifts that they make possible. Spectroscopic followup projects such as WEAVE-LOFAR also rely where possible on accurate optical positions of target sources. Historically, radio continuum surveys have produced catalogues of radio sources for others to follow up with further radio or optical observations; for example, the highly influential revised 3CR sample of the brightest extragalactic low-frequency radio sources in the northern sky (3CRR; Laing et al. 1983), itself based on radio data taken in the 1960s (Bennett 1962; Gower et al. 1967), only received its final optical identification in 1996 (Rawlings et al. 1996). The radio survey that was the largest in terms of numbers of sources detected until very recently, the NRAO Very Large Array (VLA) Sky Survey (Condon et al. 1998), which covers the whole sky above declination -40° , has never had anything approaching a full optical identification catalogue, partly because of the lack of any appropriate counterpart optical catalogue but also because its low resolution (45 arcsec) precludes matching of the radio sources with optical data. Higher-resolution large-area surveys, such as FIRST (Becker et al. 1995) are more easily matched to optical data, but high-resolution surveys with the VLA are insensitive to large-scale structure due to a lack of short interferometric baselines, and so obtaining a catalogue that is both optically identified and flux-complete in the radio has historically involved labour-intensive combination of multiple radio catalogues with the optical data (e.g. Gendreau & Wall 2008; Best & Heckman 2012).

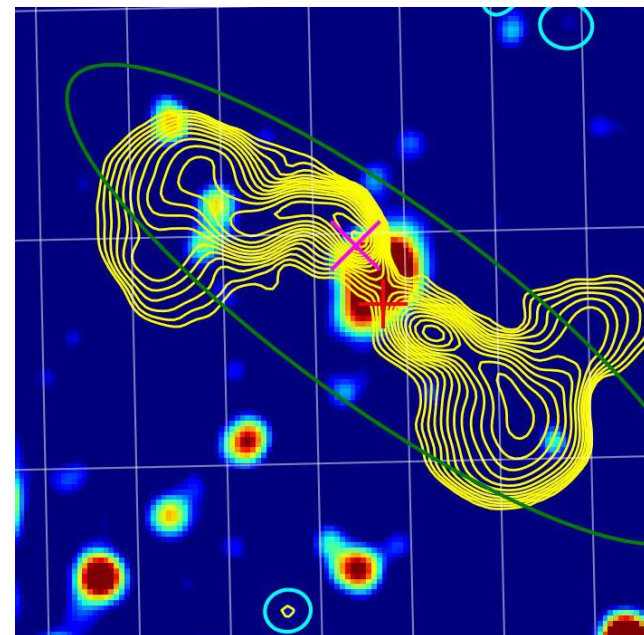
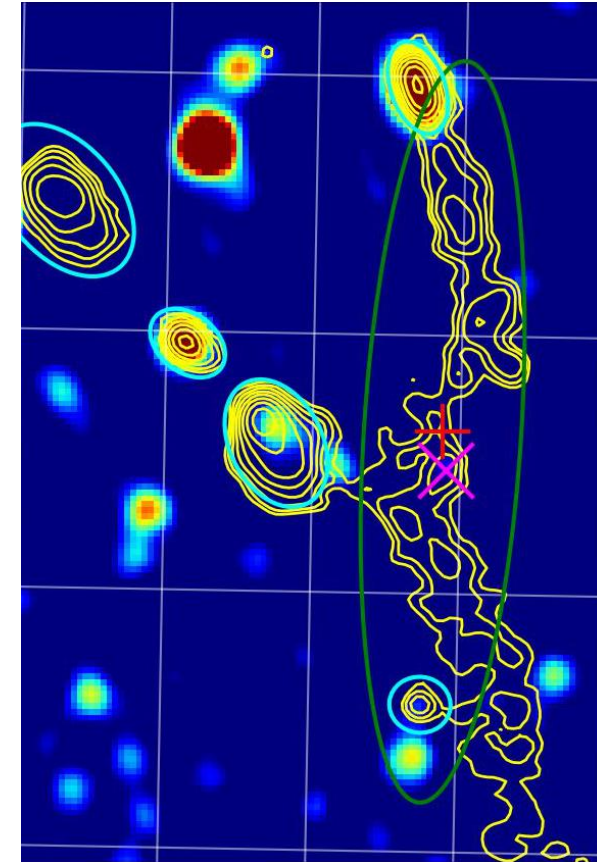
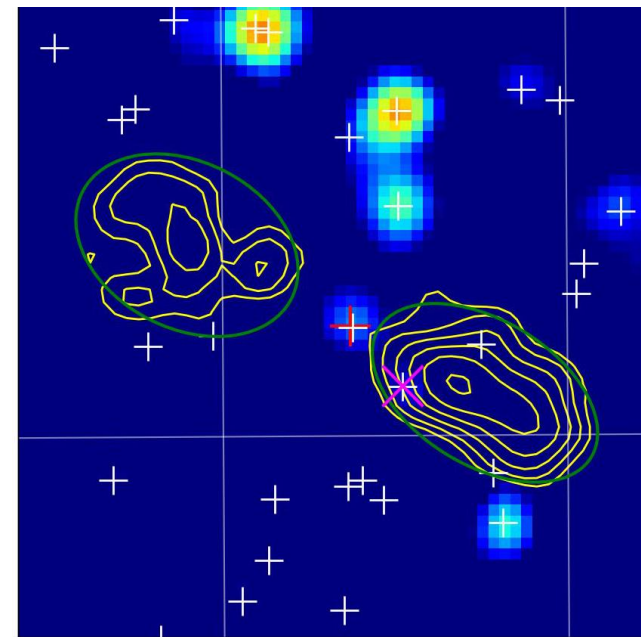
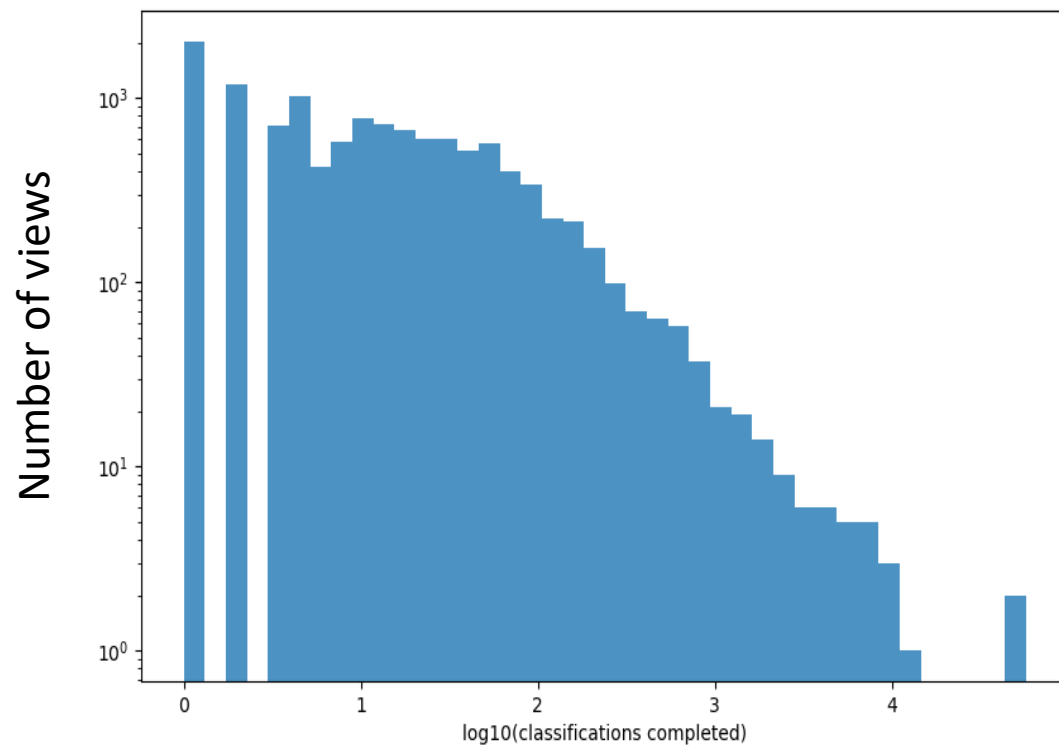
A further complication of the process of optical identification of radio sources is due to the fact that radio structures can be physically large, with complex, resolved structure extending to much larger scales than those of the host galaxy observed in the optical. In extreme (but far from uncommon) cases, the catalogued positions of the two lobes of a double radio galaxy may

* e-mail: m.j.hardcastle@herts.ac.uk

¹ See <http://lofar-surveys.org/>

- 11,106 volunteers
- 878,148 classifications
- 2.5 year project duration
- 174,799 subjects inspected
- 46,208 optical IDs
- Input into main optical IDs paper with 3,500,000 optical IDs
- Vast range of science enabled...

RGZ-LOFAR: Some issues



RGZ-LOFAR: Value added by citizen science

- Individual thought put into most interesting objects
- Tags, comments etc flag targets for followup
- Dialogue between citizen scientists and researchers
- Topics can be proposed and studied in real time

Radio Galaxy Zoo: LOFAR Talk

[Radio Galaxy Zoo: LOFAR Talk](#) > [Science](#) > #orc - Odd Radio Circles

Search or enter a #tag



#orc - Odd Radio Circles

First Previous Page 1 of 1 Next Last



EsthervanDijk
@EsthervanDijk

February 8th 2022, 3:43 pm

Hey everyone,

For my master thesis I'm looking for Odd Radio Circles (ORCs) in LOFAR data. It would be really helpful if you come across something that looks like an ORC, you could label it **#orc**. Here is how you can recognize one:

- The radio emission has a circular symmetry
- The radio emission is brighter towards the edge
- There is no optical emission that seems to overlap with the radio emission
- There may be optical (host) galaxies in the background

[This article](#) shows some examples and also has some more information if you're interested!

Helpful (0) Reply Link



Mitoni_50K
@Mitoni

February 10th 2022, 7:58 pm

Only candidates I've seen so far are [this one](#) and [this one](#). Hard to say... and they're very very rare.

Helpful (0) Reply Link

Popular Tags:

[solid-ellipse](#)
[doublelobe](#)
[core-jet](#)
[compact](#)
[triple](#)
[diffuse](#)
[compacts](#)
[hourglass](#)
[submitted](#)
[hybrid](#)
[blend](#)
[core-jets](#)
[nat](#)
[bent](#)
[wat](#)
[too-zoomed-in](#)
[extended](#)
[sdragn](#)
[galaxy](#)
[clumpy](#)

Where next with SKA + LSST?

- RGZ and RGZ-LOFAR are at the limits of size
- Still issues with selecting the right objects and asking the right questions
- But clear role for citizen scientists in dealing with the most complex objects
- Improve selection – ML to the rescue?
- Genuine exploration of the data through domain-aware platform would greatly improve the citizen scientist experience



A large, semi-circular particle detector structure, likely a calorimeter or tracker, is shown in the center of the slide. It is composed of many blue, rectangular segments arranged in a circular pattern. The background is a dark blue space with numerous small, bright blue stars.

Thanks for your attention!



ESCAPE to the Future

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LSST/Vera Rubin precursor: Subaru HSC

Galaxy Zoo: Cosmic Dawn

James Pearson, Hugh Dickinson, Stephen Serjeant
Galaxy Zoo Team

ZOONIVERSE

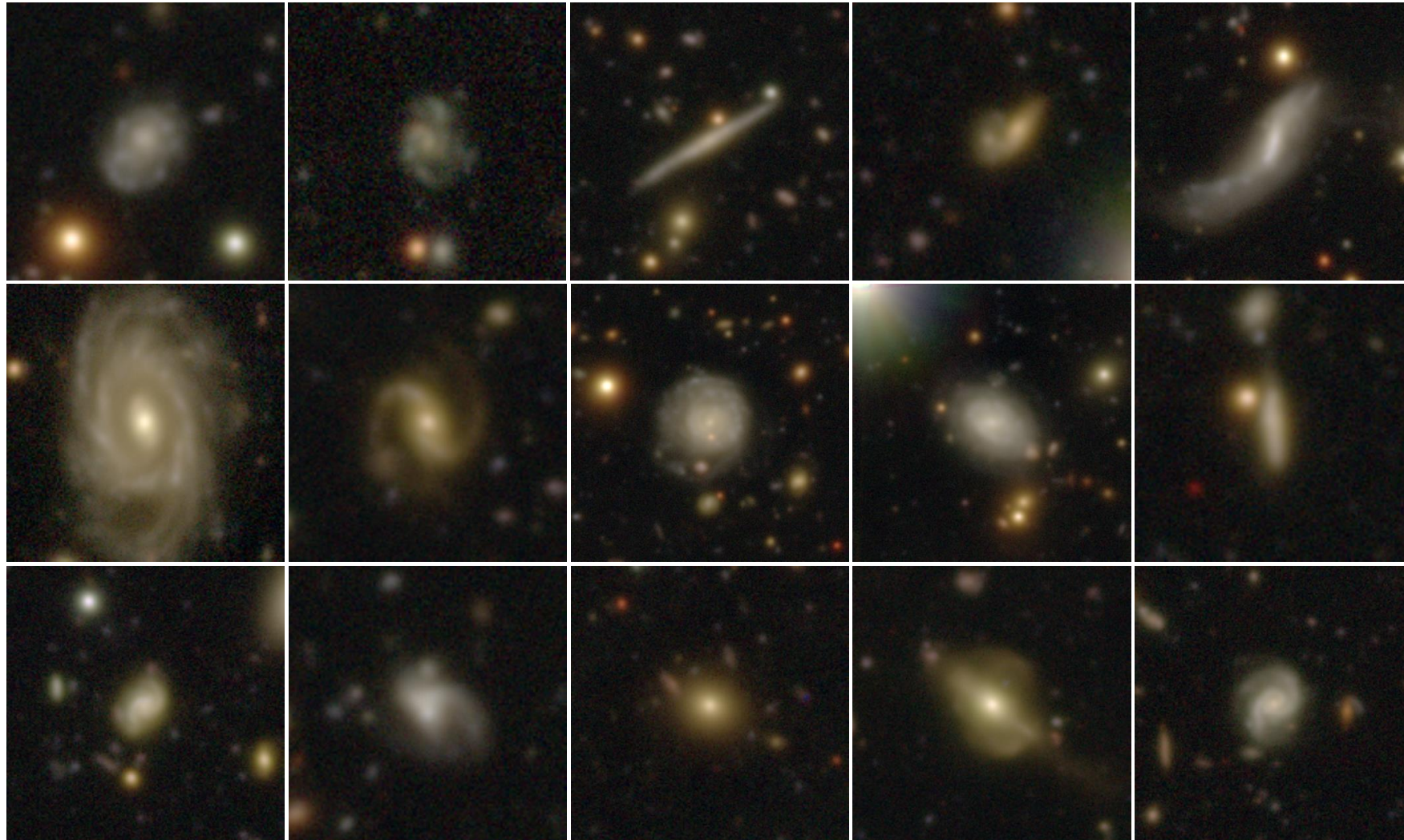
**HAWAII
TWO-O**

**COSMIC
DAWN
SURVEY**



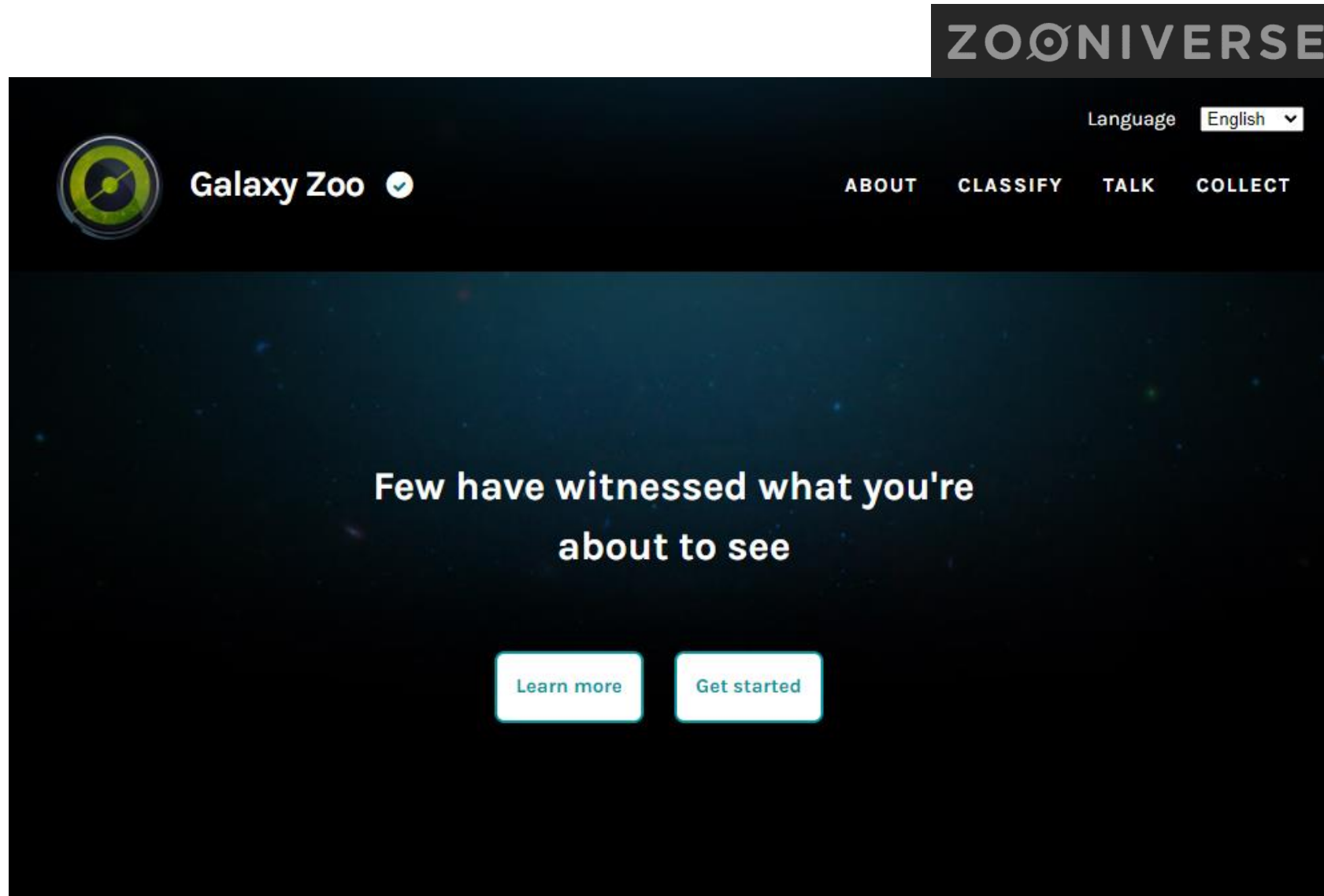
ESCAPE - The European Science Cluster of Astronomy & Particle Physics ESFRI Research Infrastructures has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 824064.

Galaxy Zoo



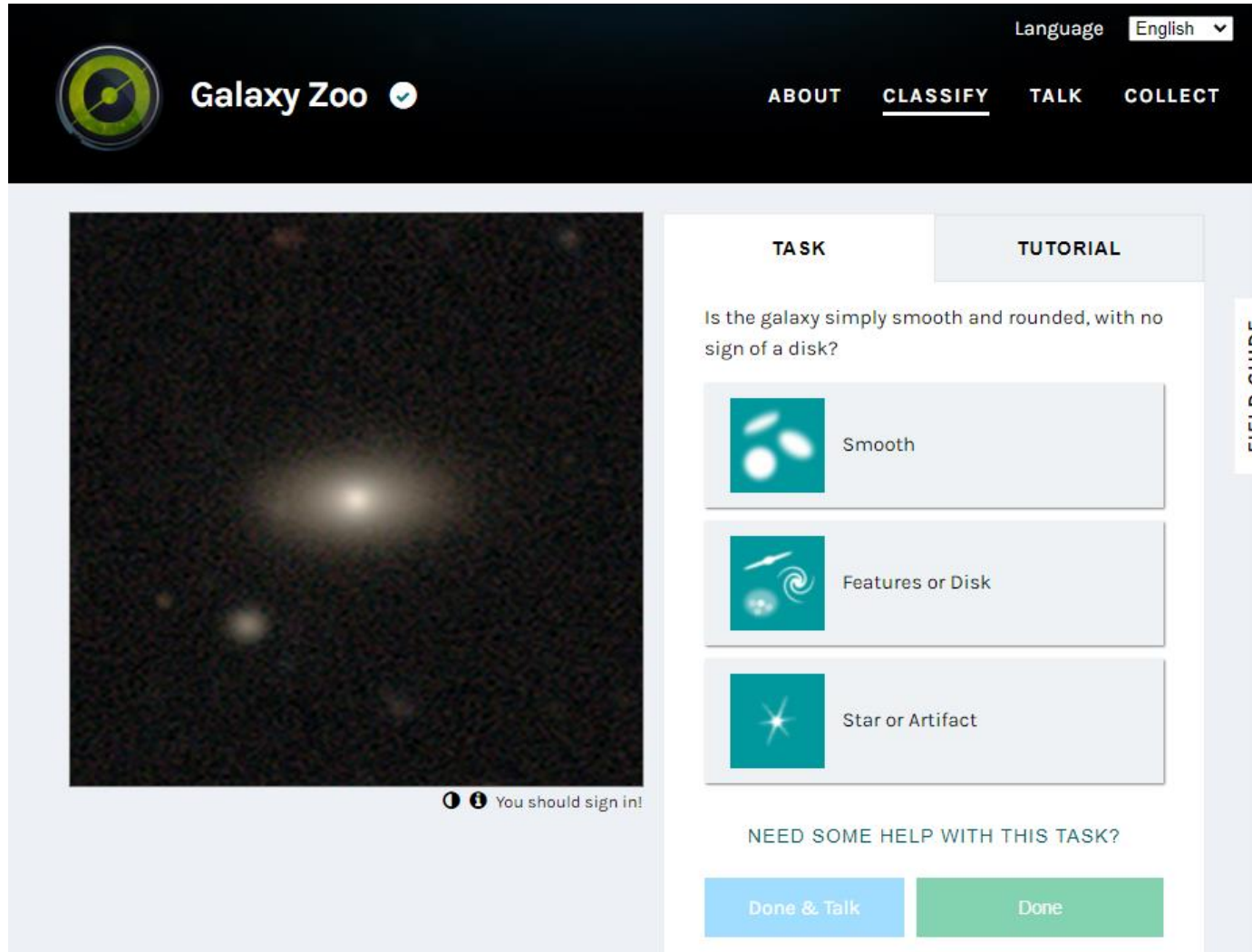
Galaxy Zoo

<https://www.zooniverse.org/projects/zookeeper/galaxy-zoo>



Galaxy Zoo

<https://www.zooniverse.org/projects/zookeeper/galaxy-zoo>



The screenshot shows the Galaxy Zoo website interface. At the top, there is a dark navigation bar with the Galaxy Zoo logo (a green circle with a white 'Z') and the text "Galaxy Zoo" with a checkmark. To the right of the logo is a language dropdown menu set to "English". Further right are four navigation links: "ABOUT", "CLASSIFY" (which is underlined), "TALK", and "COLLECT".

Below the navigation bar, the main content area is divided into two columns. The left column features a large image of a galaxy. Below the image, there is a small message: "You should sign in!". The right column contains a "TASK" section with the question: "Is the galaxy simply smooth and rounded, with no sign of a disk?". Below this question are three radio button options, each with a small icon and a label: "Smooth" (with an icon of three rounded shapes), "Features or Disk" (with an icon of a spiral galaxy), and "Star or Artifact" (with an icon of a star). To the right of these options is a vertical label "FIELD GUIDE".

At the bottom of the right column, there is a section titled "NEED SOME HELP WITH THIS TASK?". Below this title are two buttons: "Done & Talk" (in blue) and "Done" (in green).

Galaxy Zoo: Cosmic Dawn

Citizen science galaxy classification using Subaru **Hyper Suprime-Cam (HSC)** imaging from the **Hawaii Two-0 (H2O) Cosmic Dawn** survey.

Cosmic Dawn

- Multi-wavelength survey of the Euclid Deep and Calibration fields – some of the darkest and most observable fields on the sky.
- Aims to understand the co-evolution of galaxies, black holes, and the dark matter haloes that host them across cosmic time.

ZOONIVERSE

**HAWAII
TWO-0**

**COSMIC
DAWN
SURVEY**



The Open
University



Galaxy Zoo: Cosmic Dawn

H20

- Ultra-deep Subaru HSC imaging of the two primary Euclid deep calibration fields, including the Euclid Deep Field North (EDF-N).
- Studying galaxy evolution out to $z = 7$ (<800 million years after the Big Bang).

Galaxy Zoo project

- Hundreds of thousands of H20 HSC images of the (10 sq. deg.) EDF-N.

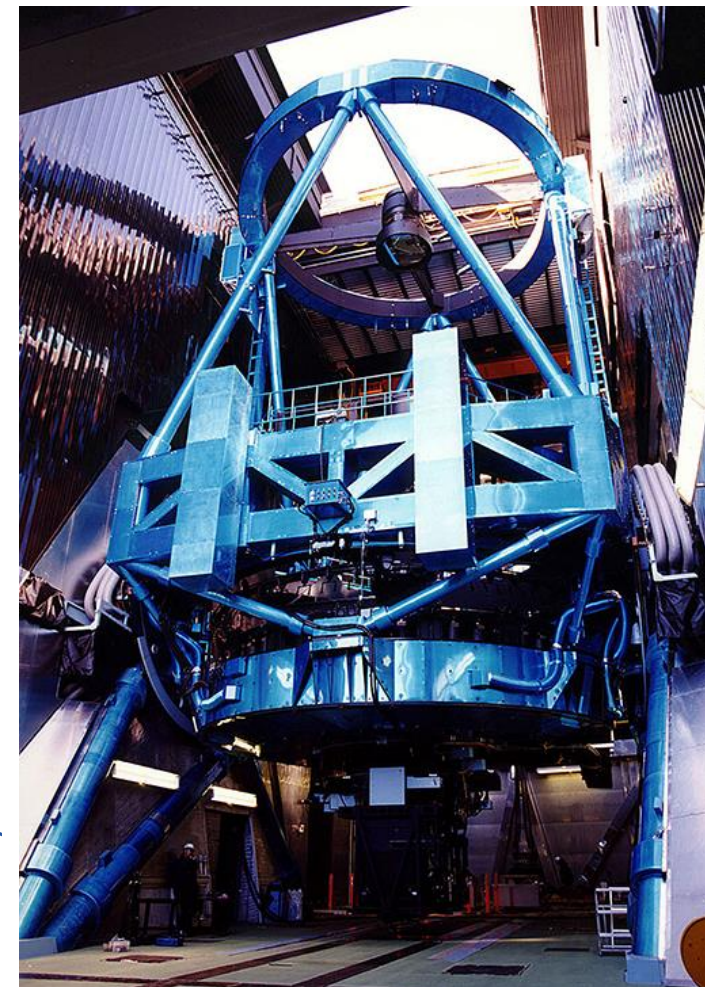
ZOONIVERSE

HAWAII
TWO-θ

COSMIC
DAWN
SURVEY



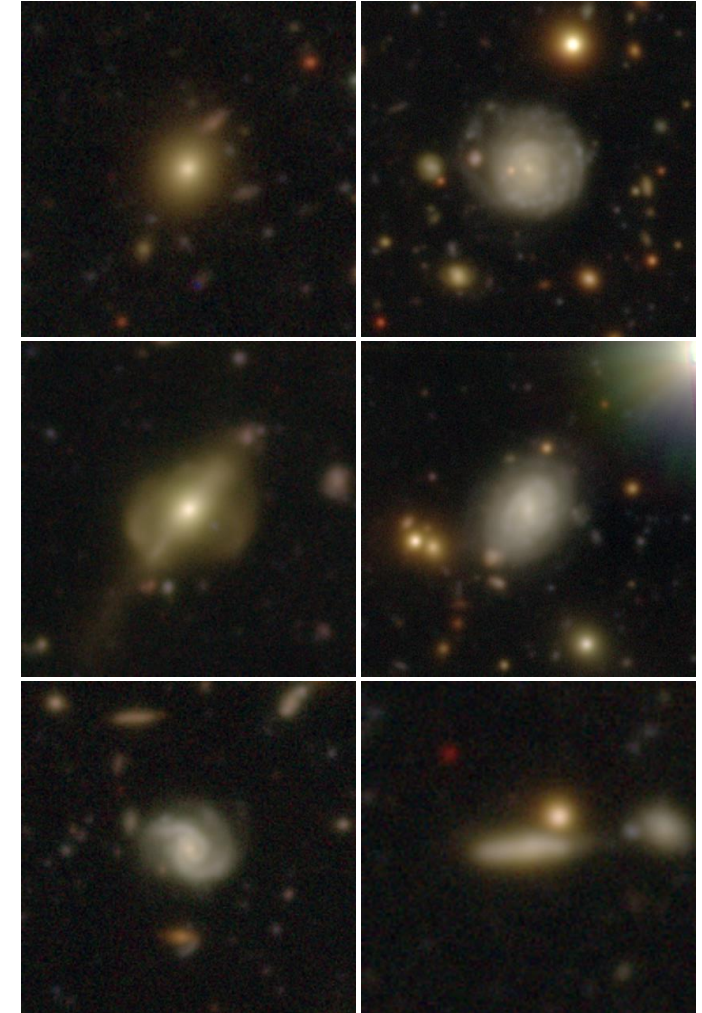
The Open
University



Galaxy Zoo: Cosmic Dawn

Benefits

- LSST Rubin precursor: mapping provides **multiband ground truth sets** for use in training deep learning models.
- Euclid precursor: mapping the EDF-N provides **initial classifications for rapid follow-up** of the most interesting objects.
- Higher-end resolution and deep multiband imaging for statistically studying both **higher redshift sources** and **low surface brightness features**.
- Expands the lists of interesting objects, including those from **serendipitous discovery**.



ZOONIVERSE

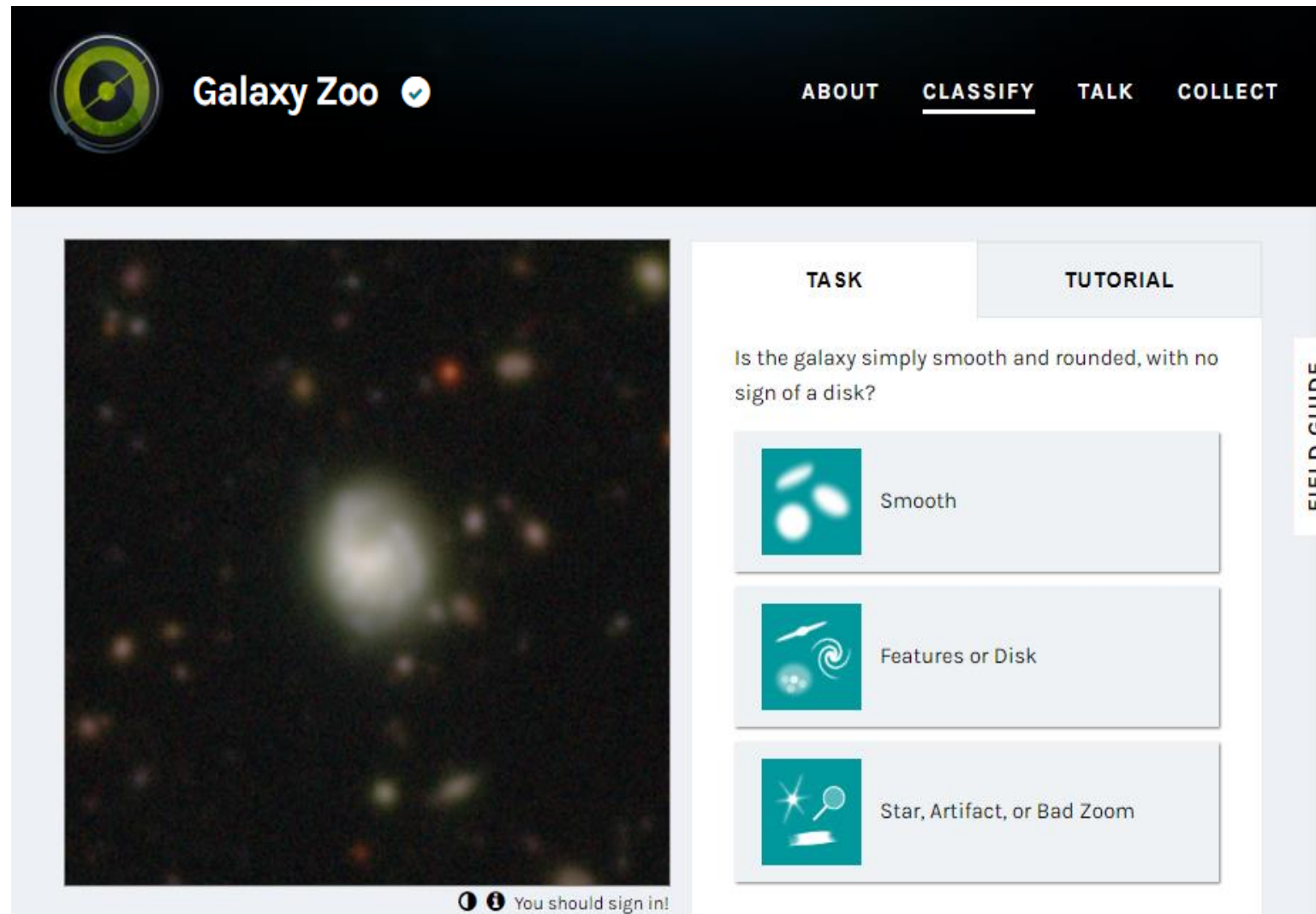
HAWAII
TWO-θ

COSMIC
DAWN
SURVEY




The Open
University

Galaxy Zoo: Cosmic Dawn




The screenshot shows the Galaxy Zoo website interface. At the top, there is a dark blue header with the Galaxy Zoo logo (a green and yellow circular icon) and the text "Galaxy Zoo" with a checkmark. To the right of the logo are navigation links: "ABOUT", "CLASSIFY" (underlined), "TALK", and "COLLECT". Below the header, the main content area is divided into two sections: "TASK" and "TUTORIAL". The "TASK" section contains the question: "Is the galaxy simply smooth and rounded, with no sign of a disk?". Below this question are three options, each with a teal square icon and a label: "Smooth" (icon of three rounded shapes), "Features or Disk" (icon of a spiral galaxy), and "Star, Artifact, or Bad Zoom" (icon of a star and a magnifying glass). To the right of the "TASK" section is a vertical sidebar labeled "FIELD GUIDE". At the bottom of the main content area, there is a small notification that says "You should sign in!" with a user icon and an information icon.


Galaxy Zoo: Cosmic Dawn


Galaxy Zoo

Are there any obvious bright clumps?




Bright clumps




None


What problem do you see with the image?



Star




Non-star Artifact




Bad Image Zoom


What type of artifact is it?




Saturation Feature (Bleed Trail)




Diffraction Spike




Satellite Trail



Cosmic Ray

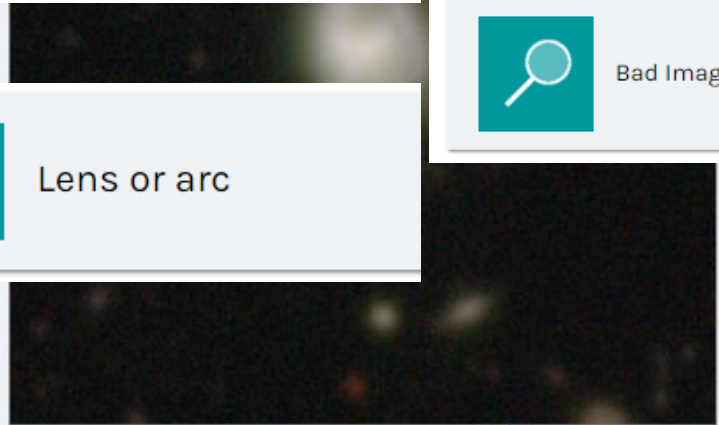




Scattered Light



Other / Not Sure

Star, Artifact, or Bad Zoom

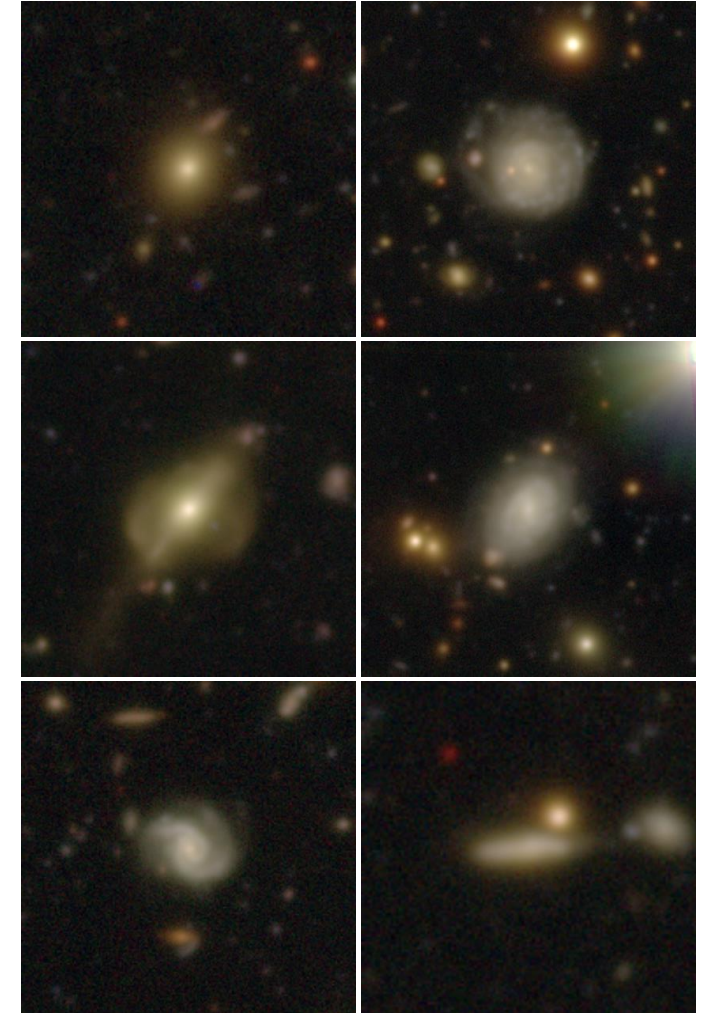


  You should sign in!

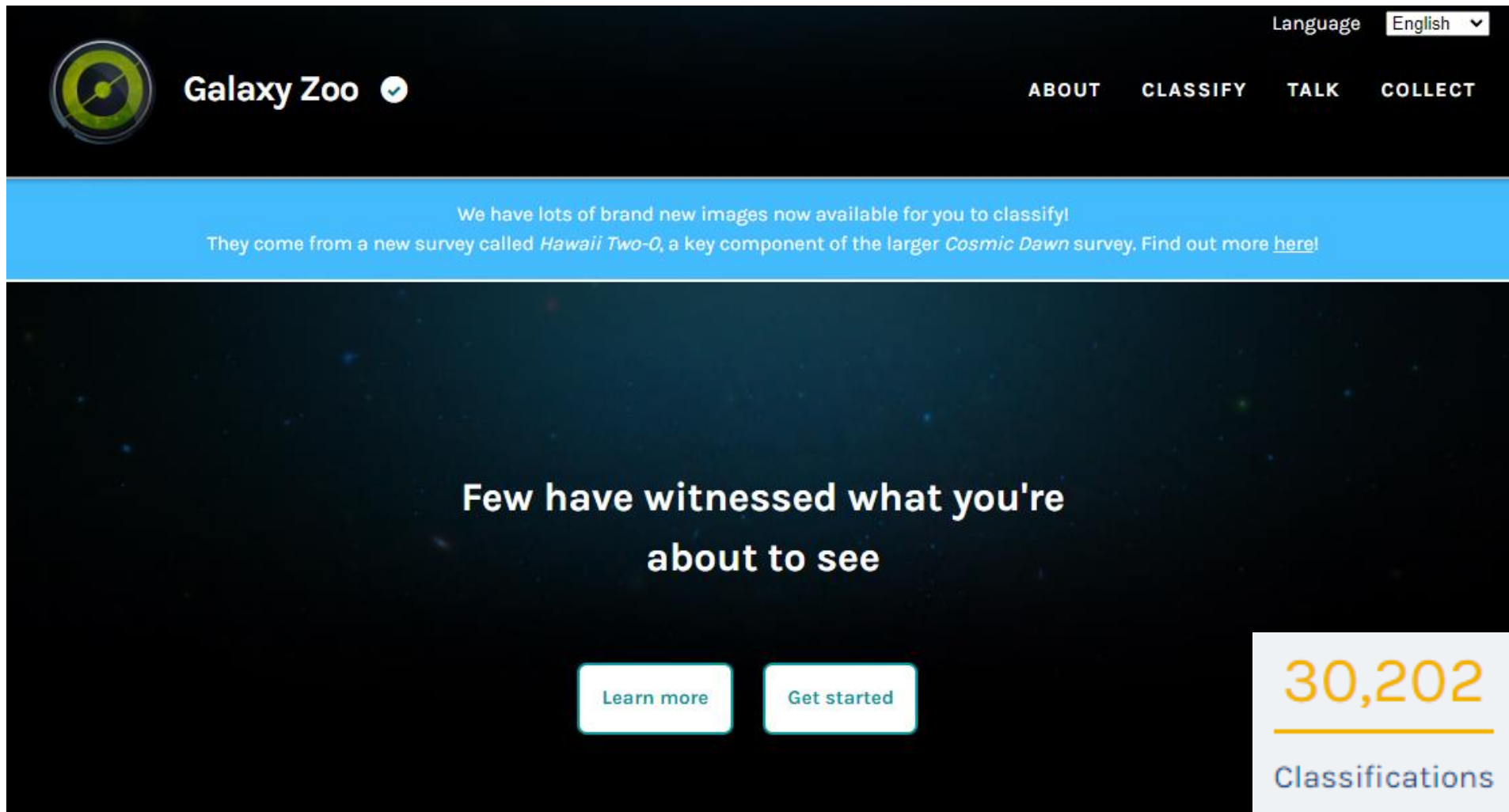
Galaxy Zoo: Cosmic Dawn

Potential Publications

- General data release paper
- Strong gravitational lens discoveries
- Clumpy galaxy statistics
- Low surface brightness features
- Barred galaxy discoveries and statistics
- Interesting cases of utilising machine learning (Zoobot)
- Galaxy mergers identified by GZ, and their correlation with AKARI/Spitzer data
- Correlations between Galaxy Zoo morphology and IR luminosity



Galaxy Zoo: Cosmic Dawn



The screenshot shows the Galaxy Zoo website interface. At the top, there is a navigation bar with the Galaxy Zoo logo, a language dropdown set to 'English', and links for 'ABOUT', 'CLASSIFY', 'TALK', and 'COLLECT'. Below the navigation bar is a blue banner with the text: 'We have lots of brand new images now available for you to classify! They come from a new survey called *Hawaii Two-O*, a key component of the larger *Cosmic Dawn* survey. Find out more [here!](#)'. The main content area features a dark space background with the text 'Few have witnessed what you're about to see'. Below this text are two buttons: 'Learn more' and 'Get started'. On the right side, there is a white box displaying '30,202' in large orange numbers, with 'Classifications' written below it.

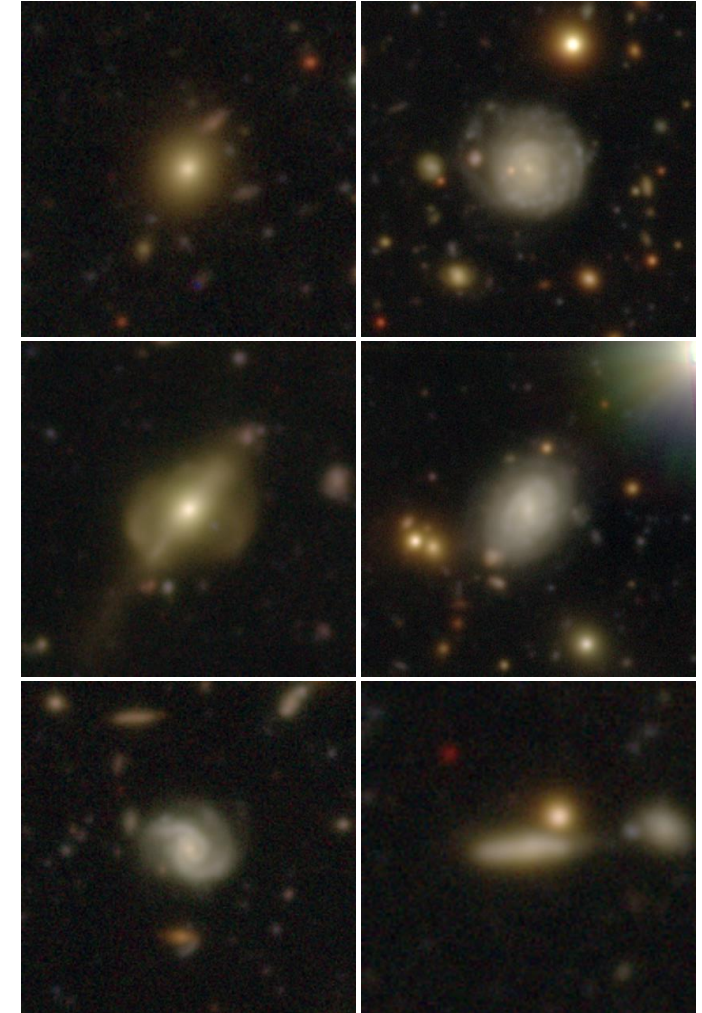
Thanks for listening!

<https://www.zooniverse.org/projects/zookeeper/galaxy-zoo>

Galaxy Zoo: Cosmic Dawn

Summary

- Galaxy Zoo is the longest running Zooniverse citizen science project, classifying galaxies based on their visual morphologies.
- Galaxy Zoo: Cosmic Dawn forms its next iteration, using deep multi-band Subaru HSC imaging of the EDF-N, with data from the H20 Cosmic Dawn survey.
- Benefits include:
 - Studying higher- z sources and those with LSB features,
 - Expanding the list of interesting objects (e.g. through serendipitous discovery),
 - Mapping the EDF-N acts as a precursor for Euclid by providing initial classifications for rapid follow-up,
 - Project acts as a precursor for Rubin LSST by creating multiband ground truth sets for training deep learning models.



ZOONIVERSE

HAWAII
TWO- θ

COSMIC
DAWN
SURVEY



The Open
University



ESCAPE to the Future
25-26 October 2022
Brussels, Belgium

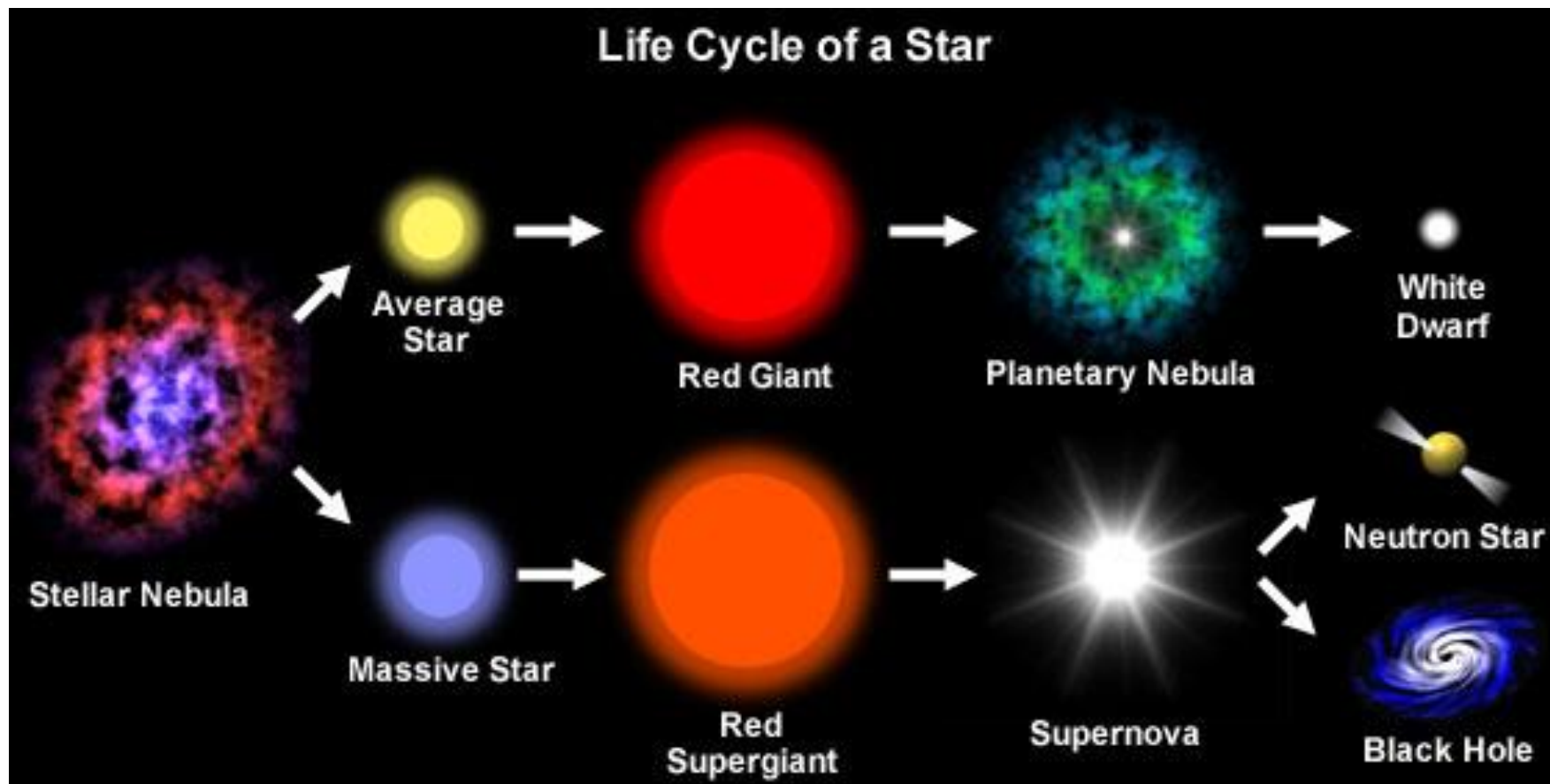
ESCAPE Citizen Science SuperWASP: Black Hole Hunter

Hugh Dickinson – The Open University

Team: Adam McMaster, Andrew Norton, Matthew Middleton, Heidi Thiemann, Stephen Serjeant

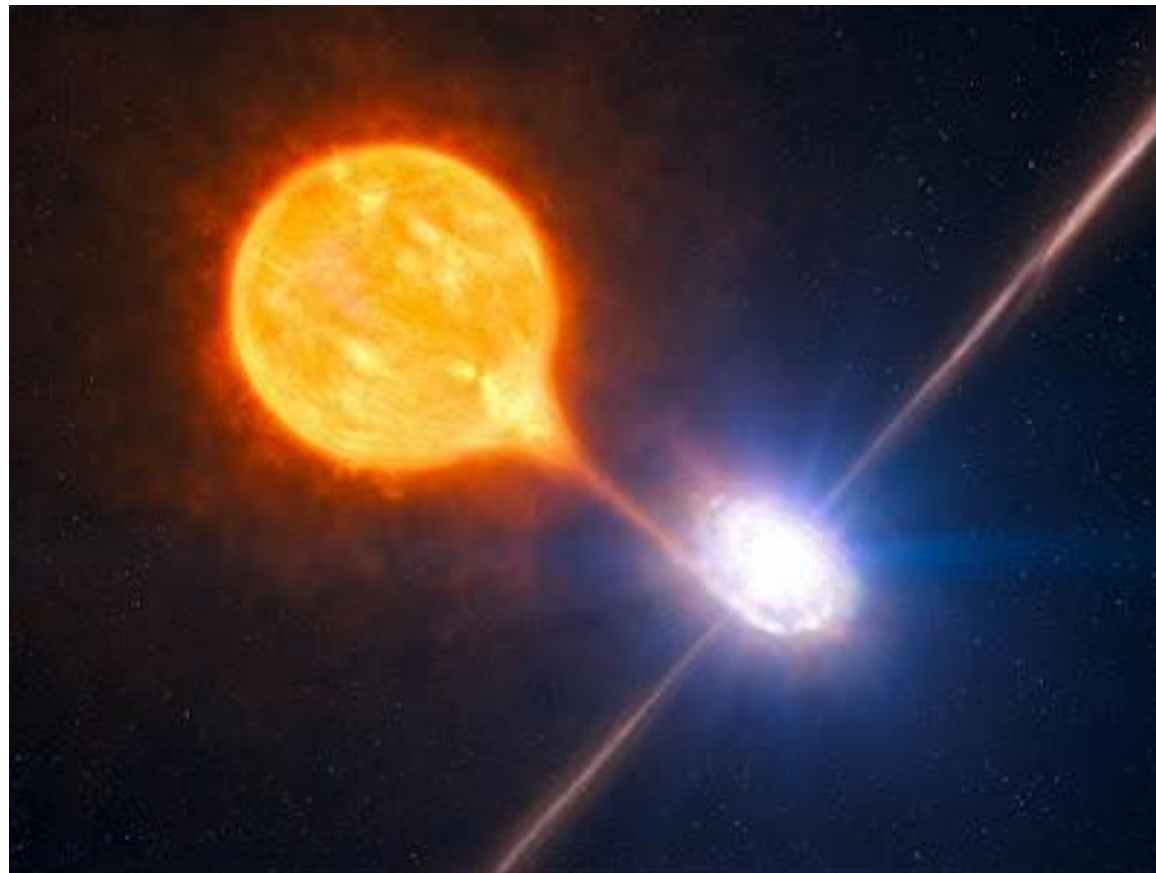


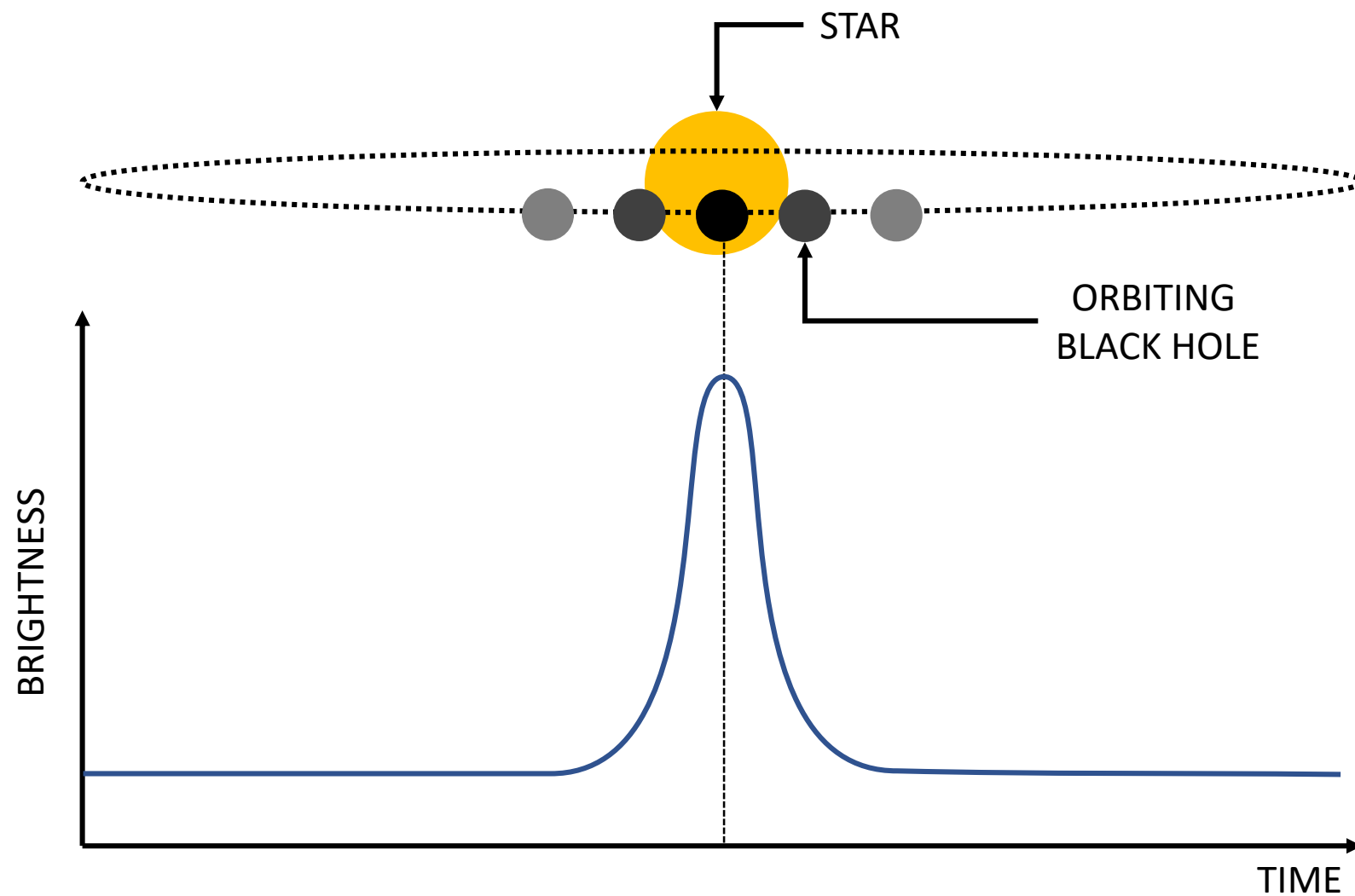
Searching for hidden black holes



There should be a few
100,000 black holes
in the Milky Way

We have only detected
about thirty!



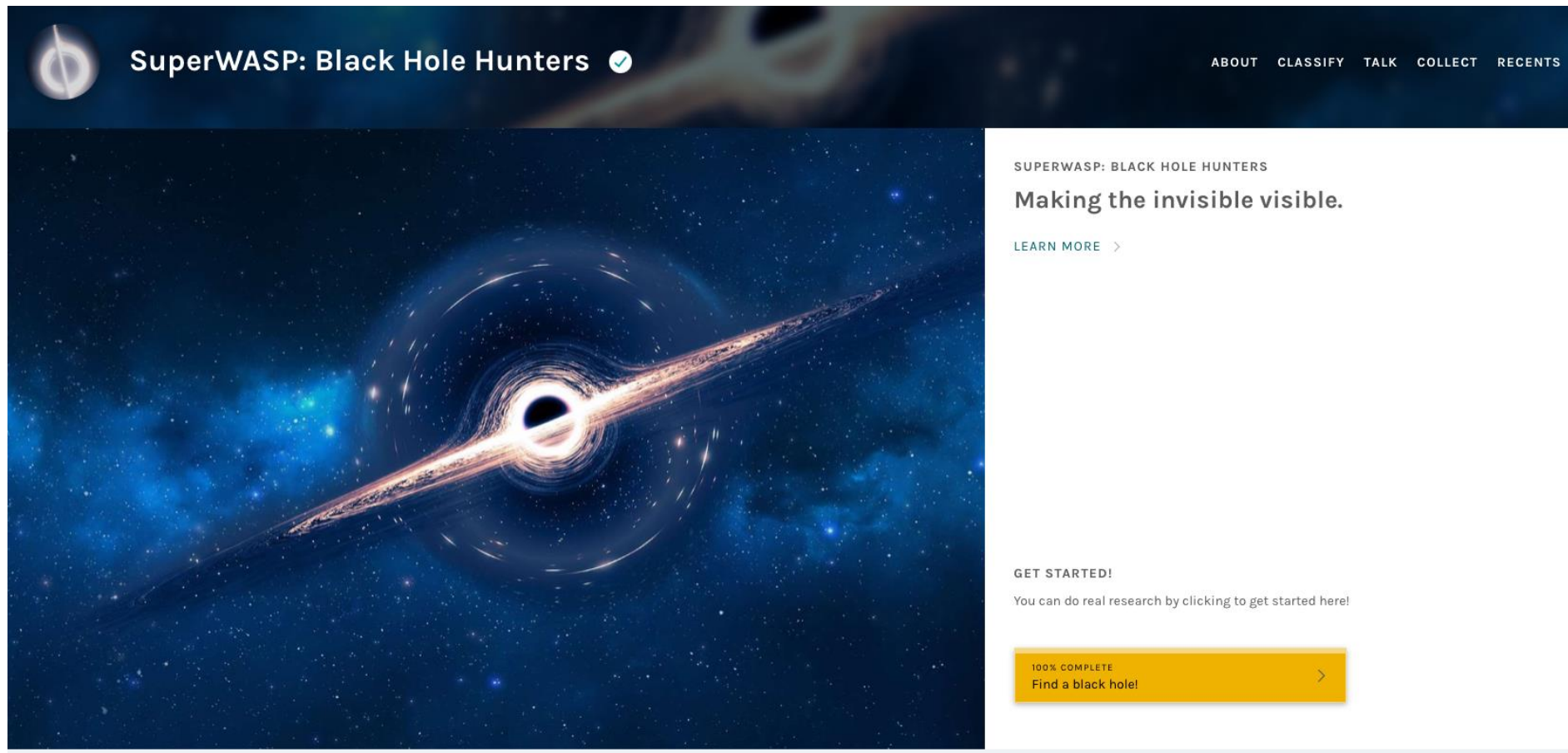


The Citizen Science Approach



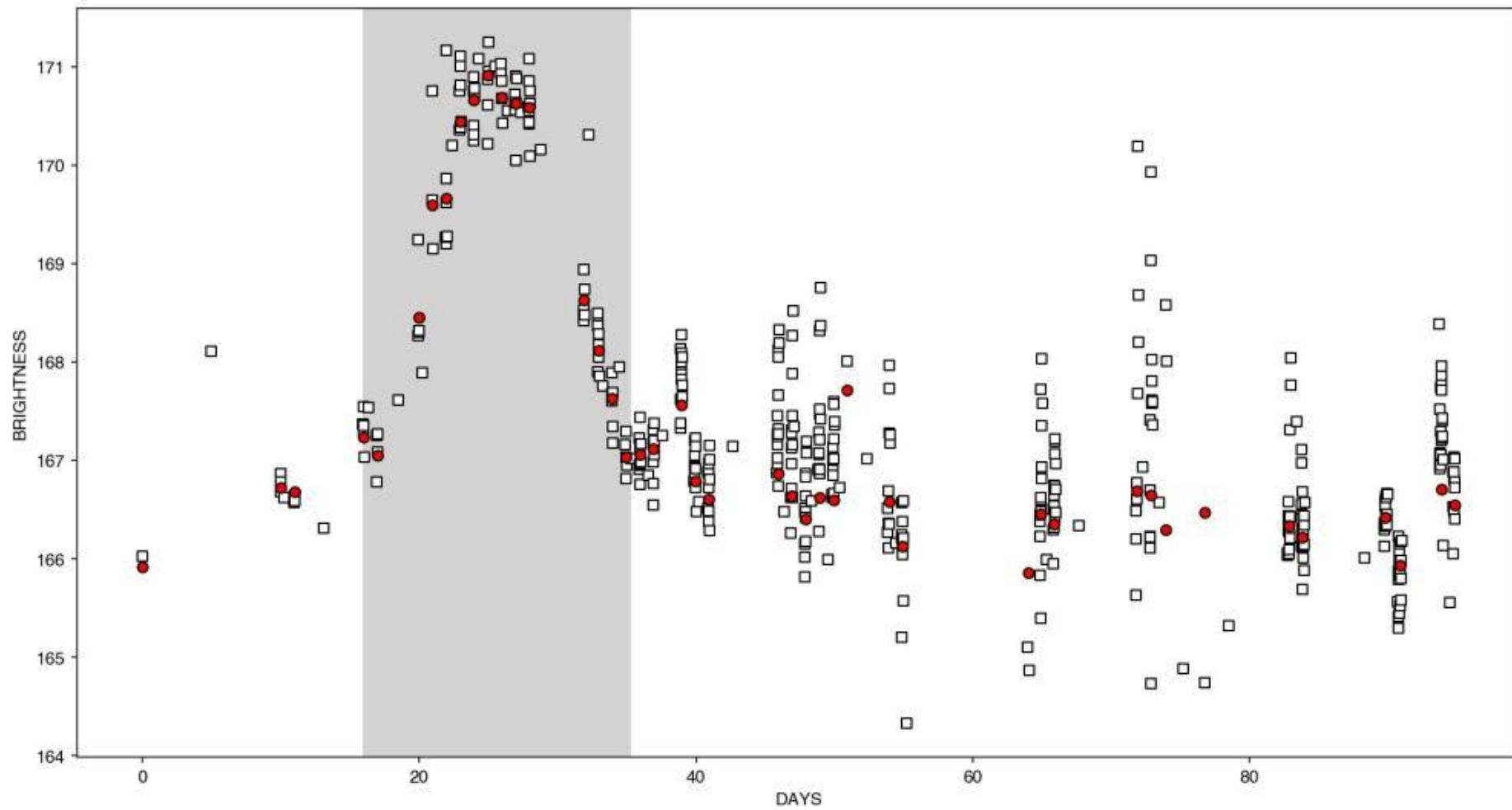
The **W**ide **A**ngle **S**earch for **P**lanets – a ground-based exoplanet search

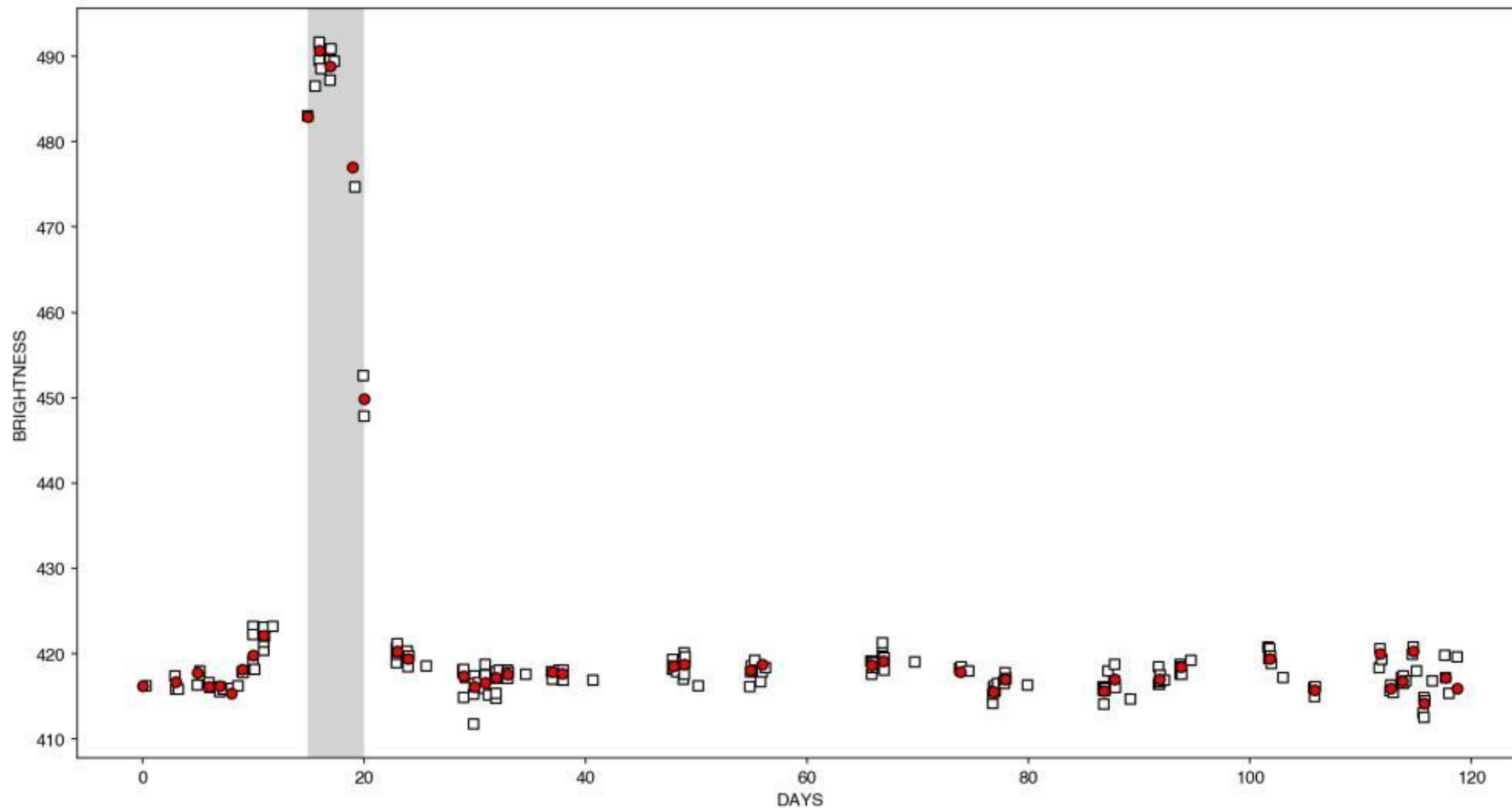
Two telescopes (North and South)

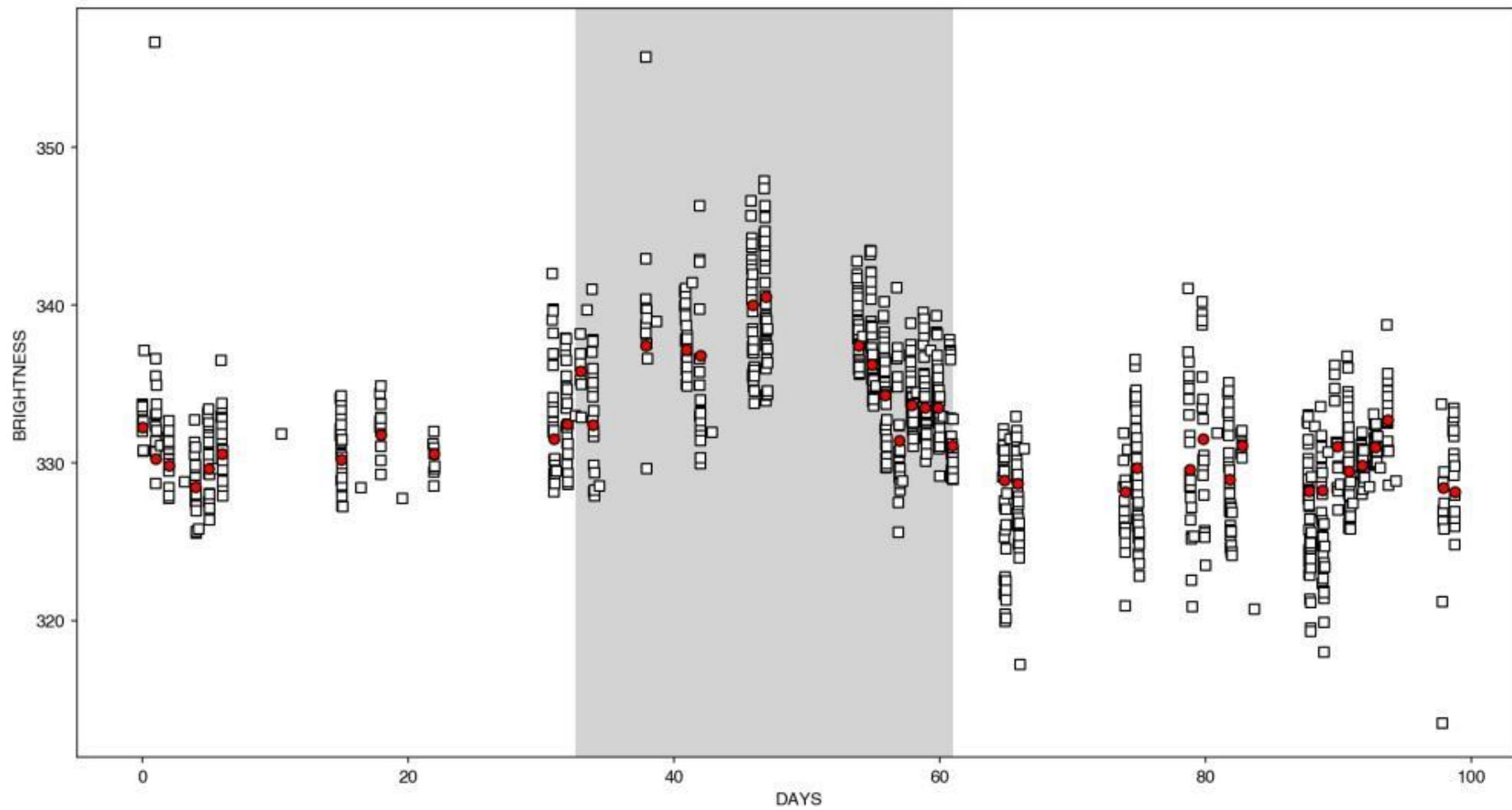


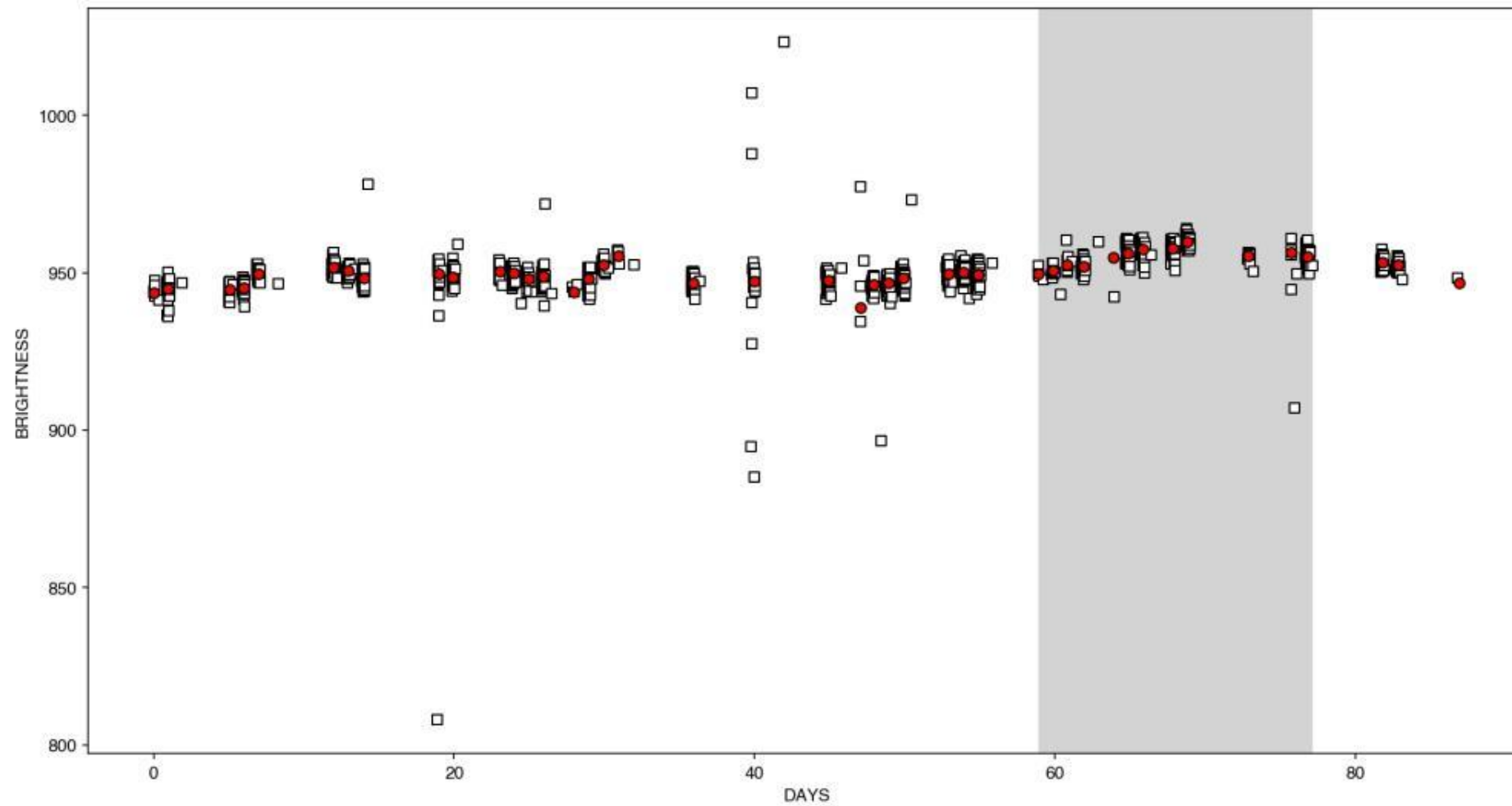
<https://www.zooniverse.org/projects/hughdickinson/superwasp-black-hole-hunters>

What are volunteers looking for?

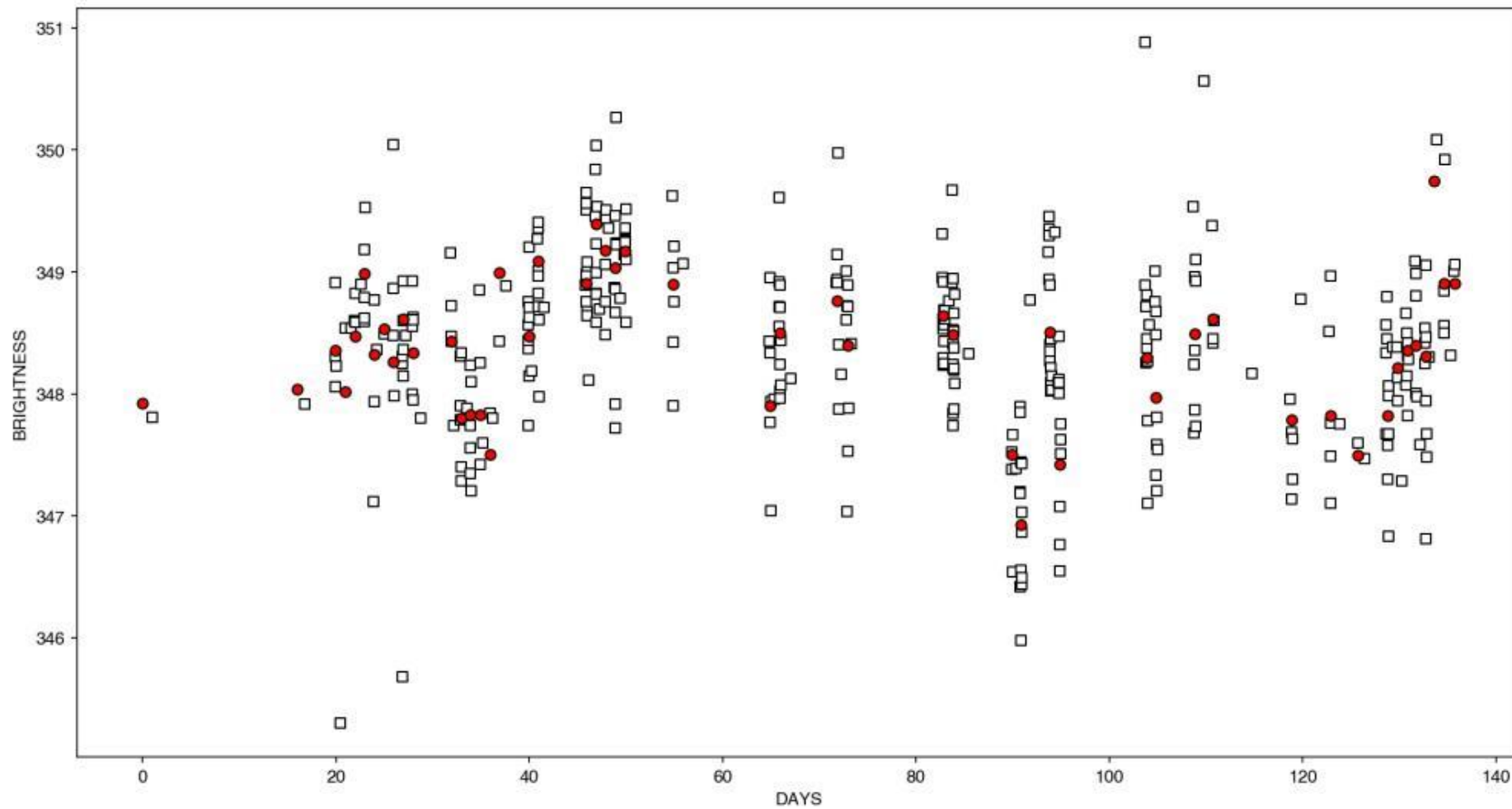


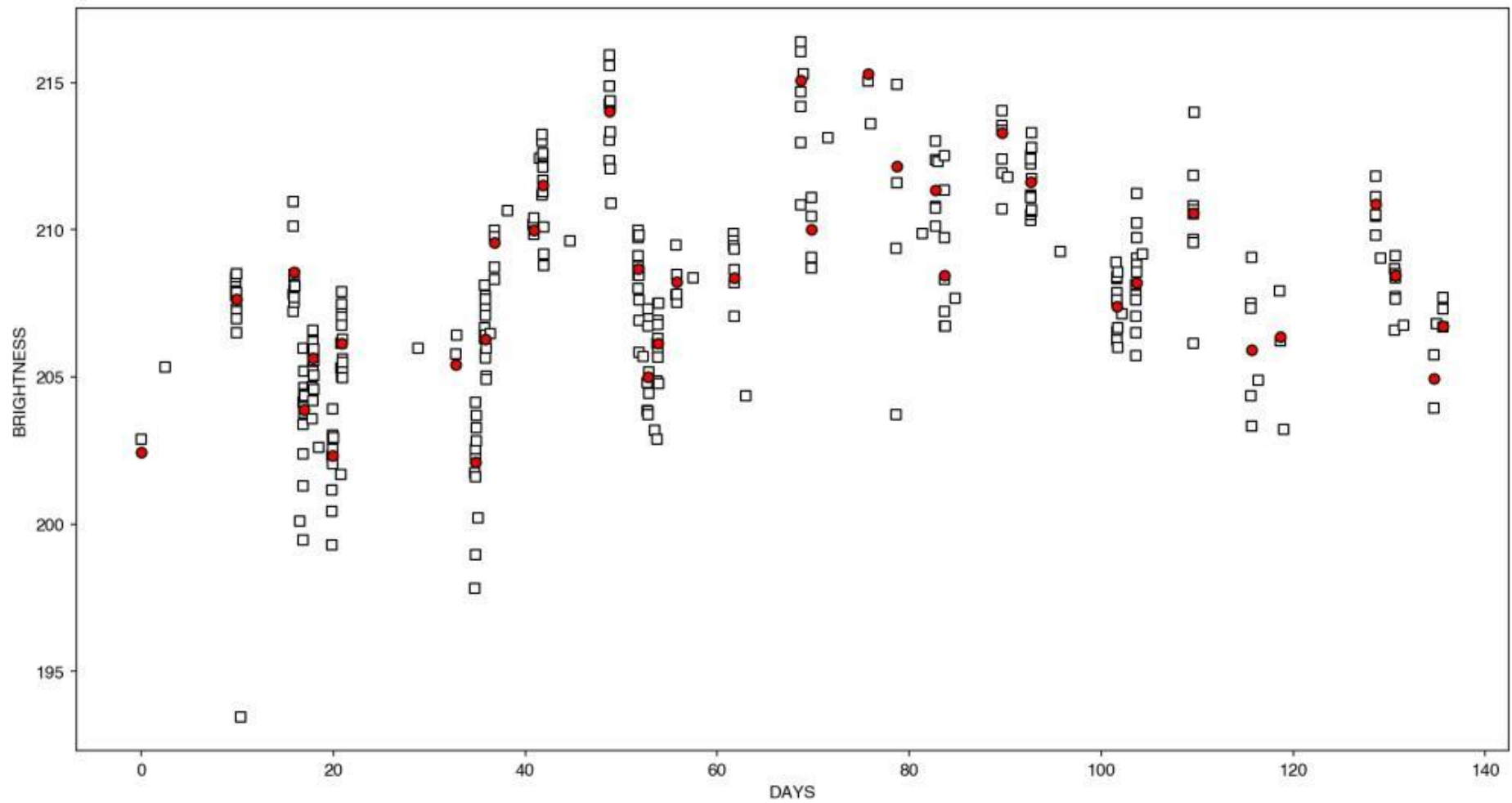


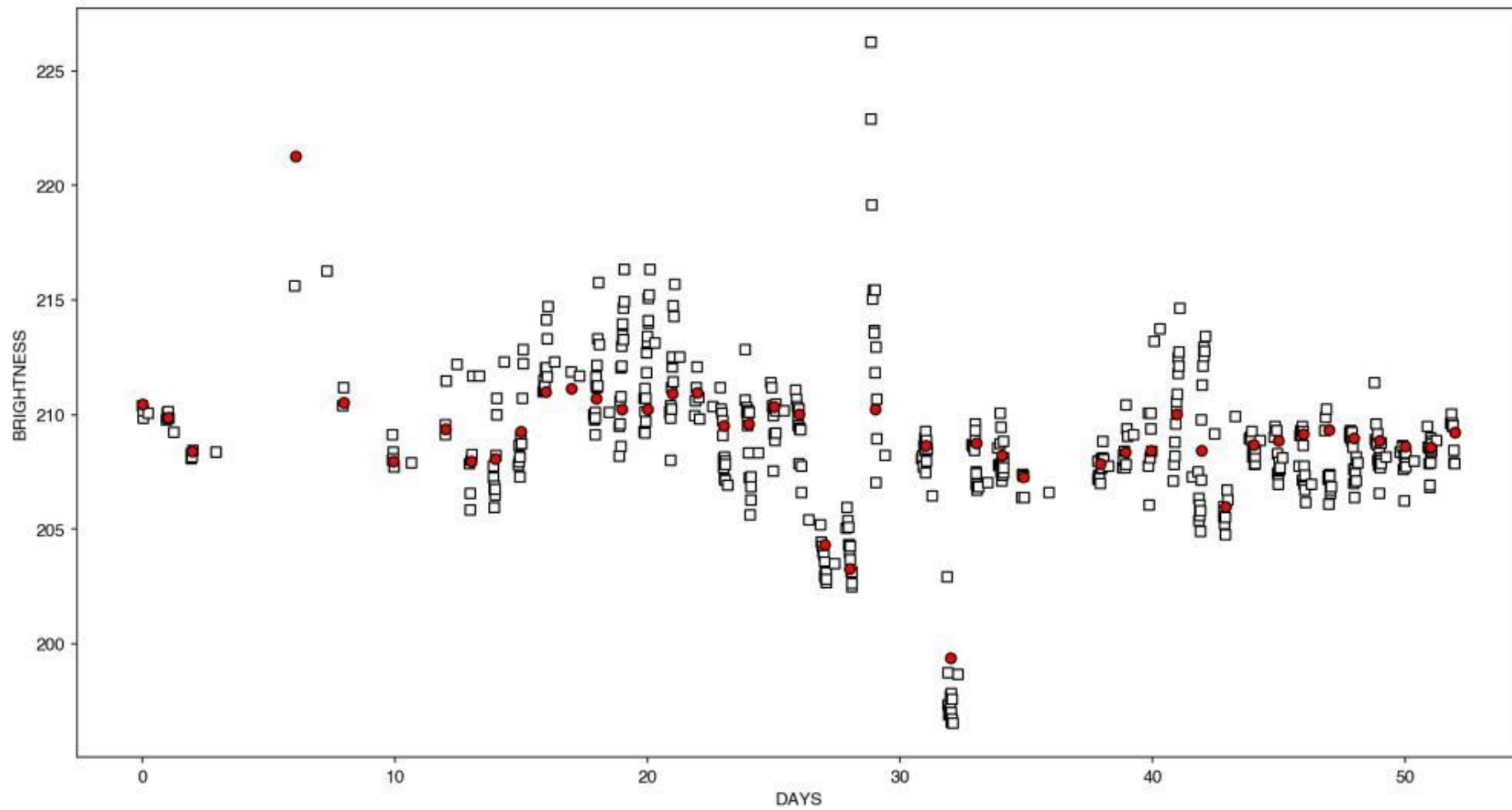




What are volunteers looking at?







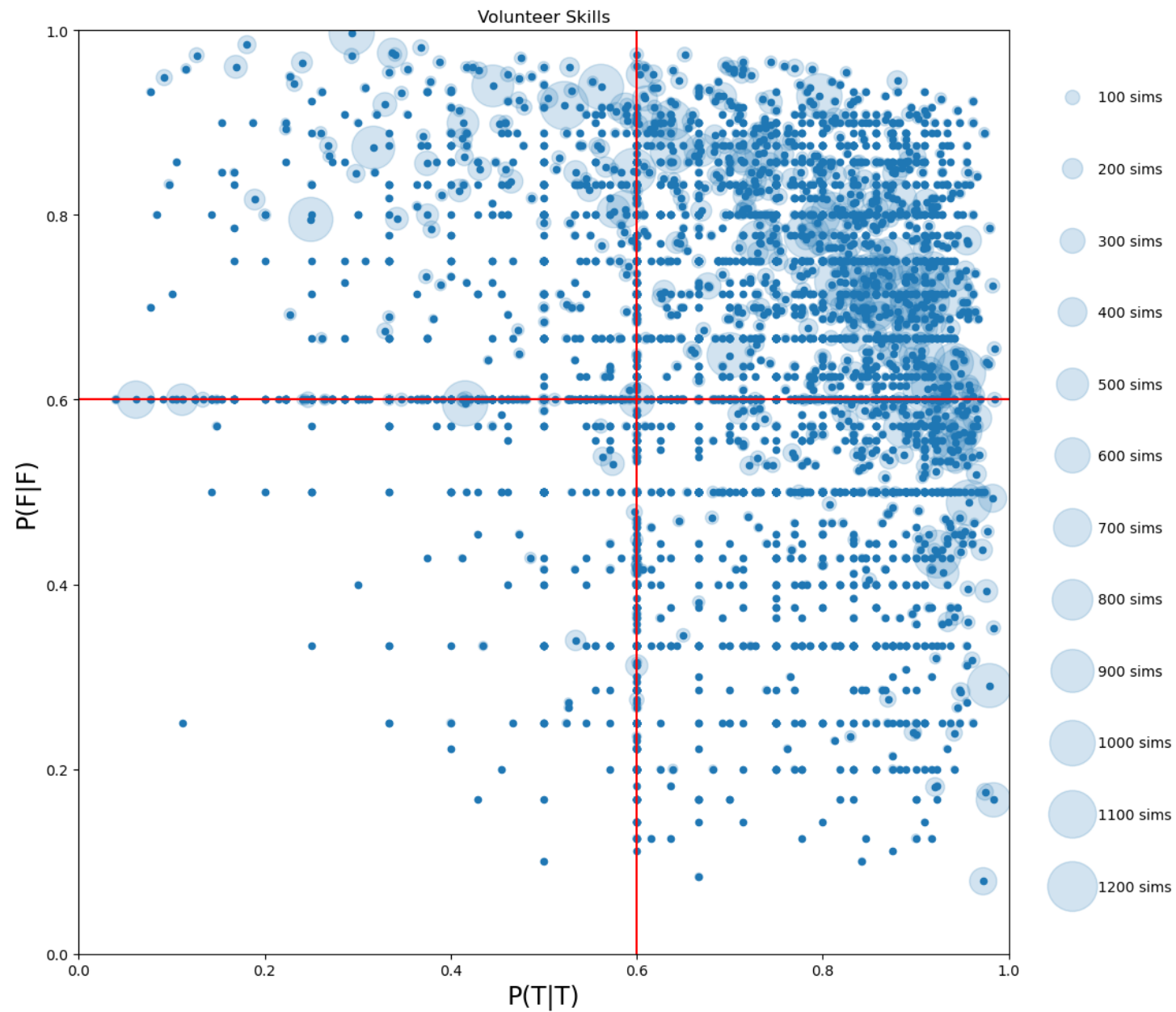
Big numbers!

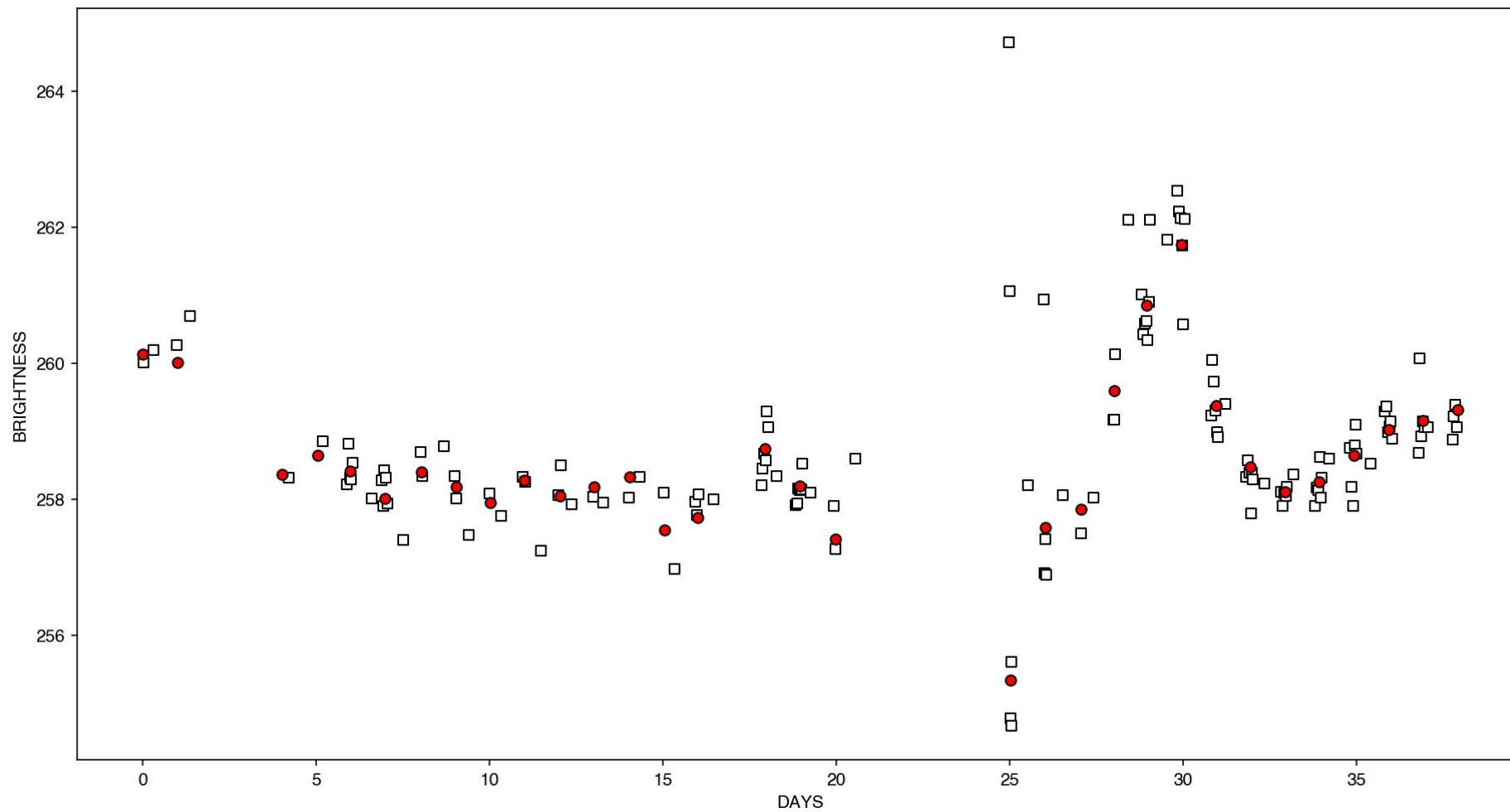
Number of Volunteers
engaged:
5,582

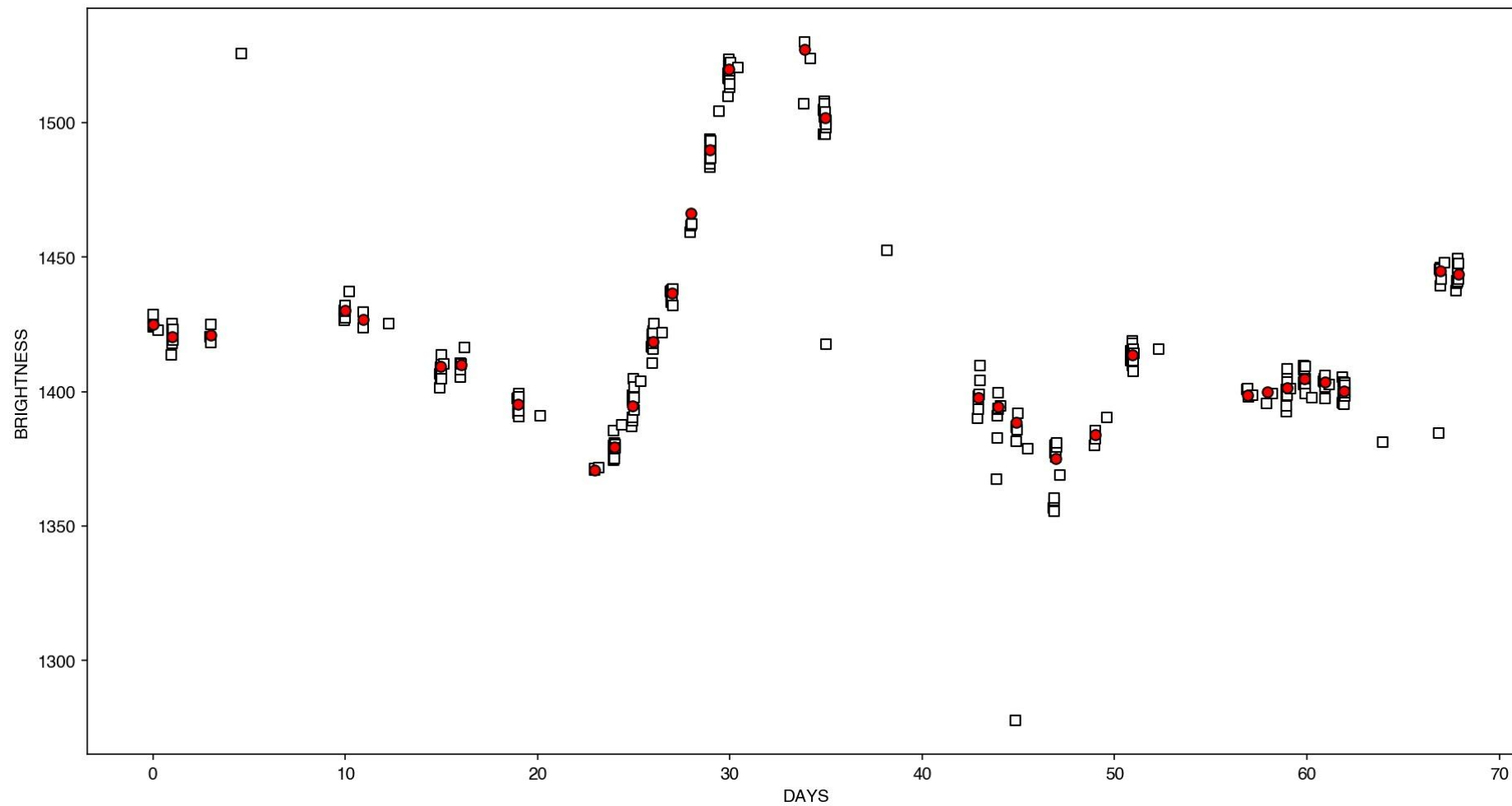
Number of light curves
inspected:
208,700

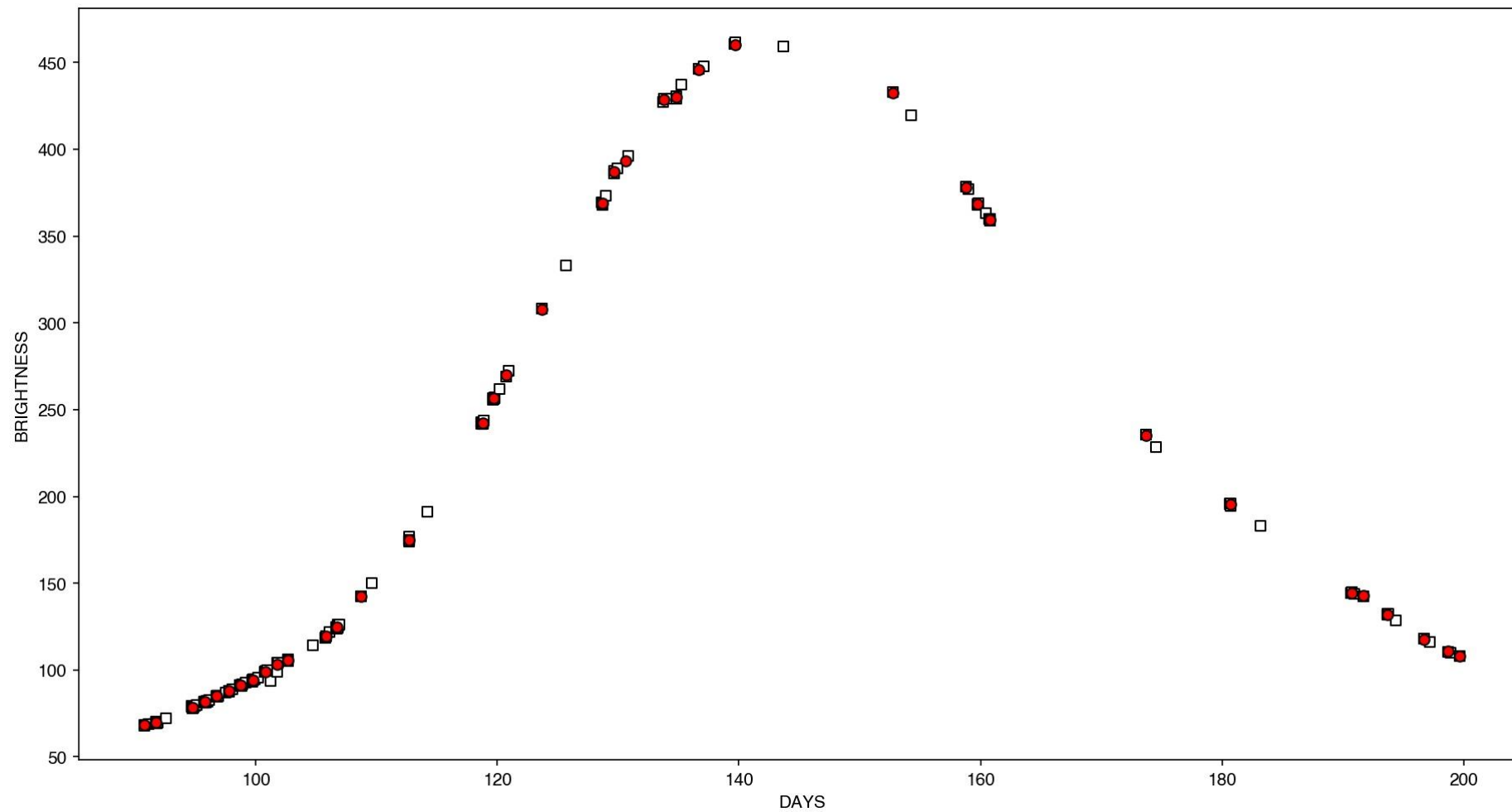
Total number of
classifications:
2,107,767

Analysing the results

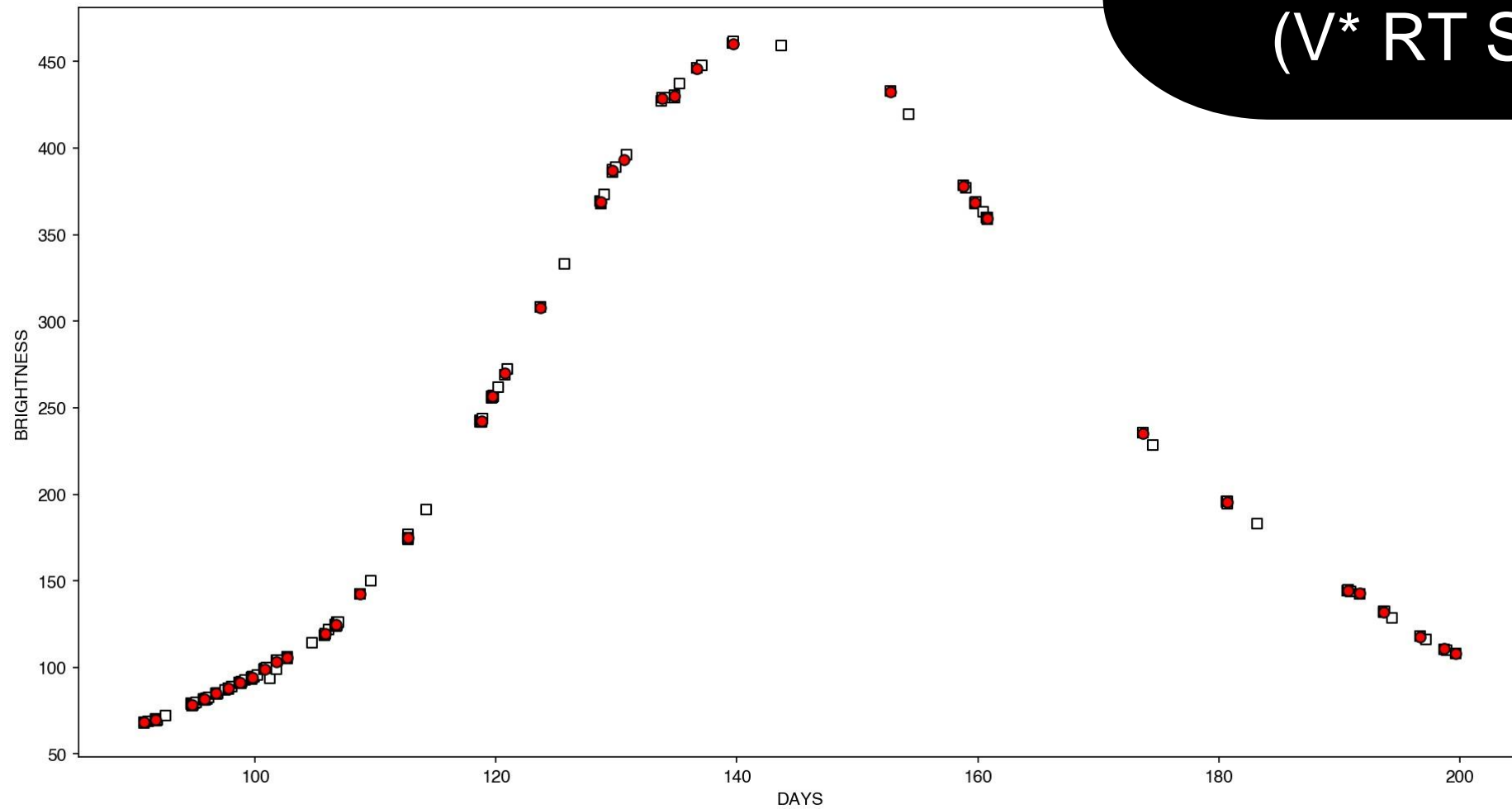


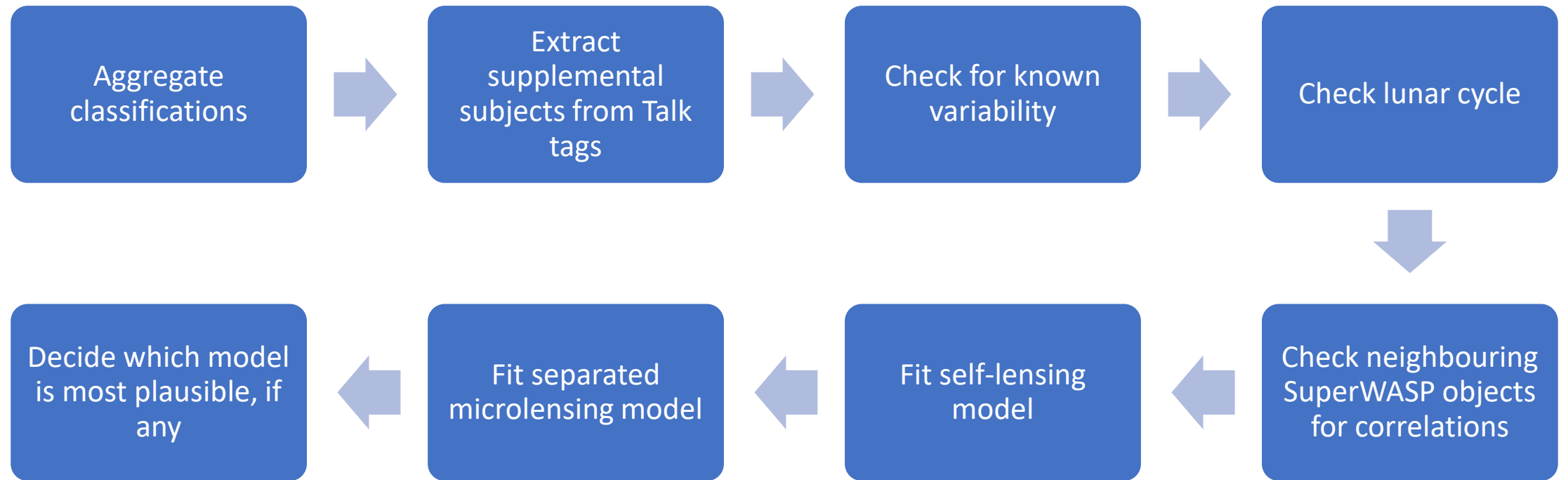






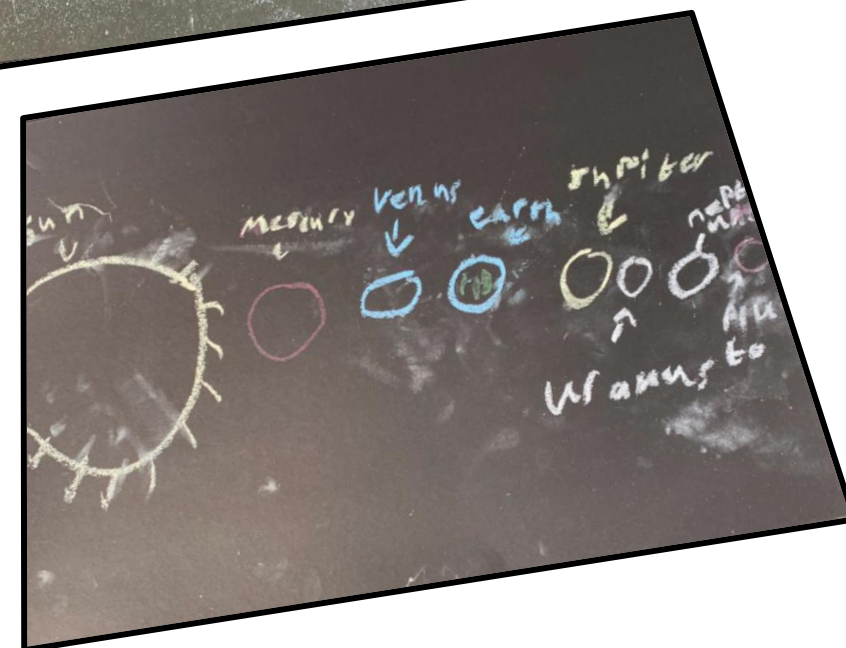
Mira Variable Star (V* RT Sgr)





Analysis is ongoing - watch this space!

Bonus: Meeting the volunteers!



A large, semi-circular particle detector structure, possibly a calorimeter or tracker, is shown in the center of the slide. It is composed of many blue, rectangular segments arranged in a circular pattern, with numerous thin lines radiating from the segments, suggesting a complex internal structure or data flow. The background is a dark blue space filled with many small, bright white stars.

Thanks



ESCAPE to the Future
25-26 October 2022
Brussels, Belgium

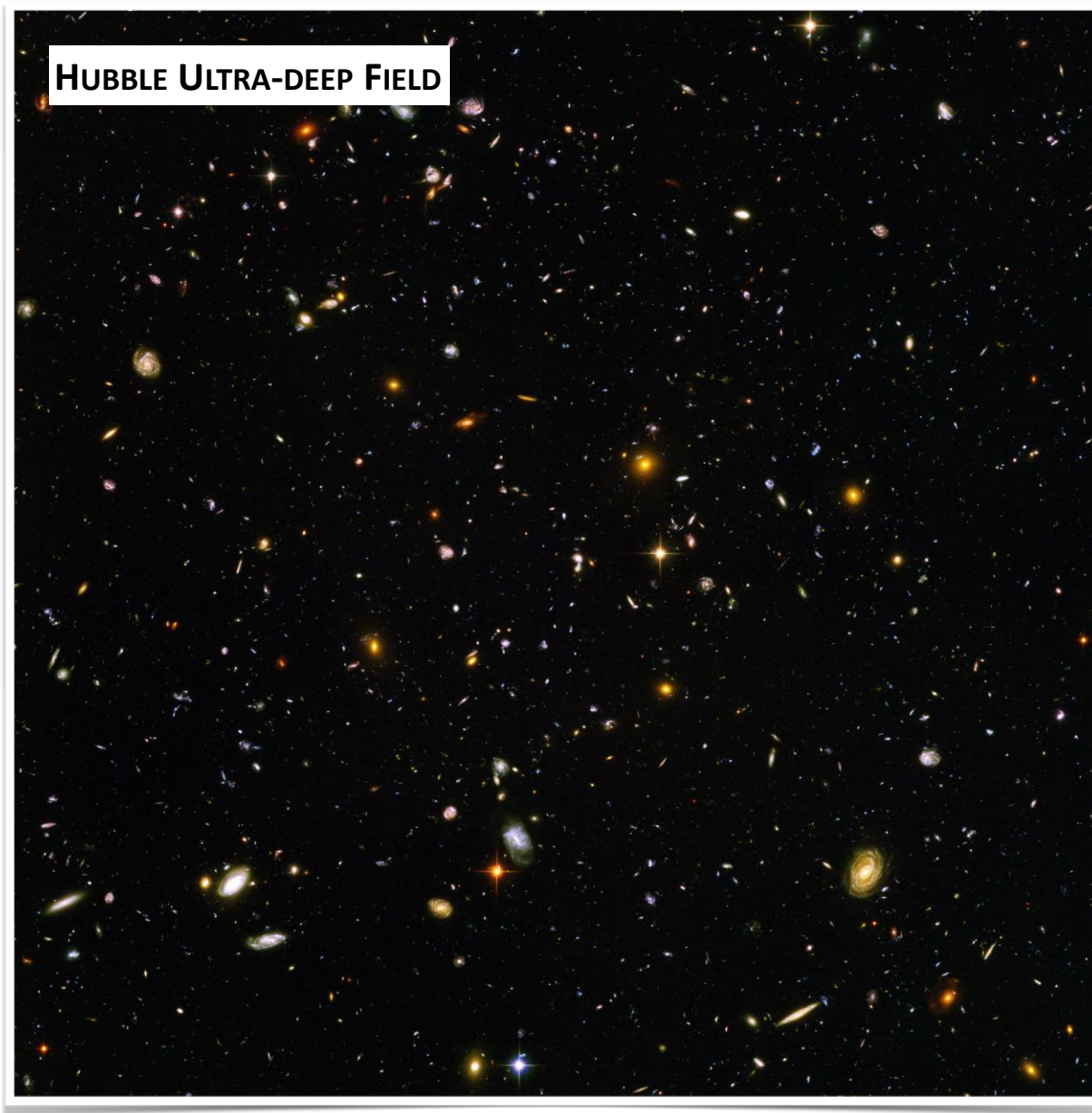
ESCAPE Citizen Science Galaxy Zoo: Clump Scout

Hugh Dickinson – The Open University

Team: Nico Adams, Vihang Mehta, Lucy Fortson, Claudia
Scarlata, Stephen Serjeant + *Galaxy Zoo Team*



Searching for Giant Star-forming Clumps

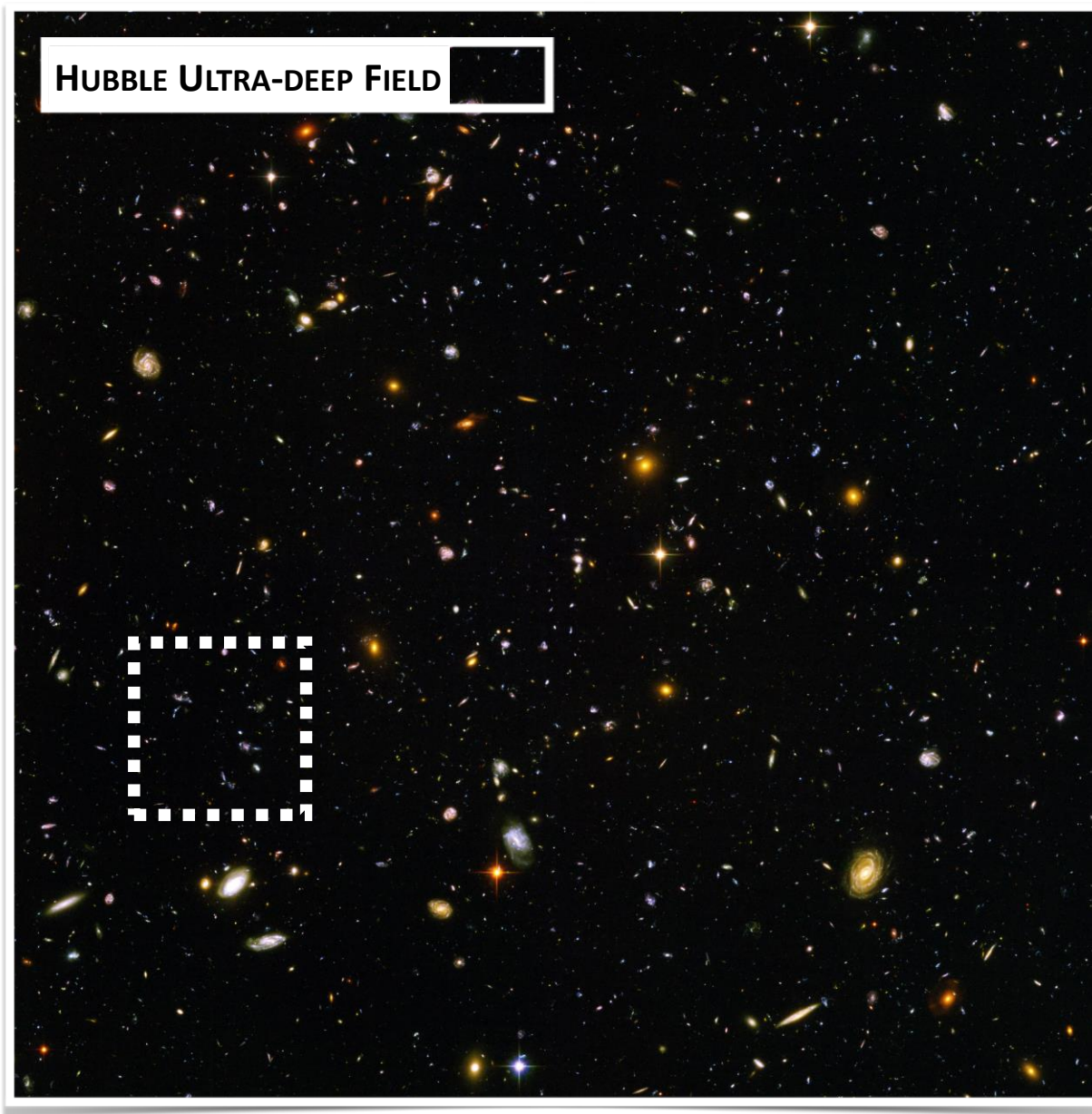


2.4'

NASA, ESA, S. Beckwith (STScI) and the HUDF Team

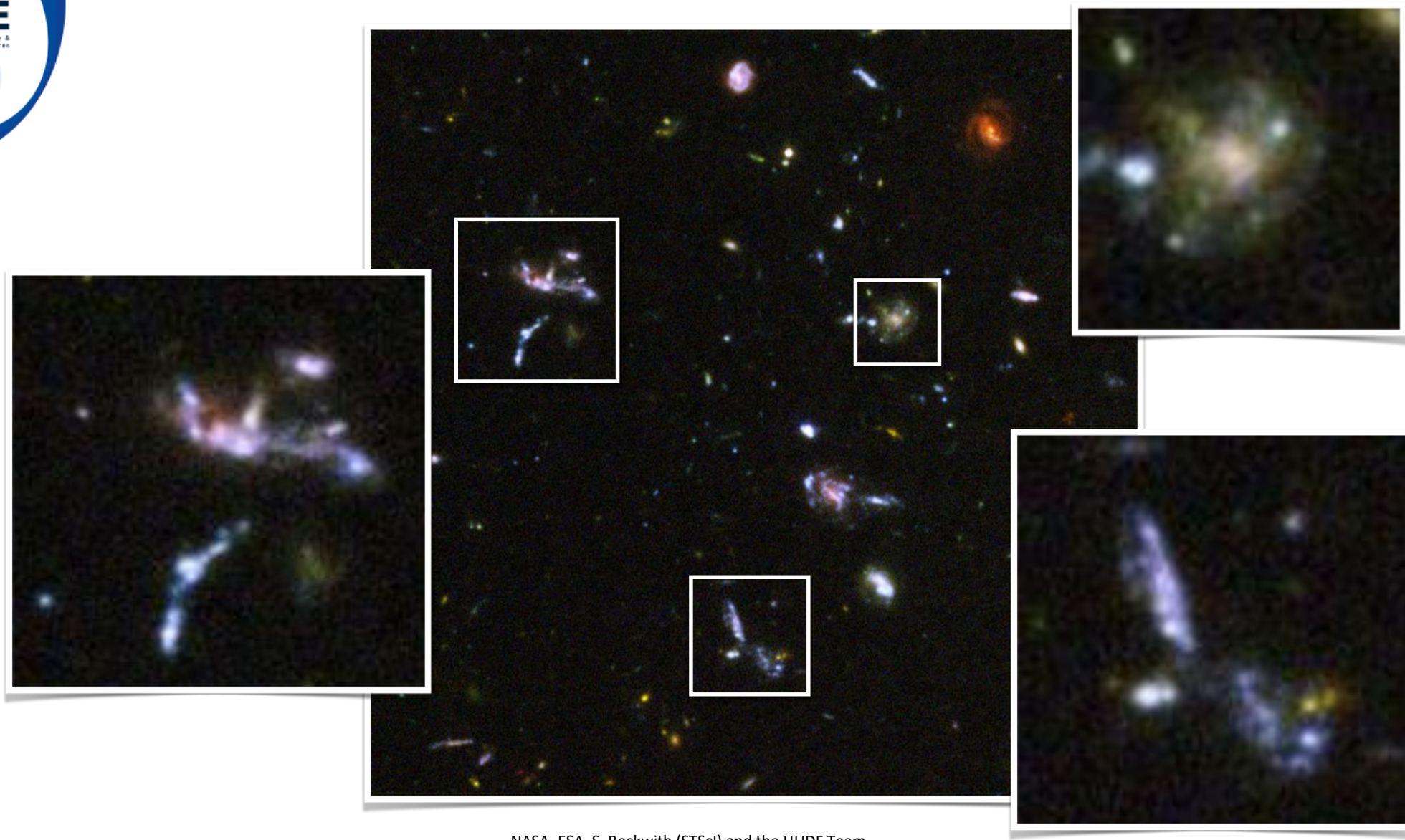


Hubble Image: NASA, ESA, K. Kuntz (JHU), F. Bresolin (University of Hawaii), J. Trauger (Jet Propulsion Lab), J. Mould (NOAO), Y. H. Chu (University of Illinois, Urbana) and STScI;
CFHT Image: Canada-France-Hawaii Telescope/J.-C. Cuillandre/Coelum; NOAO Image: G. Jacoby, B. Bohannan, M. Hanna/NOAO/AURA/NSF



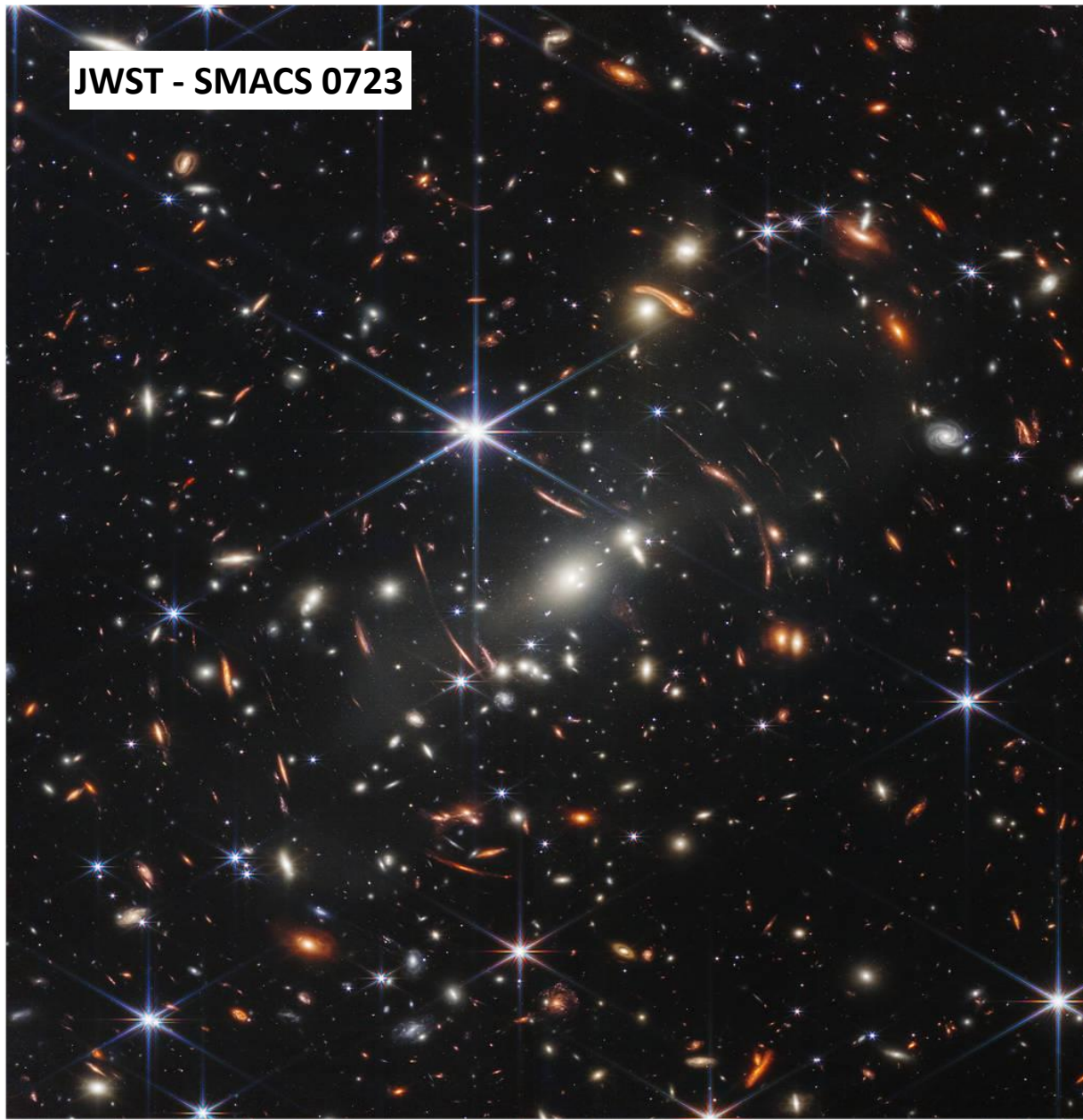
2.4'

NASA, ESA, S. Beckwith (STScI) and the HUDF Team

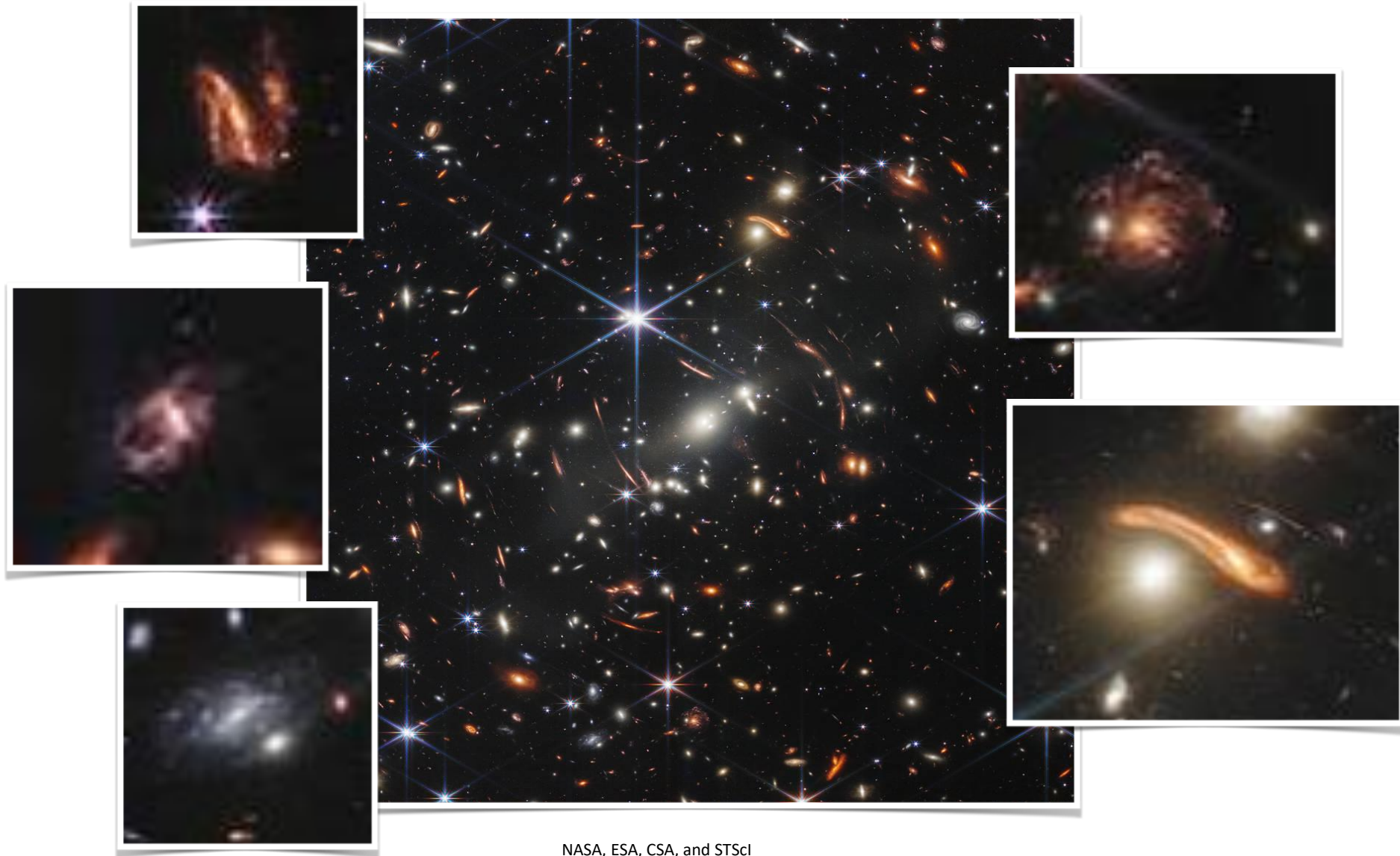


NASA, ESA, S. Beckwith (STScI) and the HUDF Team

JWST - SMACS 0723

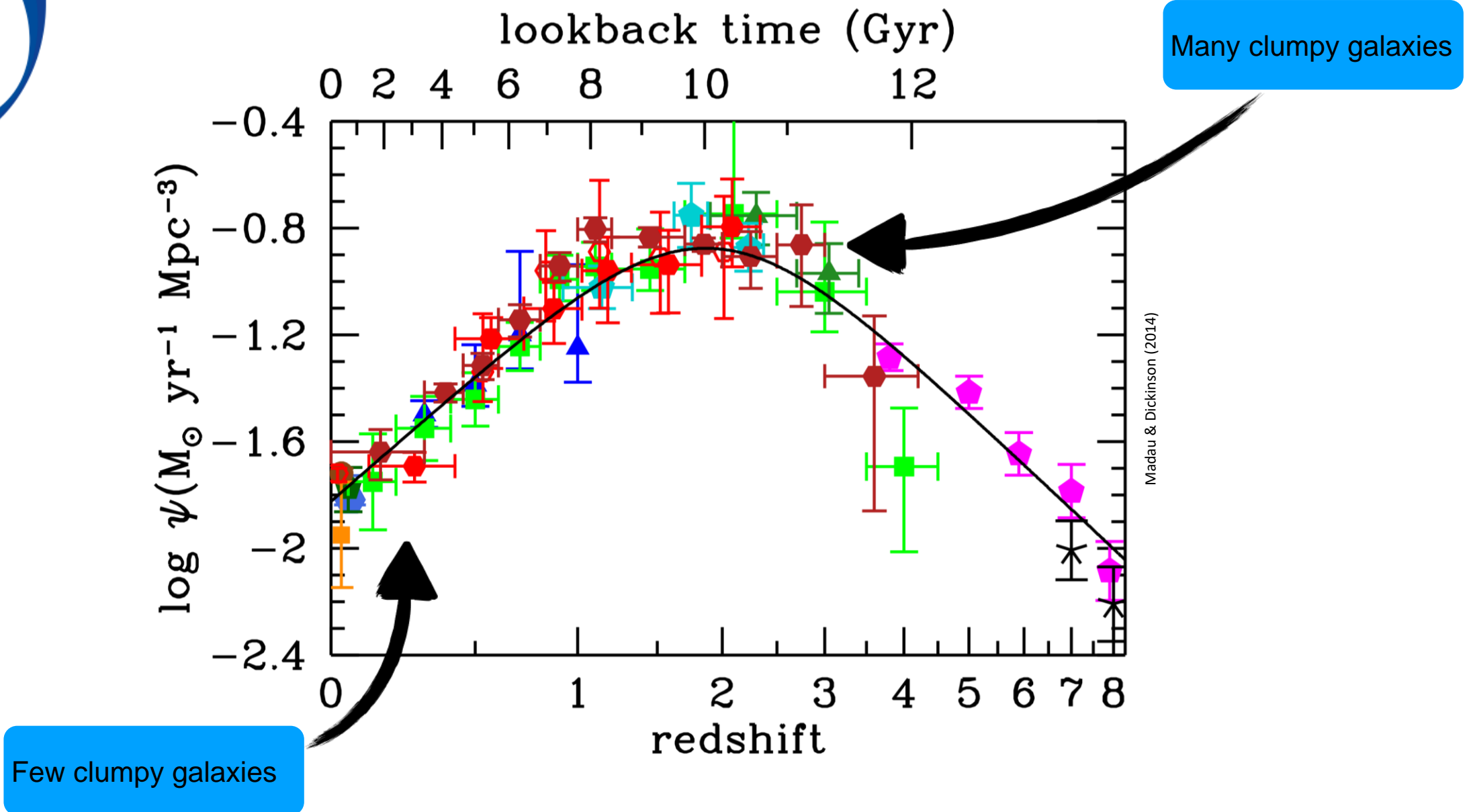


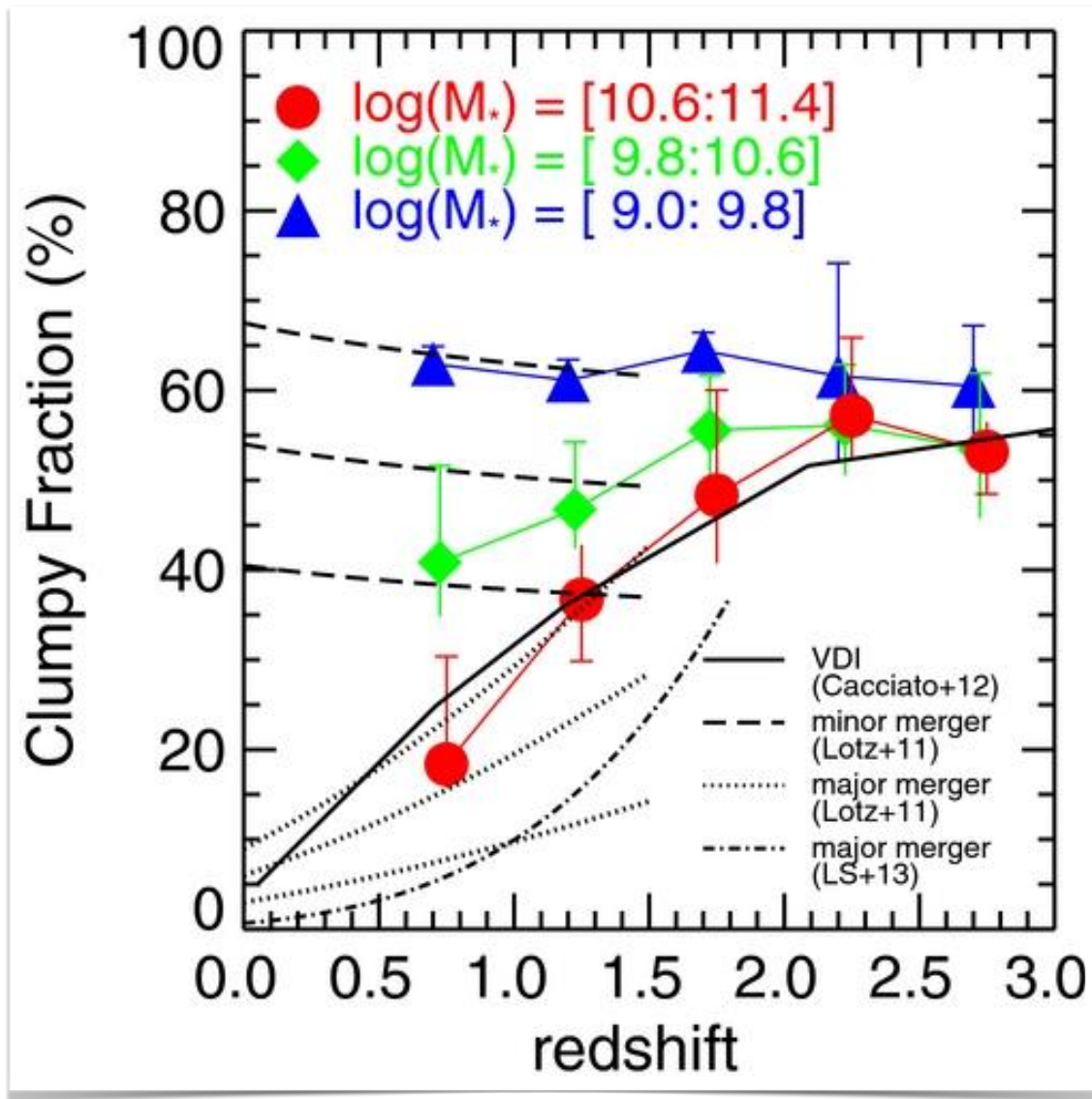
NASA, ESA, CSA, and STScI



NASA, ESA, CSA, and STScI

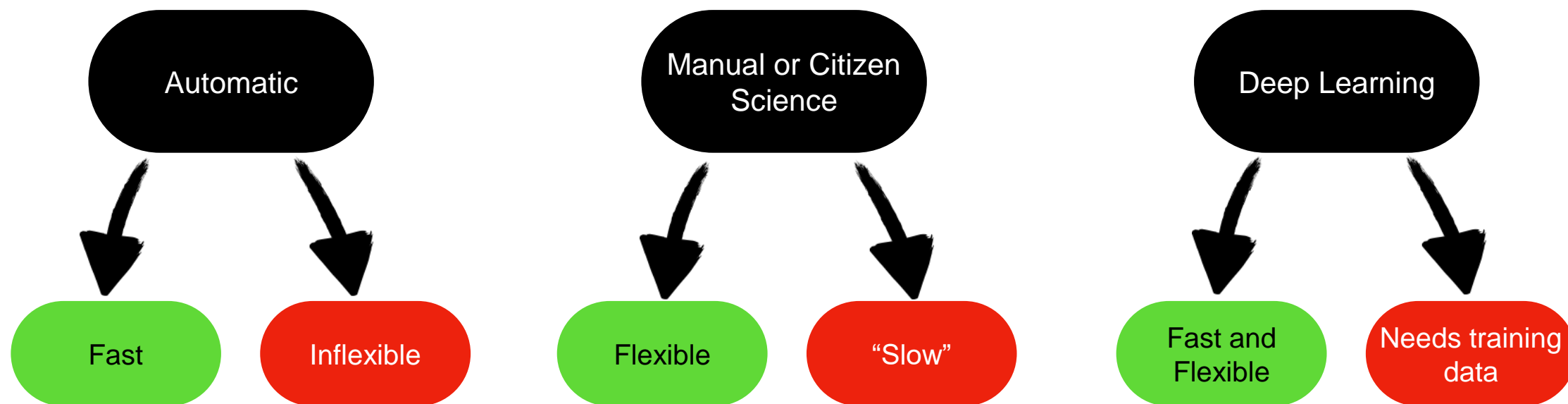
Why are clumpy galaxies important?

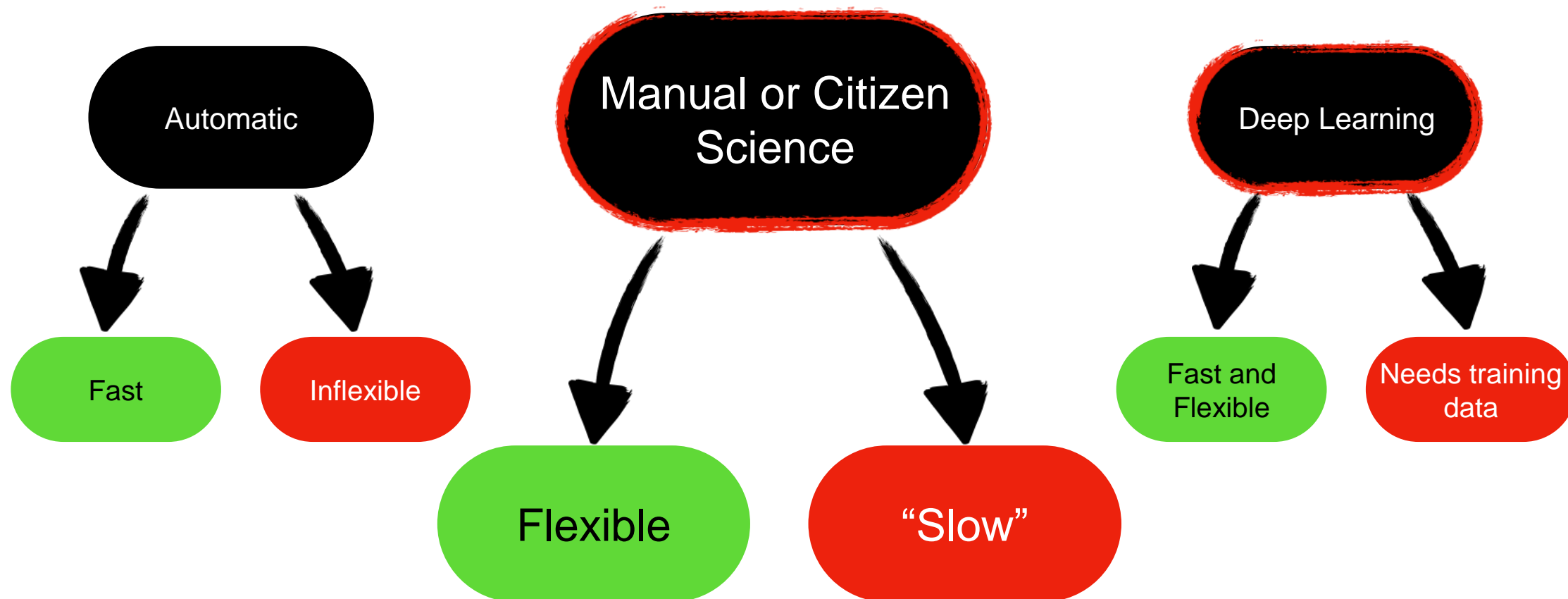




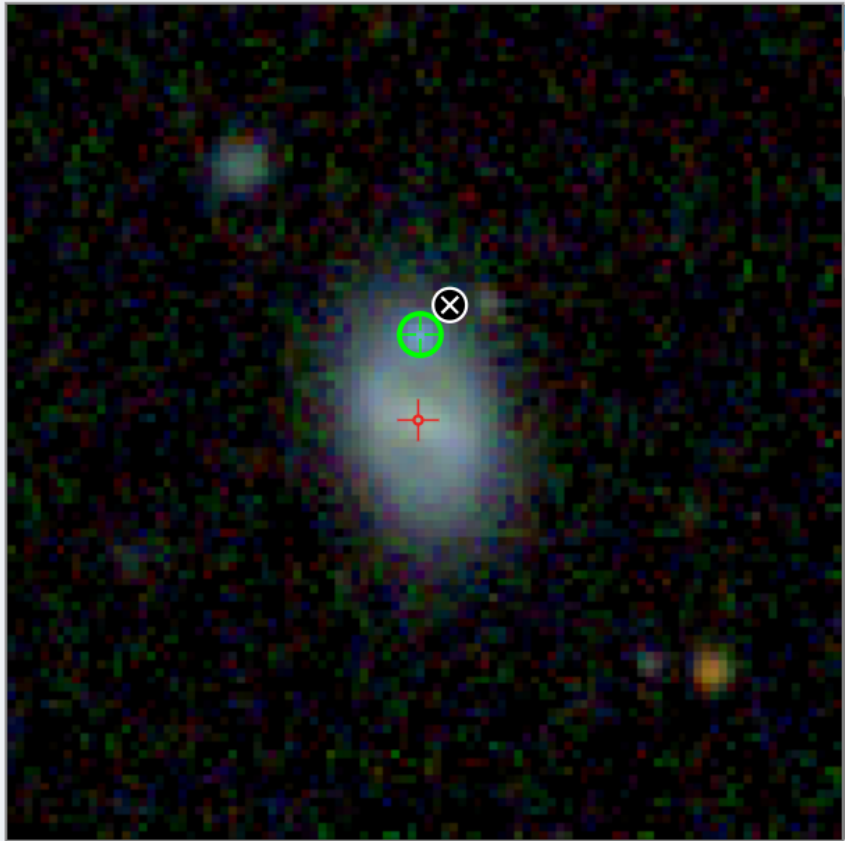
Guo et al. (2015)

Finding nearby clumpy galaxies





The Citizen Science Approach




A zoomed-in view of a galaxy with two clump markers: a green one with a white 'x' and a red one. A toolbar on the right contains icons for zooming in (+), zooming out (-), panning (arrow), and rotating (circular arrows).


TASK

TUTORIAL

Now click on any clumps that you can see in that galaxy. If you can't find any, click "done".

 Normal Clump Marker

1 drawn

 Unusual Clump Marker

0 drawn

NEED SOME HELP WITH THIS TASK?

☐ Hide previous marks (2)

Back

Done & Talk

Done

<https://www.zooniverse.org/projects/hughdickinson/galaxy-zoo-clump-scout/classify>

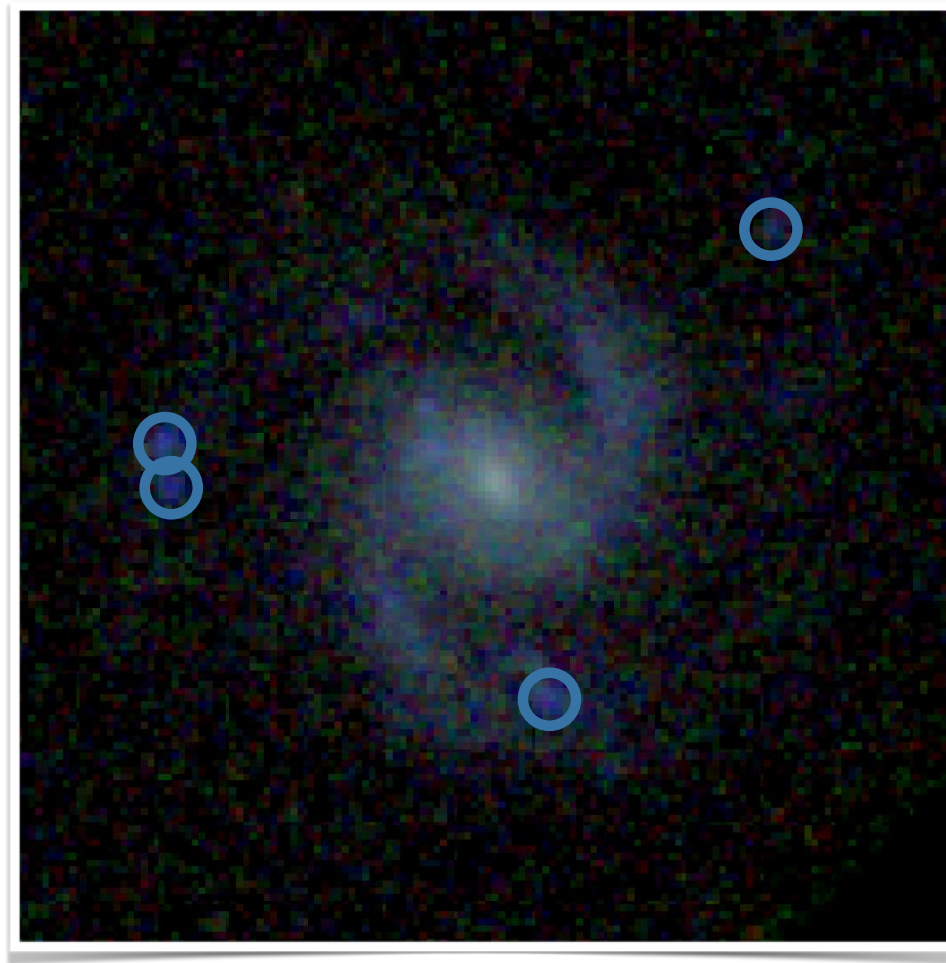
Number of Volunteers
engaged:
~15,000

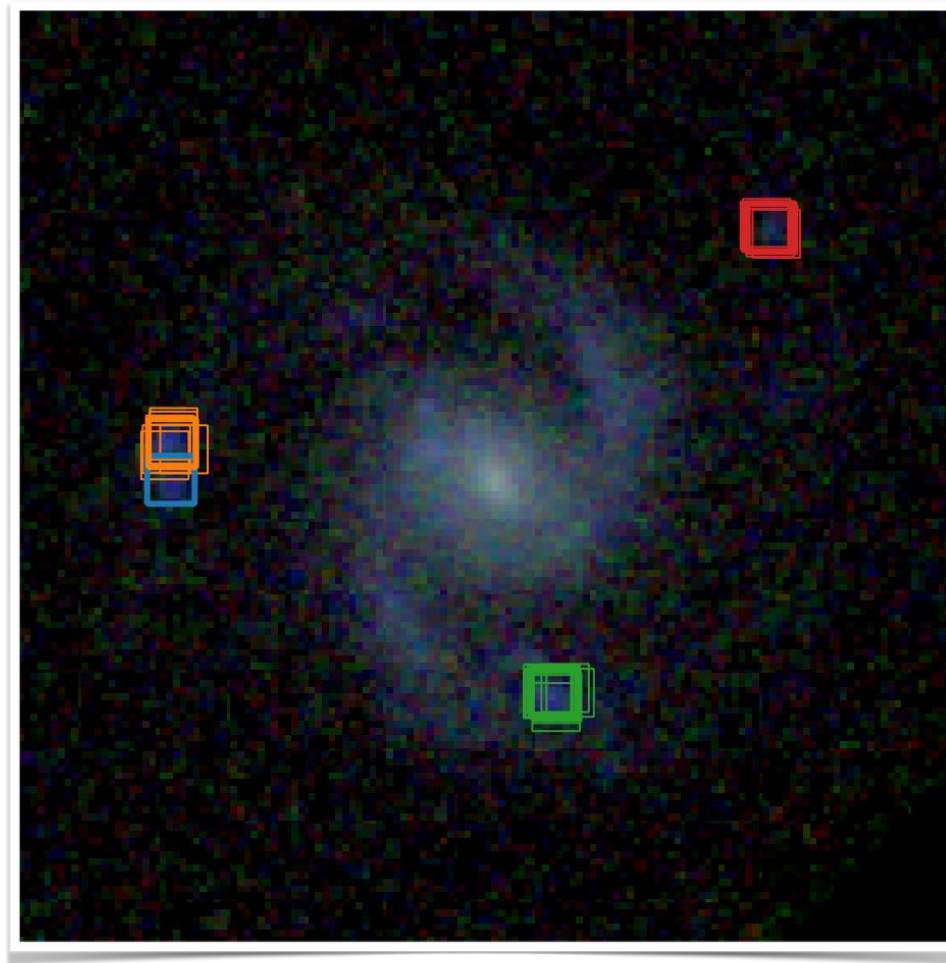
Number of Galaxies
inspected:
~80,000

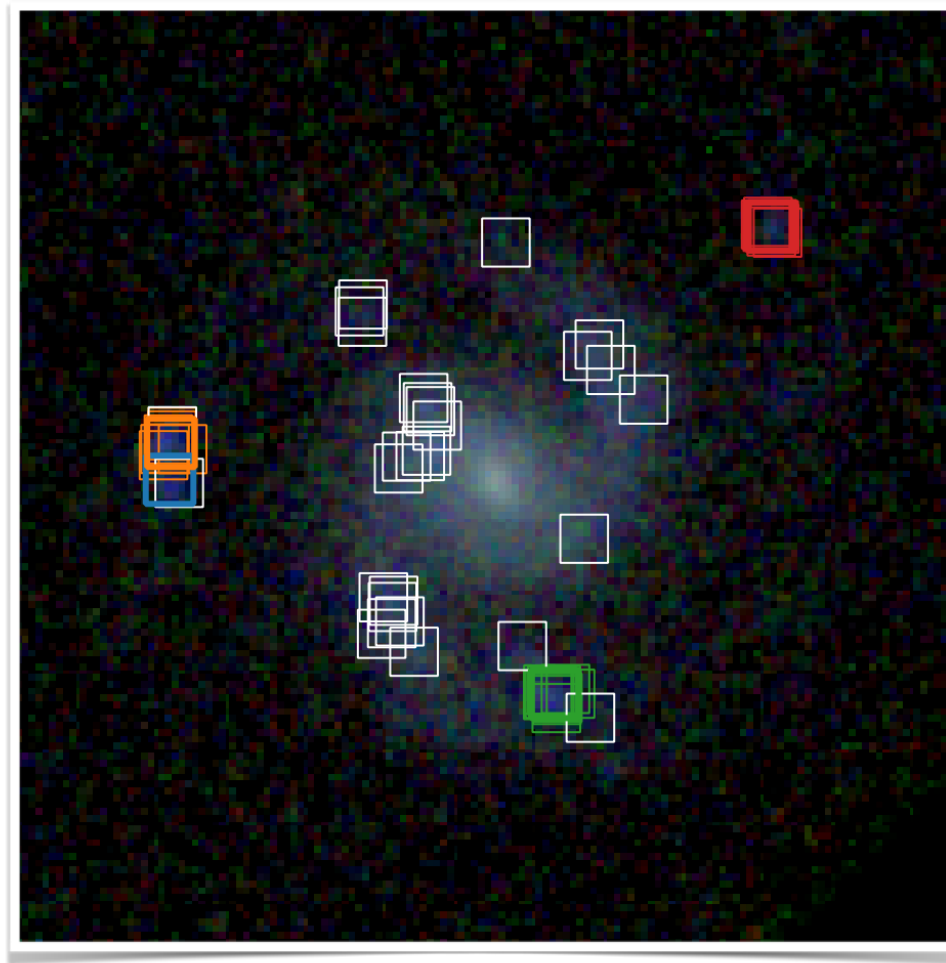
The First Rule of Citizen Science

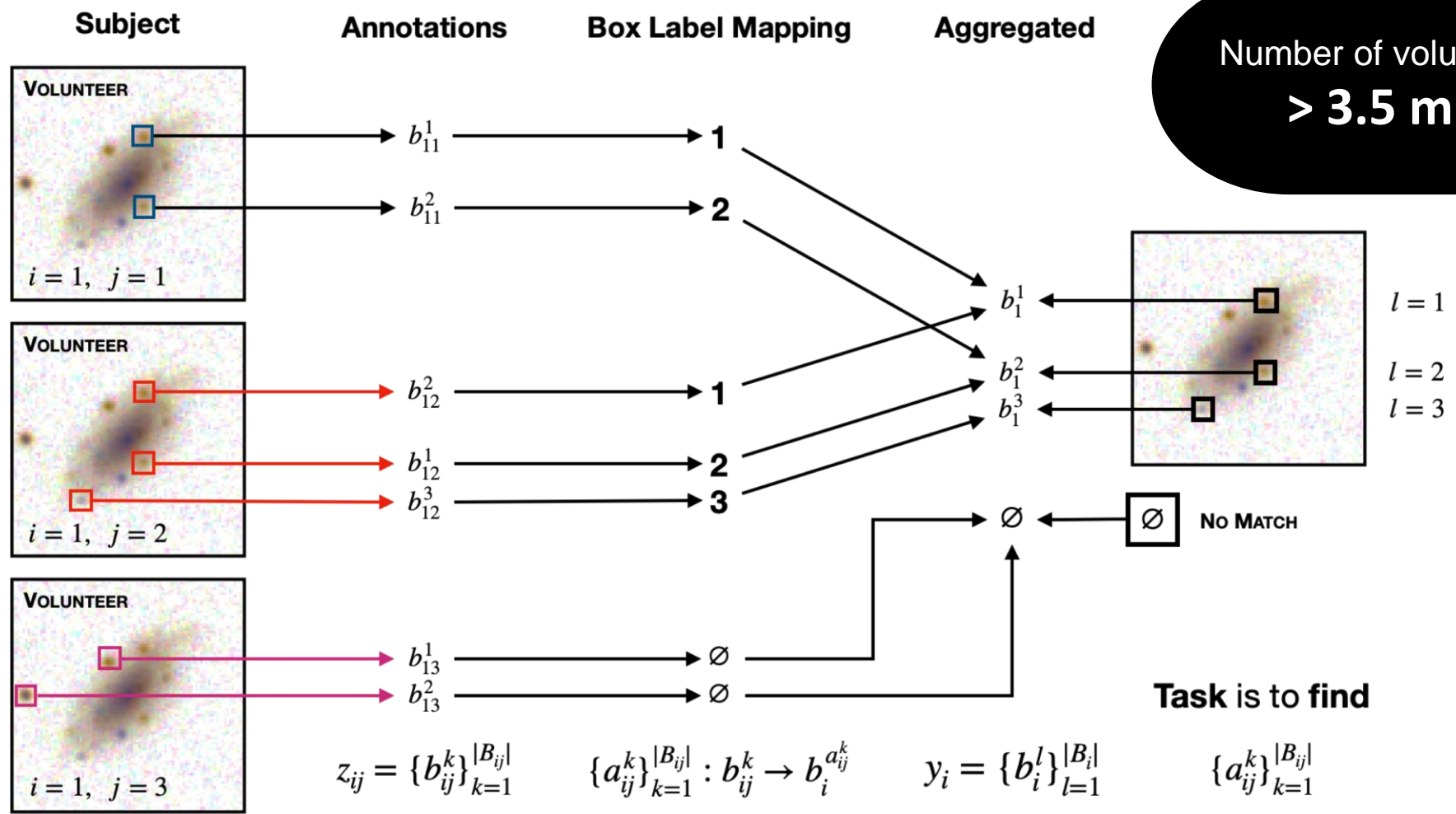
“Nobody Reads the Tutorial”







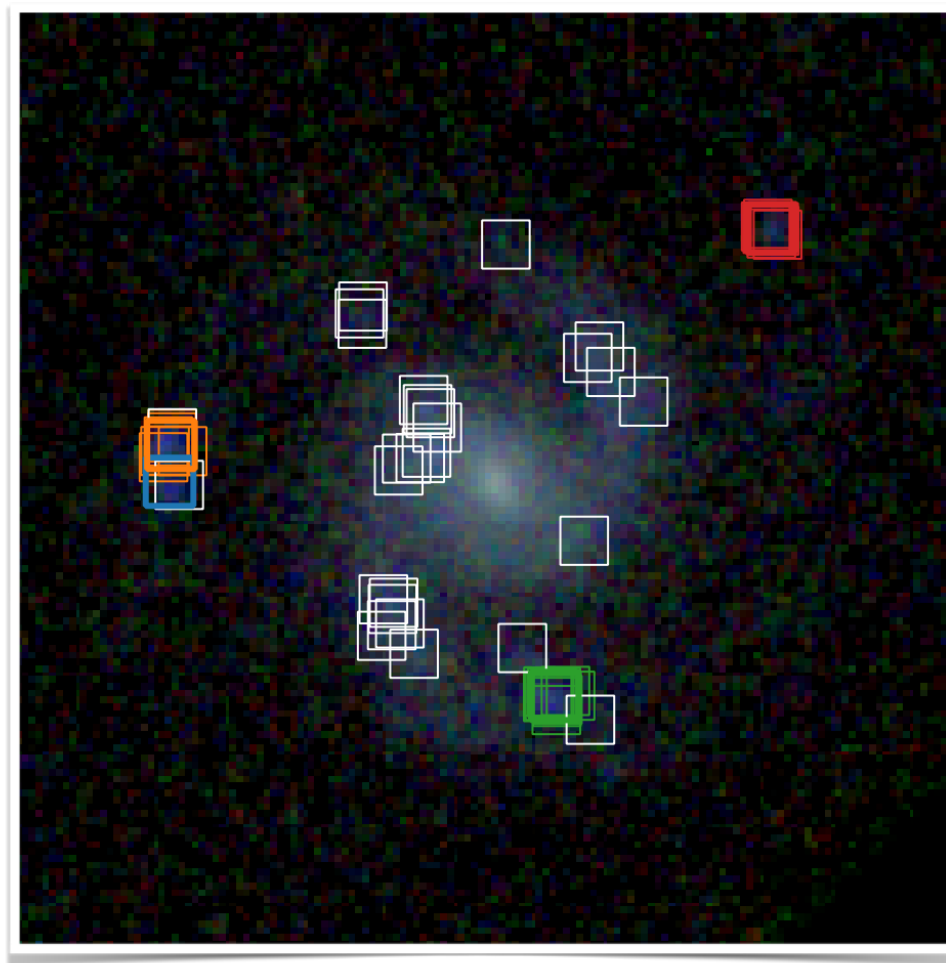


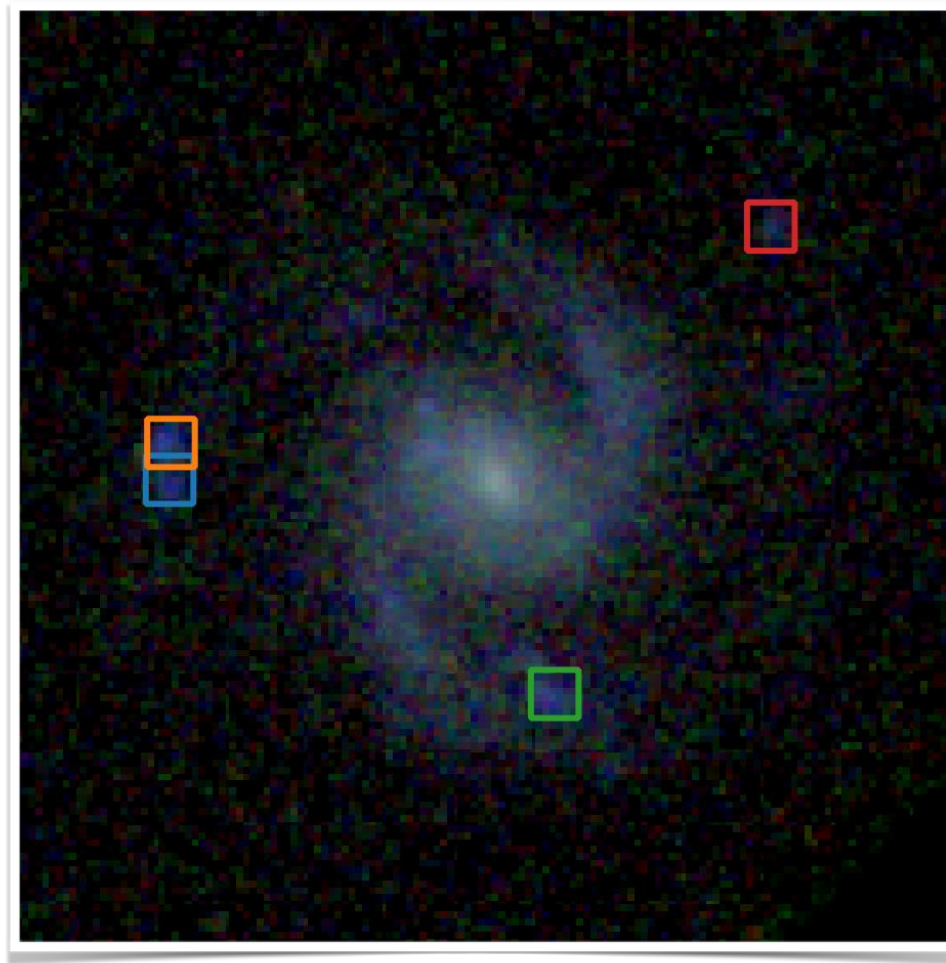


Number of volunteer clicks
> 3.5 million

github.com/ou-astrophysics/BoxAggregator

Dickinson et al (2022) - arxiv.org/abs/2210.03684






Number of clumpy galaxies:

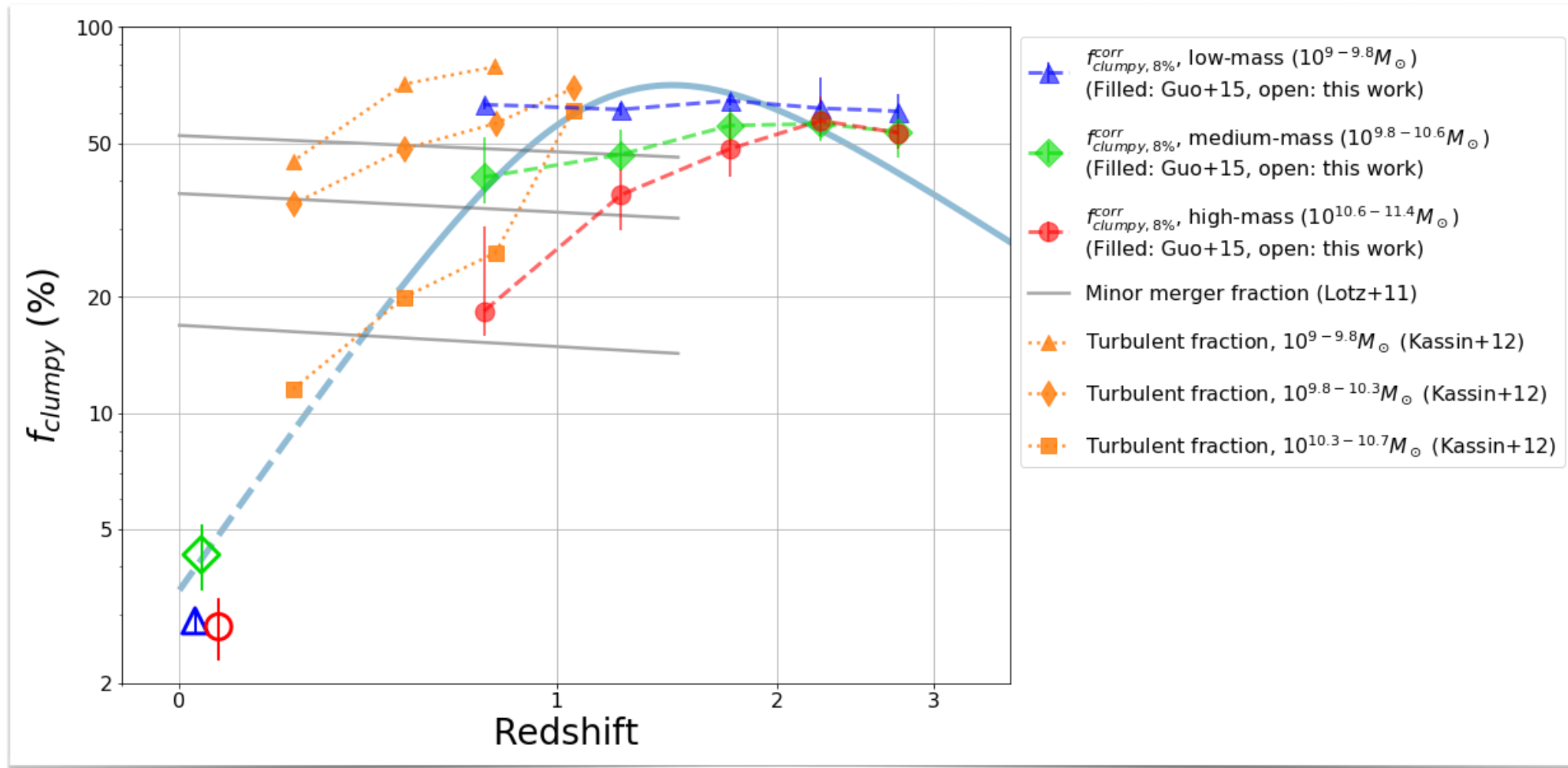
~35,000

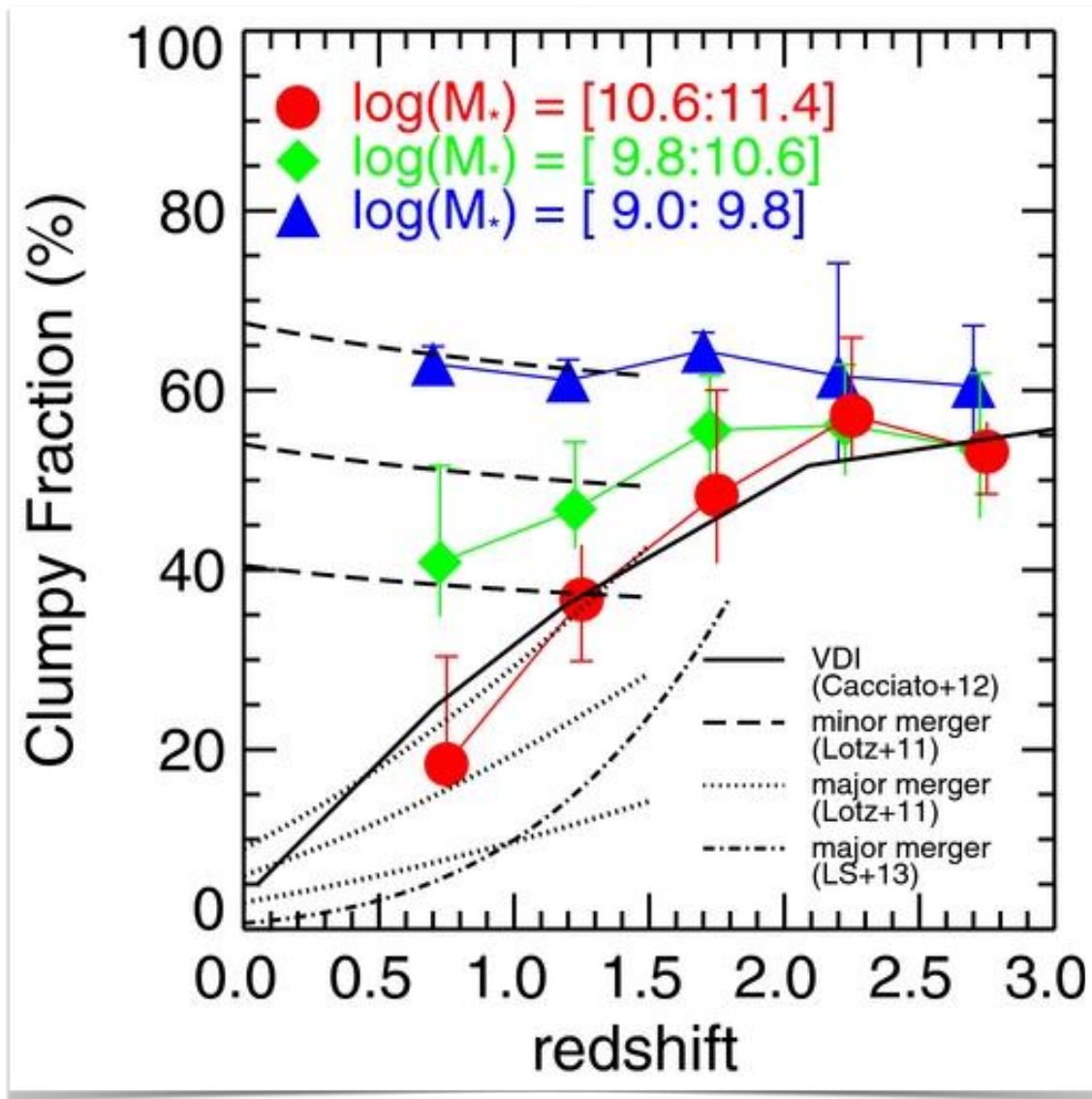
Number of potential clumps:

~100,000

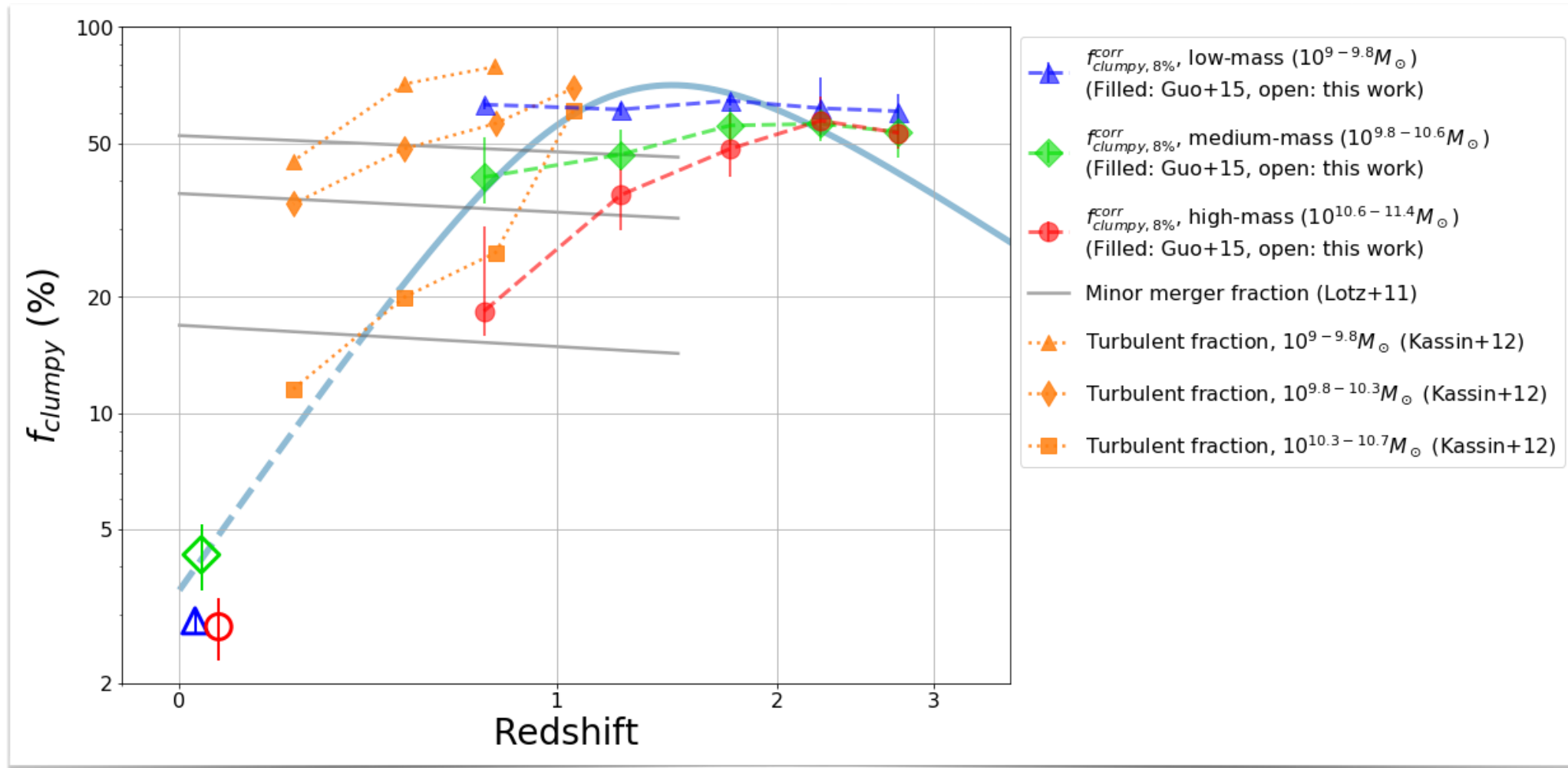
**First catalogue
released!**

 Adams et al (2022) - arxiv.org/abs/2201.06581

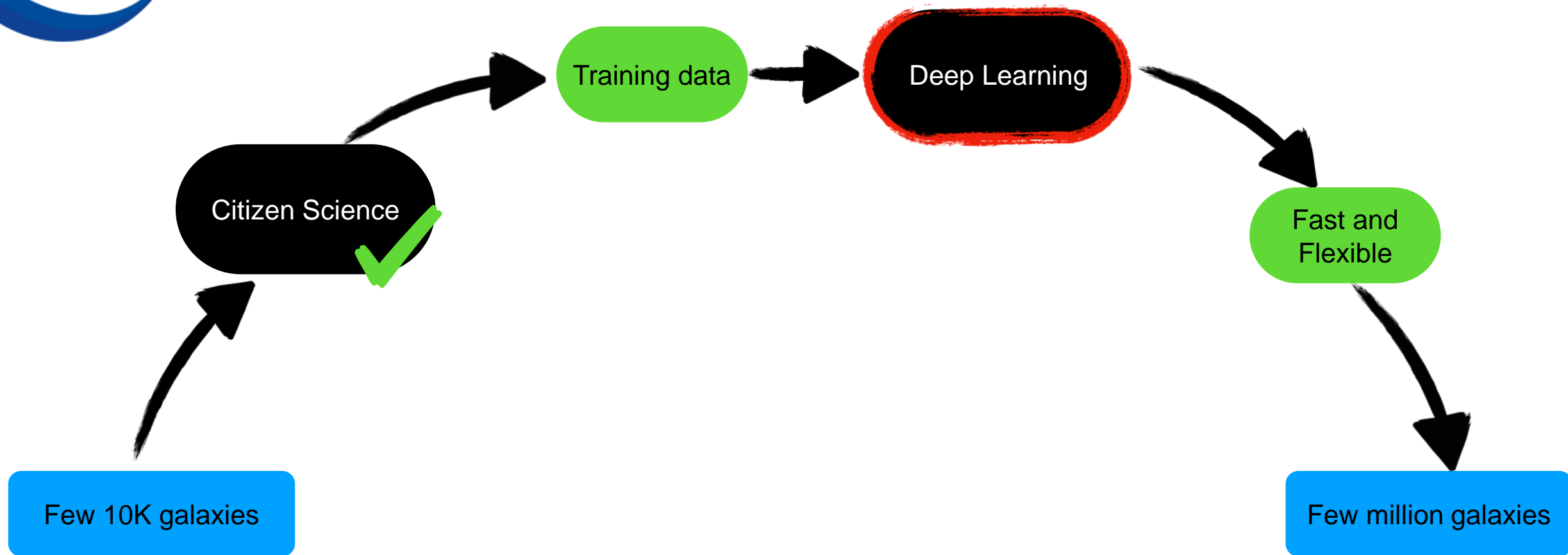




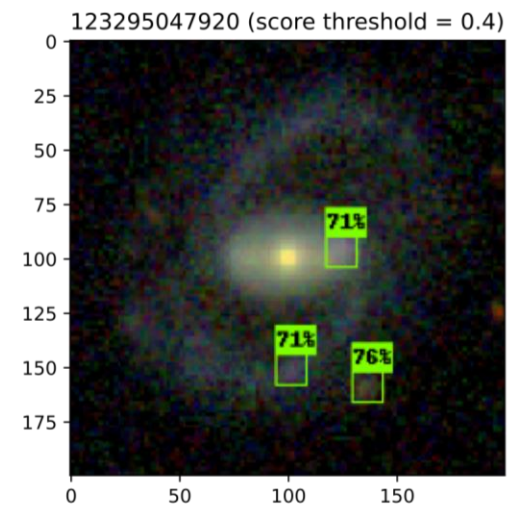
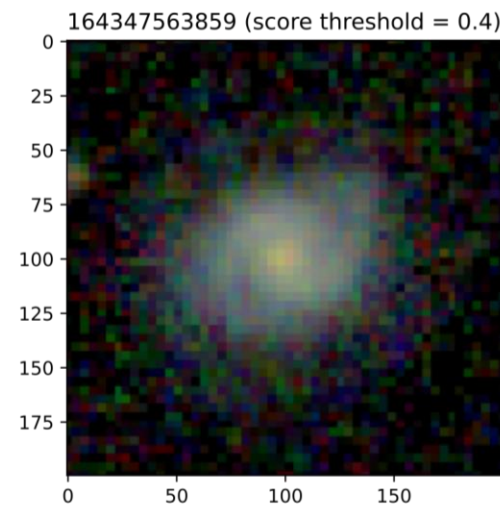
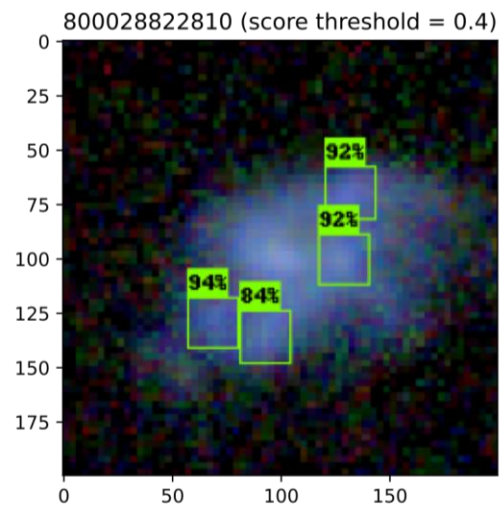
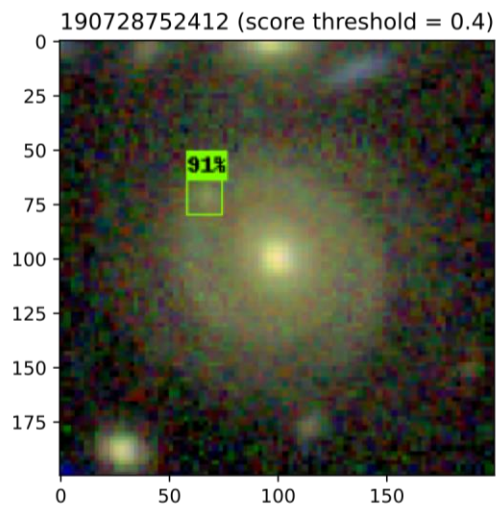
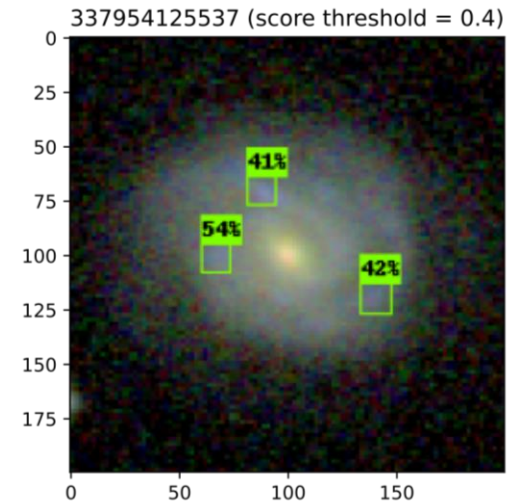
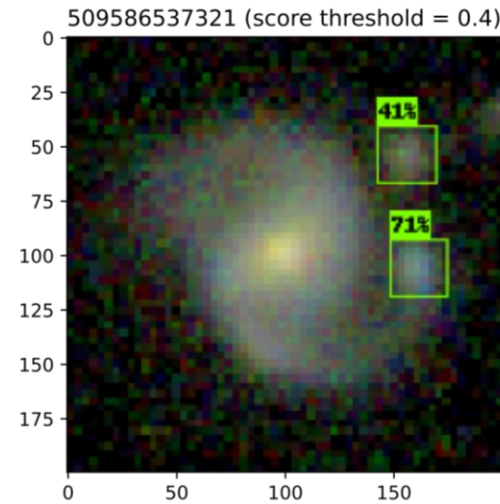
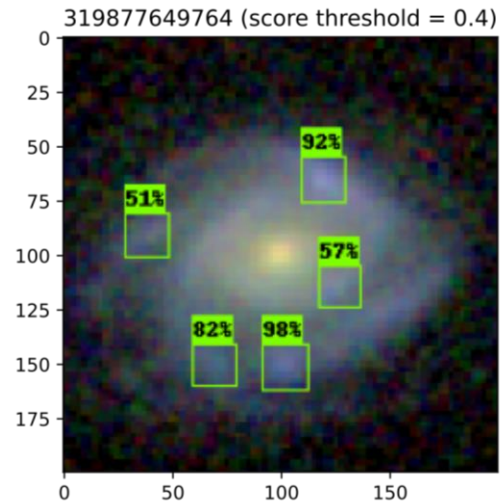
Guo et al. (2015)

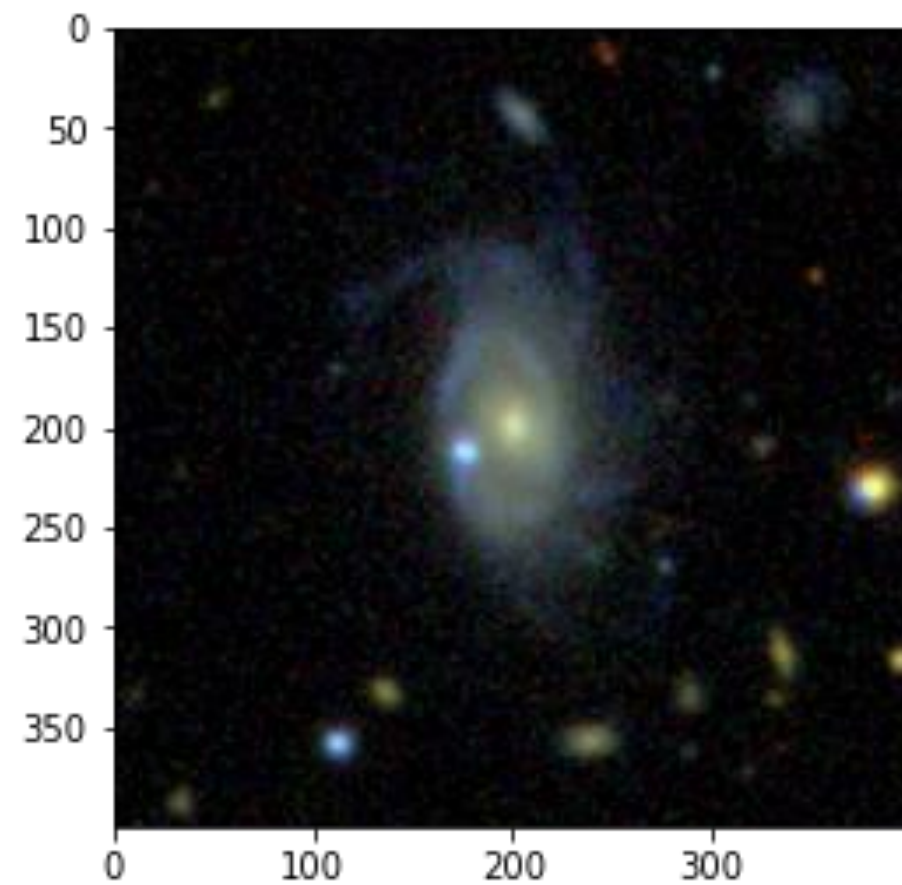
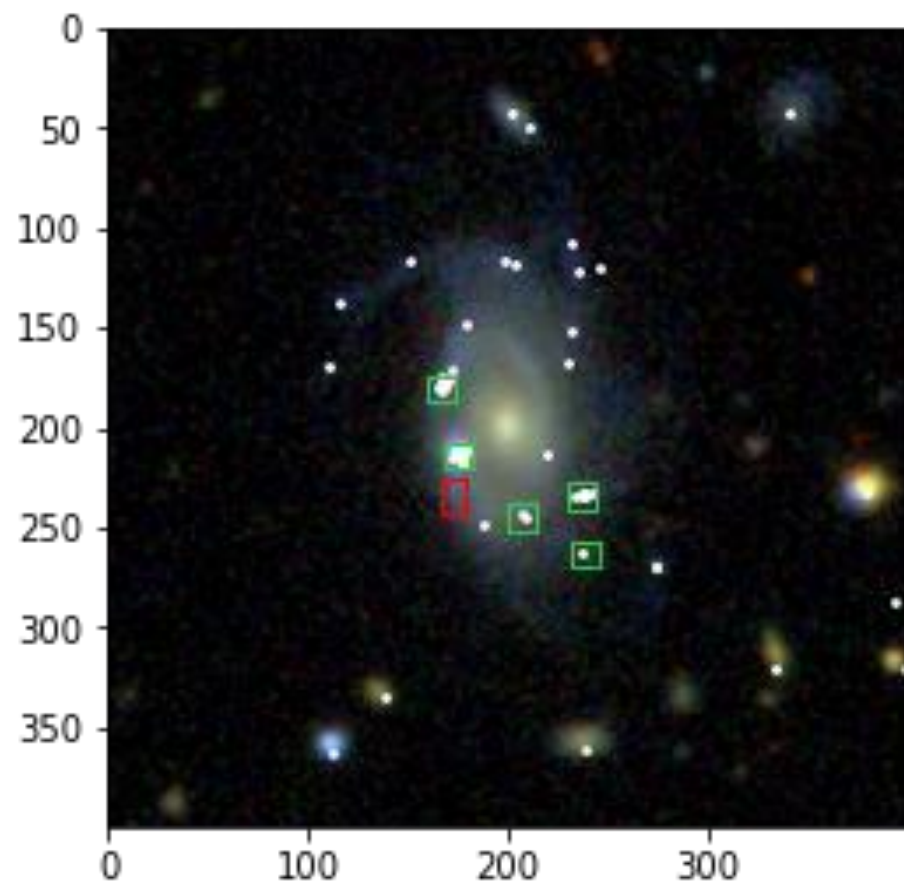


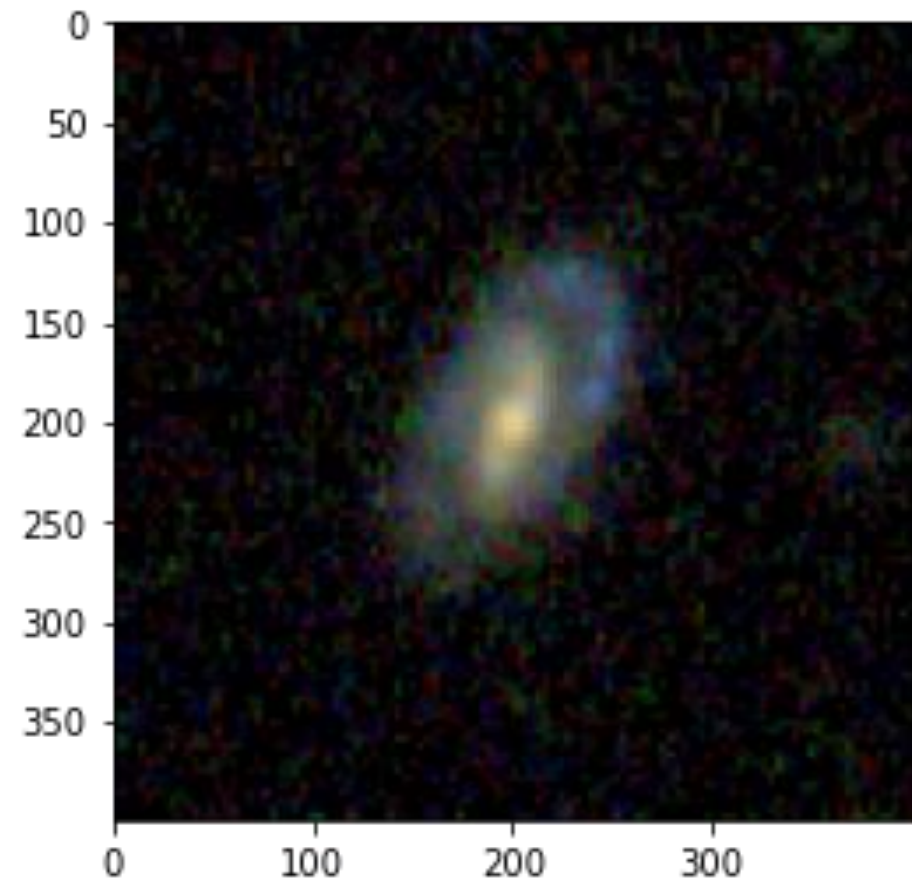
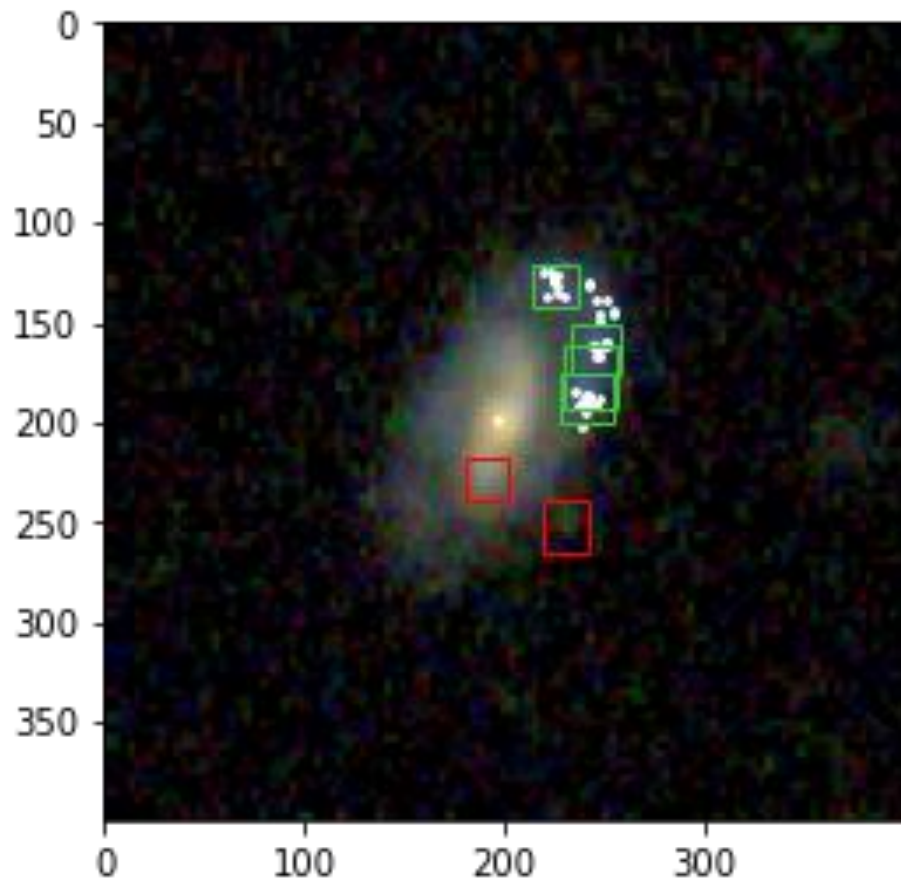
The Deep Learning Approach

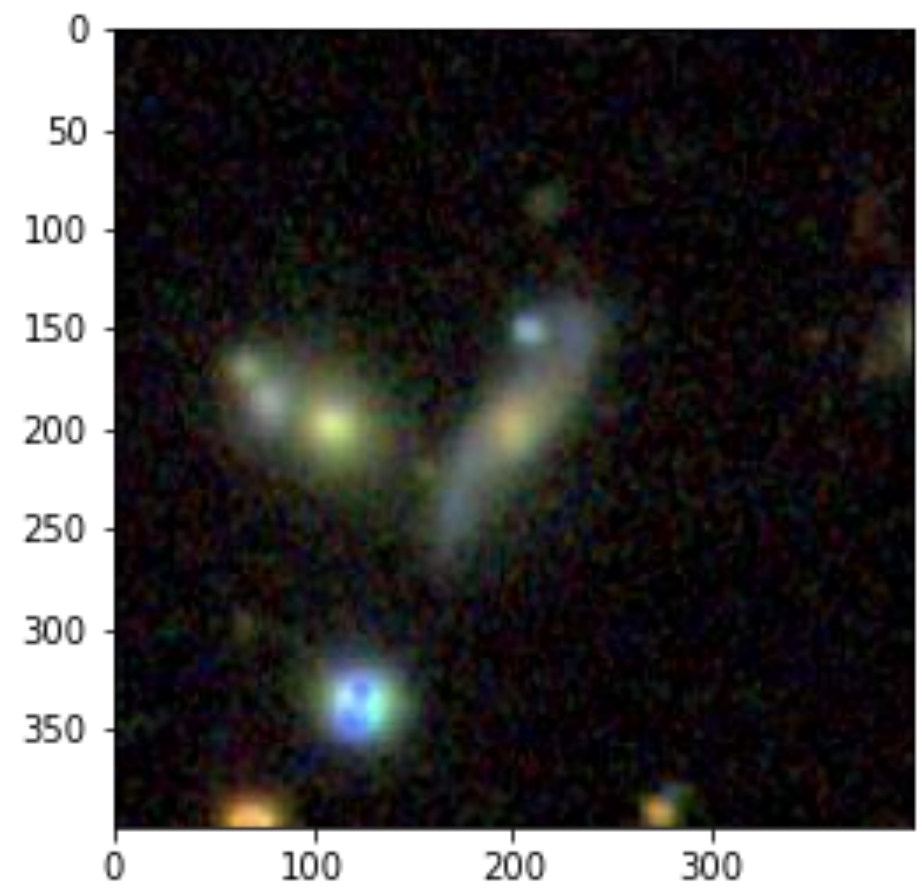
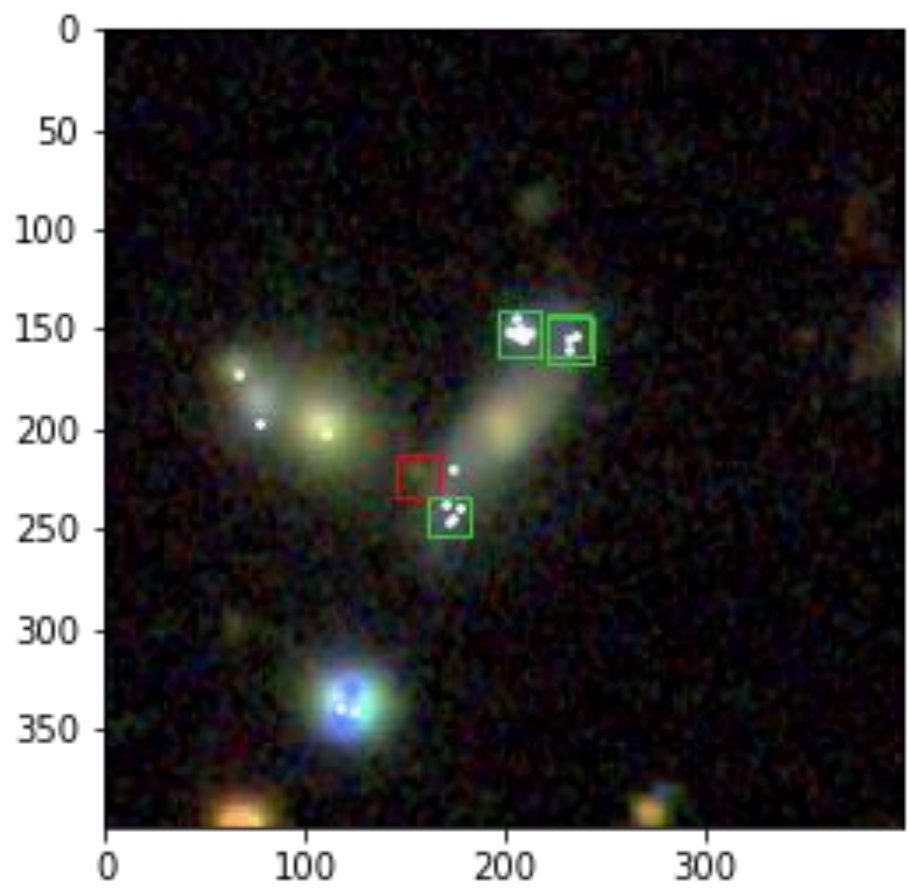


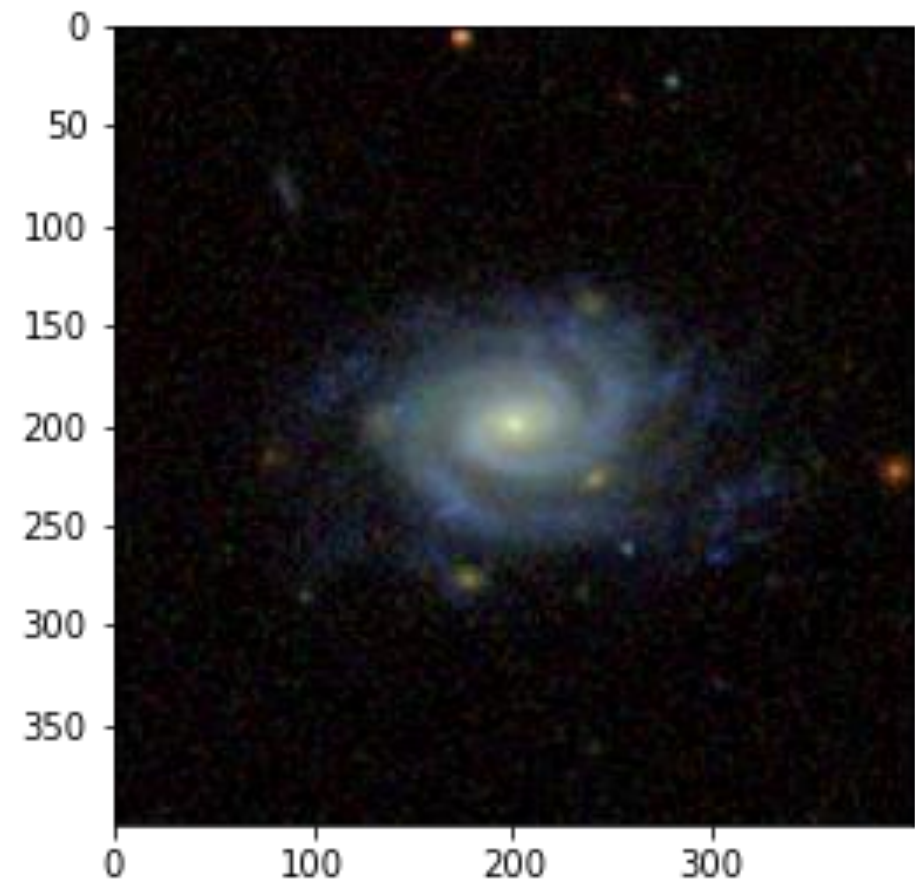
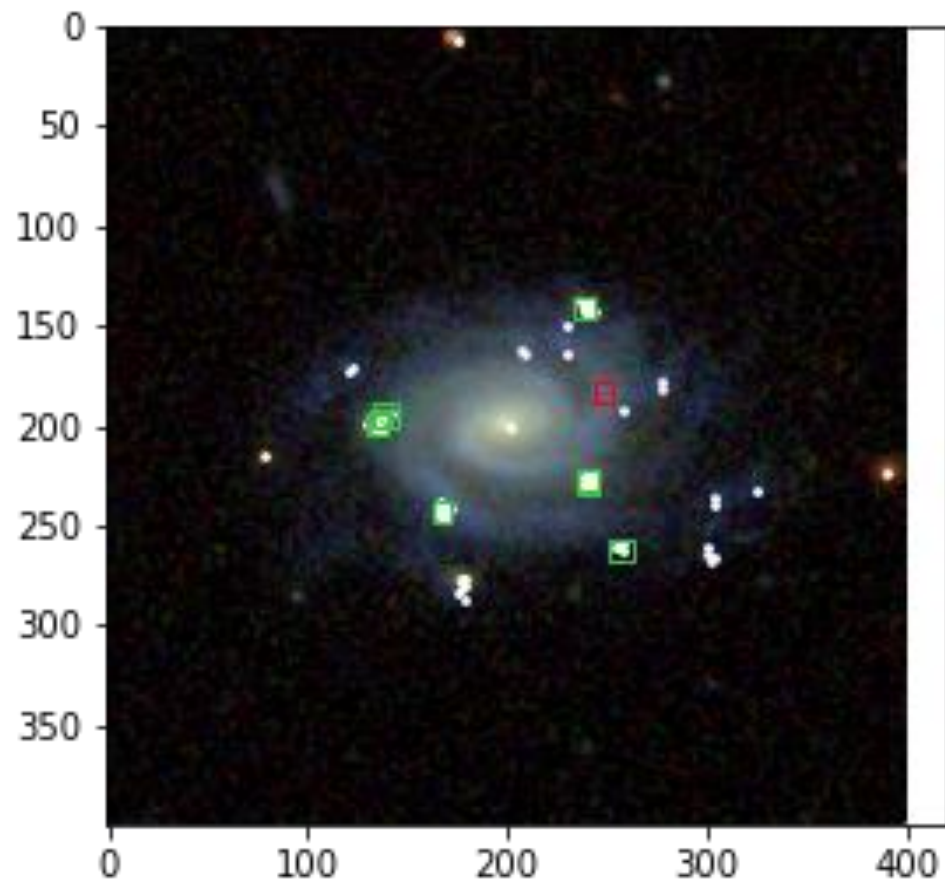
Generic Deep Learning model finds
four times
as many clumps as
Clump Scout volunteers!











Number of Volunteers engaged:
~15,000

Number of Galaxies inspected:
~80,000

Number of clumpy galaxies:
~35,000

Number of potential clumps:
~100,000


Two papers now out!


First catalogue released!

ML Model Trained!

Third paper in prep!

 github.com/ou-astrophysics/BoxAggregator

 Adams et al (2022) - arxiv.org/abs/2201.06581

 Dickinson et al (2022) - arxiv.org/abs/2210.03684

A large, semi-circular structure composed of many blue, rectangular segments, resembling a particle detector or a large telescope. It is set against a dark blue background filled with numerous small, bright white stars.

Thanks!

ESCAPE to the Future

25-26 October 2022
Brussels, Belgium

Managing Citizen Science from ESAP

James Pearson, Hugh Dickinson



ZOONIVERSE

Zooniverse Projects

ALL DISCIPLINES

ARTS

BIOLOGY

CLIMATE

HISTORY

LANGUAGE

LITERATURE

MEDICINE

NAT

Most Recently Launched

Showing 1-20 of 101 projects found.

Name:

1


2

3


4

5


6




NEST QUEST GO: TANAGERS & BLACKBIRDS




SPIDER CRAB WATCH



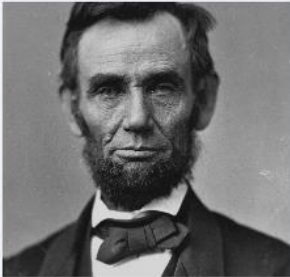
CIVIL WAR BLUEJACKETS




THE WILD SOUTHWEST




FLY FINDER




PEOPLE'S CONTEST DIGITAL ARCHIVE




GENOME DETECTIVES



NOTES FROM NATURE - BIG BEE BONANZA!



CLOUDSPOTTING ON MARS



GET TO KNOW MEDIEVAL LONDONERS

PROJECT #17464

[View project](#)

[Project details](#)

[About](#)

[Collaborators](#)

[Field guide](#)

[Tutorial](#)

[Media](#)

[Visibility](#)

[Talk](#)

[Data Exports](#)

[Workflows](#)

[Subject Sets](#)

NEED SOME HELP?

[Read a tutorial](#)

[Ask for help on talk](#)

[Glossary](#)

OTHER ACTIONS

[Delete this project](#)

PROJECT DATA EXPORTS

Please note some exports may take a long period.

For examples of how to work with the data

Project Data

[Request new classification export](#) CSV format

[Request new workflow classification export](#)

[Request new subject export](#) CSV format. Mod

[Request new workflow export](#) CSV format. M

Workflow contents export: Never previously available. Workflow contents exports have been missing the "version" column from the workflow contents files in order to know what the actual se

Talk Data

[Request new Talk comments export](#) JSON format

[Request new Talk tags export](#) JSON format

☰ README.md

Panoptes Client

This package is the Python SDK for [Panoptes](#), the platform behind the [Zooniverse](#). This module is intended to allow programmatic management of projects, providing high level access to the API for common project management tasks.

[Full documentation is available at Read the Docs.](#)

Installation

Install latest stable release:

```
$ pip install panoptes-client
```

Or for development or testing, you can install the development version directly from GitHub:

```
$ pip install -U git+https://github.com/zooniverse/panoptes-python-client.git
```


Archive - Zooniverse

| | |
|-------------|------------------------------------|
| Instrument | Multiple |
| Description | Zooniverse Classification Database |



Zooniverse Classification Database

The Zooniverse is the world's largest and most popular platform for people-powered research. This research is made possible by volunteers — more than a million people around the world who come together to assist professional researchers. Our goal is to enable research that would not be possible, or practical, otherwise. Zooniverse research results in new discoveries, datasets useful to the wider research community, and many publications.

esap-gui version 21 Jan 2022 - 10:00

Data Retrieval

Data retrieval is facilitated by a RESTful web API. The ESAP platform makes use of a Python client library provided by the Zooniverse development team.

Data in Zooniverse

| Dataset or Category | Catalog | Query Access |
|---------------------|------------|------------------------------------|
| Zooniverse Panoptes | Zooniverse | Query this Dataset |

Zooniverse Panoptes

Panoptes is the name of the backend API that drives the Zooniverse citizen science platform. It provides a RESTful API with to the database of Zooniverse projects and workflows, as well as the classifications provided by citizen scientists.

Data retrieval is facilitated by a RESTful web API. The ESAP platform makes use of a Python client library provided by the Zooniverse development team.

● Aim:

- Develop a suite of tutorial workflows and material demonstrating the creation and management of Zooniverse citizen science projects through ESAP.

● Notebooks and documentary materials demonstrate:

- **Advanced Zooniverse project building** for subject creation and upload, attaching metadata, and providing training and feedback to volunteers,
- Integrating with the Zooniverse's Caesar engine for **aggregation of results and advanced subject retirement rules**.
- Accessing the **ESAP Shopping Basket** to download data for aggregation.
- Integrating Zooniverse projects with existing **deep learning frameworks**, including pre-filtering subjects and creating detailed subject retirement rules.
- Setting up an **active learning framework** to simultaneously improve both deep learning performance and the experience of volunteers.

Zooniverse: Advanced Project Building

Description: Demonstrates techniques for advanced Zooniverse project management using Python.

Link: [https://git.astron.nl/astron-sdc/escape-](https://git.astron.nl/astron-sdc/escape-wp5/workflows/zooniverse)

[wp5/workflows/zooniverse](https://git.astron.nl/astron-sdc/escape-wp5/workflows/zooniverse)

Author: Hugh Dickinson

Runtime Platform: Python

Keywords: jupyter-notebook

Zooniverse: Integrating Machine Learning

Description: Demonstrates techniques to integrate your Zooniverse project with machine learning.

Link: [https://git.astron.nl/astron-sdc/escape-](https://git.astron.nl/astron-sdc/escape-wp5/workflows/machine-learning)

[wp5/workflows/machine-learning](https://git.astron.nl/astron-sdc/escape-wp5/workflows/machine-learning)

- Tutorial Jupyter notebooks.
- Recorded walkthroughs of these tutorials.
- Speech-to-text documentation of these recordings, for greater accessibility.

Zooniverse: Advanced Aggregation with Caesar

Description: Demonstrates how to use the Zooniverse Caesar engine to aggregate your data.

Link: [https://git.astron.nl/astron-sdc/escape-](https://git.astron.nl/astron-sdc/escape-wp5/workflows/zooniverse-advanced-aggregation-with-caesar.git)

[wp5/workflows/zooniverse-advanced-aggregation-with-caesar.git](https://git.astron.nl/astron-sdc/escape-wp5/workflows/zooniverse-advanced-aggregation-with-caesar.git)

Author: Hugh Dickinson

Runtime Platform: Python

Keywords: jupyter-notebook

Zooniverse Muon Hunters

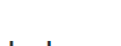
Description: Shopping Cart and Zooniverse Example

Link: [https://git.astron.nl/astron-sdc/escape-wp5/workflows/muon-](https://git.astron.nl/astron-sdc/escape-wp5/workflows/muon-hunters-example)
[hunters-example](https://git.astron.nl/astron-sdc/escape-wp5/workflows/muon-hunters-example)

Author:

Runtime Platform: Python

Keywords: jupyter-notebook



ArchivesMultiInteractiveQueryAnalysisBatch AnalysisAsynchronous Jobs

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Zooniverse: Advanced Project Building



Description: Demonstrates techniques for advanced Zooniverse project management using Python.


Link: <https://git.astron.nl/astron-sdc/escape-wp5/workflows/zooniverse-advanced-project-building>


Author: Hugh Dickinson

Runtime Platform: Python

Keywords: jupyter-notebook

Zooniverse: Integrating Machine Learning





ESCAPE

ESAP

ESFRI Science Analysis Platform

Archives

Multi Query

Interactive Analysis

Batch Analysis

Asynchronous Jobs

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JIVE BinderHub

Description:

JIVE BinderHub

Link: <http://jupyter.jive.nl/binderhub/>

MyBinder


Description:

MyBinder

Link: <https://mybinder.org/>

Thanks to Google Cloud, OVH, GESIS Notebooks and the Turing Institute for supporting us! 🙌

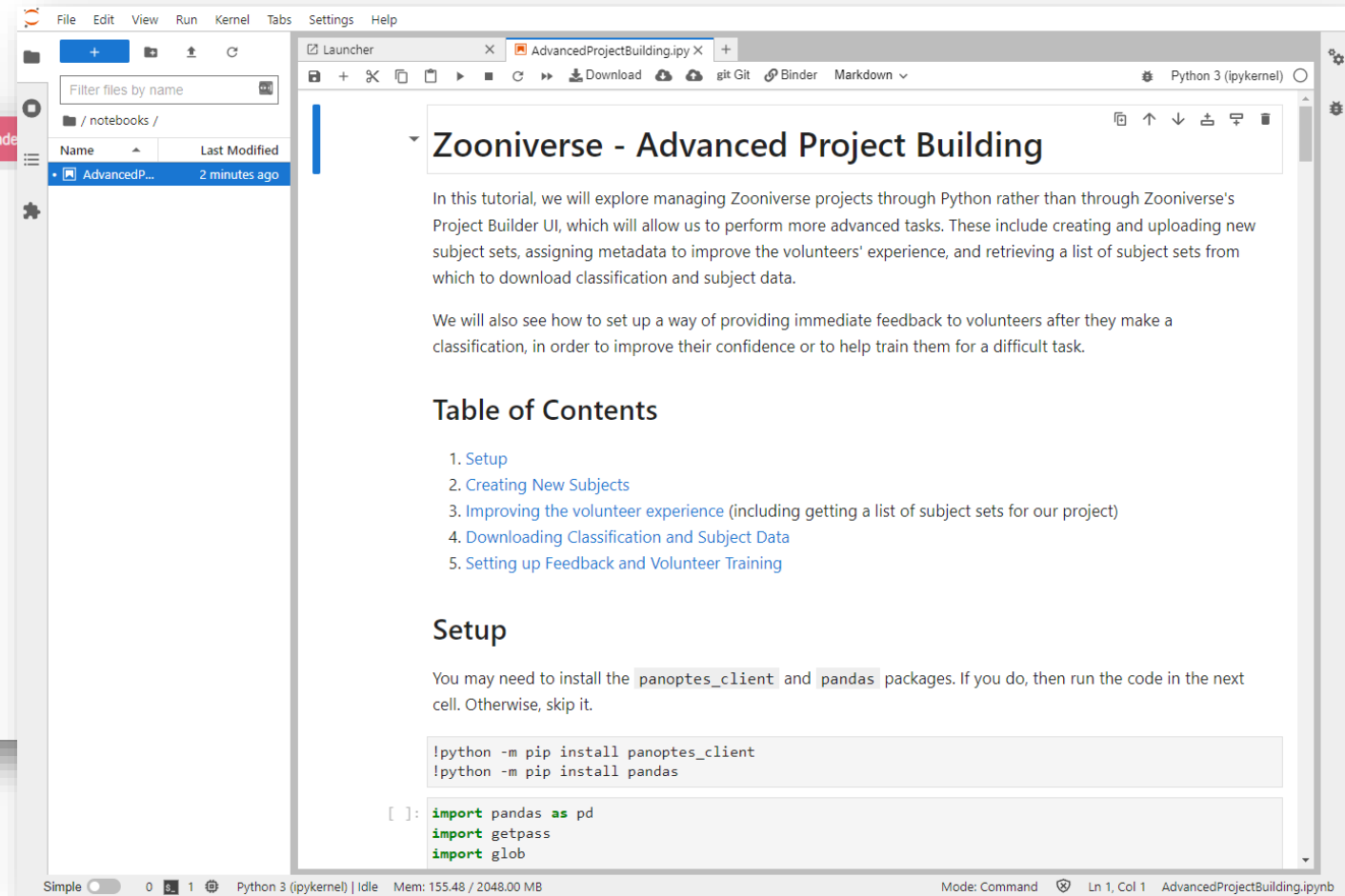
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Starting repository: <https://git.astron.nl/astron-sdc/escape-wp5/workflows/zooniverse-advanced-project-building/main>

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Launcher AdvancedProjectBuilding.ipynb

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Zooniverse - Advanced Project Building

In this tutorial, we will explore managing Zooniverse projects through Python rather than through Zooniverse's Project Builder UI, which will allow us to perform more advanced tasks. These include creating and uploading new subject sets, assigning metadata to improve the volunteers' experience, and retrieving a list of subject sets from which to download classification and subject data.

We will also see how to set up a way of providing immediate feedback to volunteers after they make a classification, in order to improve their confidence or to help train them for a difficult task.

Table of Contents

1. Setup
2. Creating New Subjects
3. Improving the volunteer experience (including getting a list of subject sets for our project)
4. Downloading Classification and Subject Data
5. Setting up Feedback and Volunteer Training

Setup

You may need to install the `panoptes_client` and `pandas` packages. If you do, then run the code in the next cell. Otherwise, skip it.

```
!python -m pip install panoptes_client
!python -m pip install pandas

[ ]: import pandas as pd
import getpass
import glob
```

Simple 0 1 Python 3 (ipykernel) | Idle Mem: 155.48 / 2048.00 MB Mode: Command Ln 1, Col 1 AdvancedProjectBuilding.ipynb

What's Next?

What's Next?

```
In [2]: import ipyaladin.aladin_widget as ipyal
```

```
In [3]: aladin=ipyal.Aladin(target='NGC 2976', fov=1.0, survey='P/SDSS9/color')  
aladin
```



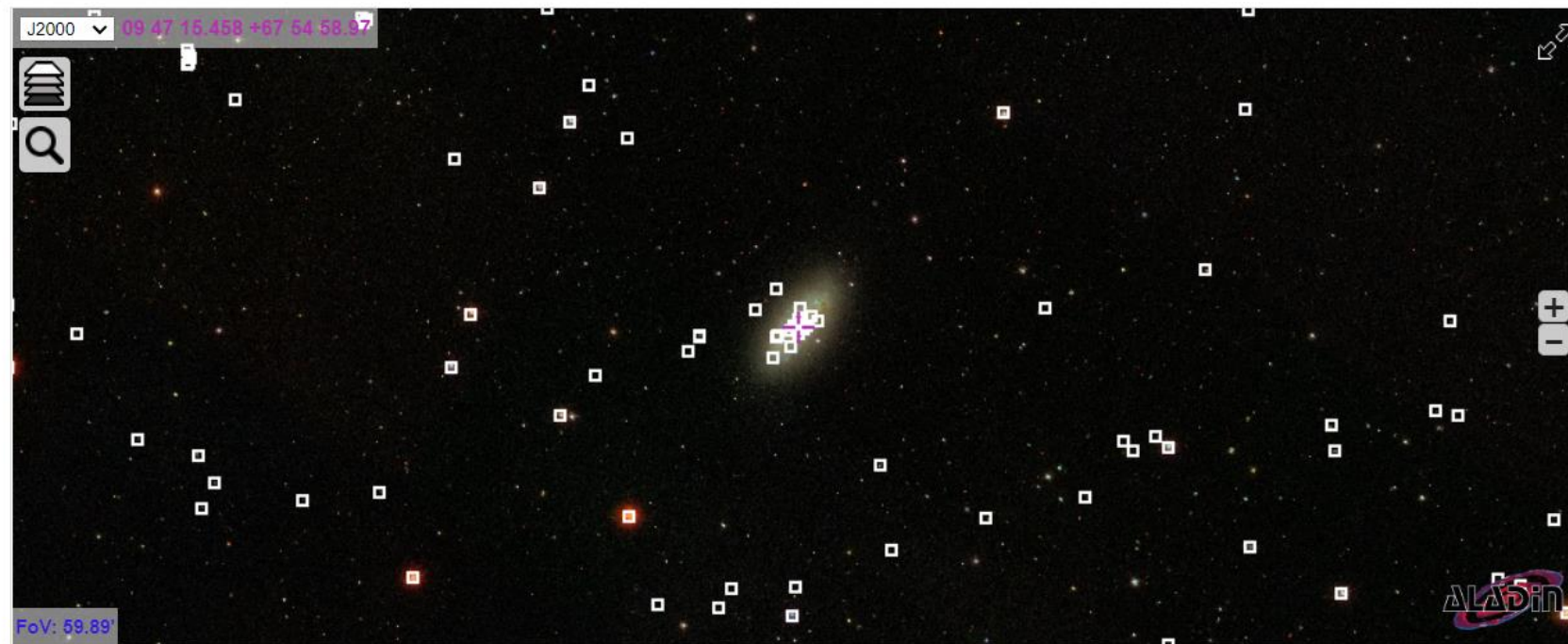
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In [ ]:
```

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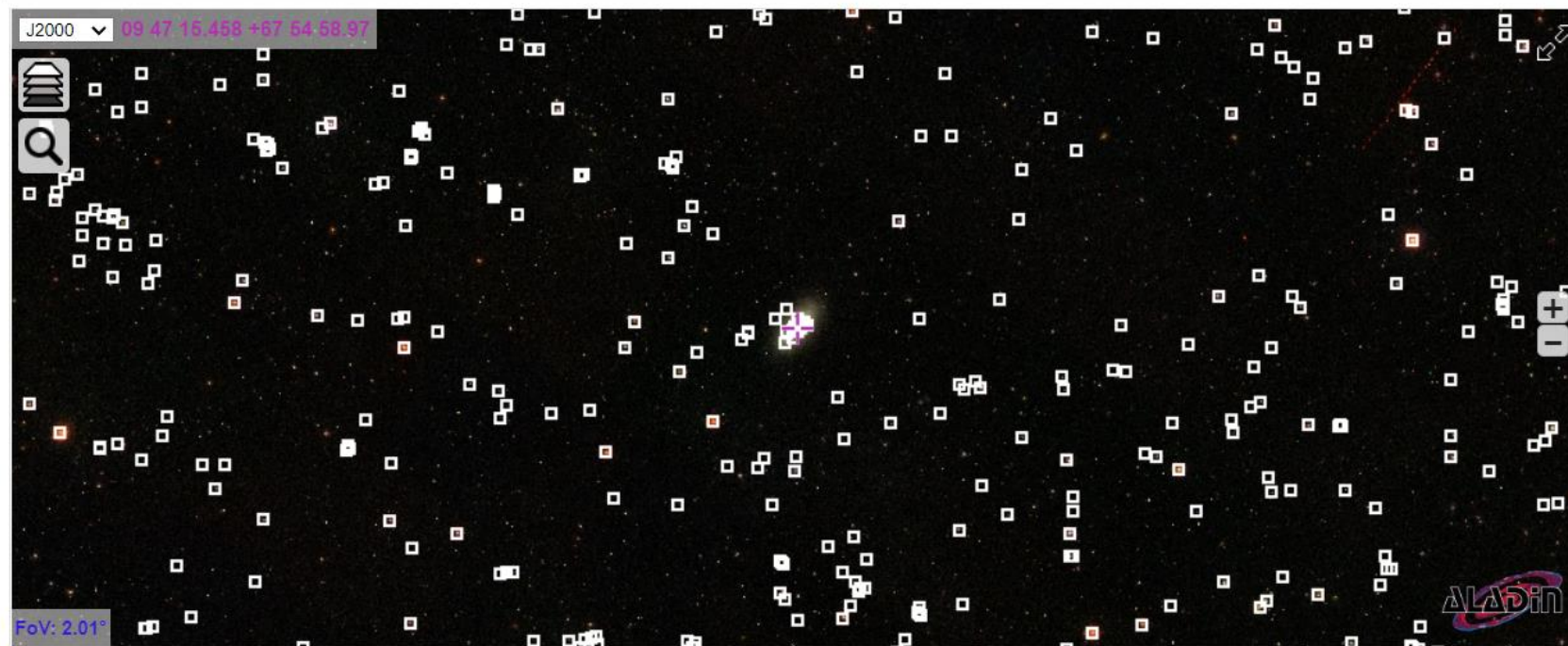


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In [4]: from panoptes_client import GalaxyZoo  
table = GalaxyZoo.query_region('NGC 2976', radius='1 degree')  
aladin.add_table(table)
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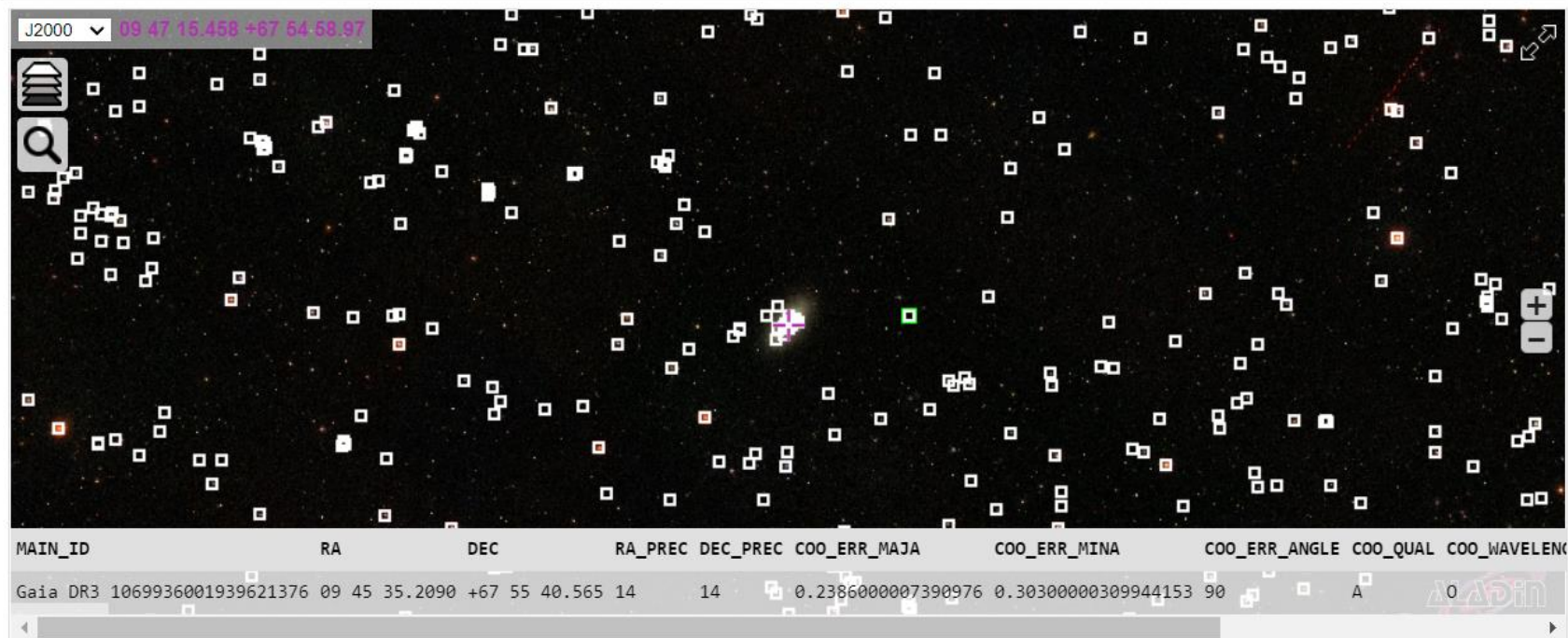


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In summary, this work allows:

- professional scientists to combine the powers of both ESAP and Citizen Science for their research,
- volunteers to engage even further with this research and with astronomy in general.

Thanks for listening!

Summary

- The Zooniverse platform for people-powered research gives everyone the opportunity to contribute meaningfully to scientific discovery.
- To aid researchers, we have developed a suite of easy-to-use workflows and material for managing Zooniverse projects through ESAP, demonstrating:
 - **advanced project building** techniques,
 - using Zooniverse's **Caesar engine for aggregation** of results and **advanced subject retirement rules**,
 - accessing the **ESAP Shopping Basket**,
 - integrating with **deep learning models** to make projects more efficient, including setting up an **active learning cycle**.
- Recorded walkthroughs of these notebooks, with speech-to-text documentation for greater accessibility, are available.
- We hope to develop a **Virtual Observatory (VO) tool** for seamless data exploration of galaxies in the VO with labelled Galaxy Zoo morphologies.

Where next for citizen science in EOSC?

- What limits the take up of crowdsourced data mining in EOSC?
 - Trust in the reliability? Skills at aggregating the data? Temptation just to pay Amazon MT?
 - Seeing science results will help
 - Seeing it work up close will help
 - Build multi-disciplinary exemplar experiments following ESCAPE model
 - Create worked examples of plug-and-play notebooks for running projects in EOSC
- Improve integration with other EOSC services, eg VO, AAI, virtuous circle with ESAP ML (for large projects)
- Open data standards in FAIRsharing.org?
- Dedicated EOSC task force for citizen science?
- Funding for ESAP platform for multi/inter-disciplinary citizen science?

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