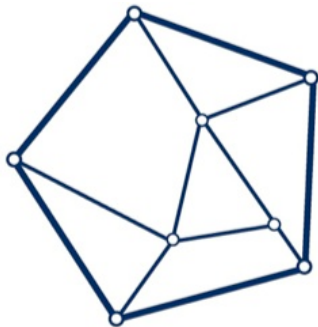


Using citizen science as a tool for SKA Precursor data

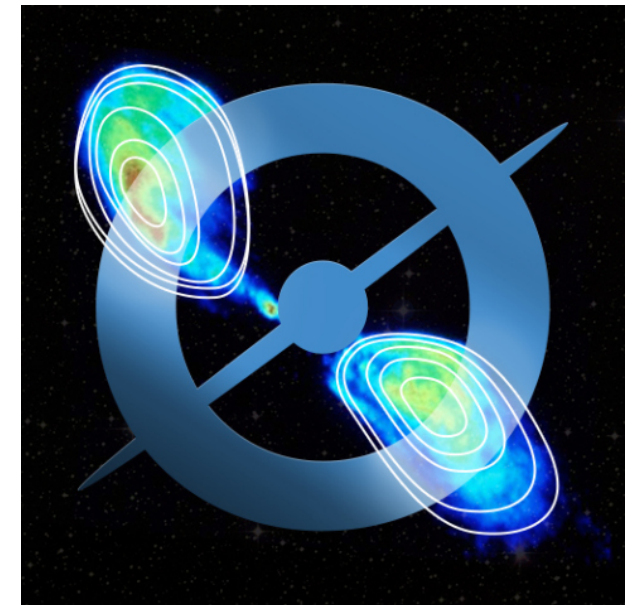
Julie Banfield

*Australian National University / CAASTRO
Western Sydney University*

 @42jkb
 @radiogalaxyzoo



Australian Government
Australian Research Council



- › SKA precursor observations will be creating large radio component catalogues.
- › **Issue:**
 - How do we move from component catalogues to radio source catalogues?
- › **Ideas:**
 - Visual cross-identification
 - Machine learning methods (supervised and unsupervised)

“Classifying very large data sets is obviously beyond the capability of a single person. Therefore the galaxy classification problem calls for new approaches”

Lahav et al. (1995) Science





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Larger datasets need more processing power!

Then



Now



Zooniverse concept:
power of people+computers

Slide courtesy of Ivy Wong (UWA/ICRAR)

Cognitive Surplus

200 billion hours a year spent
watching TV by US adults



People have
A LOT
of free time!



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OLD WEATHER



SNAPSHOT SERENGETI



PENGUIN WATCH

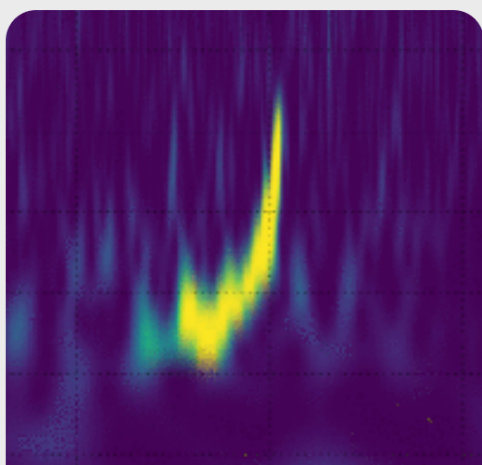


MEASURING THE ANZACS

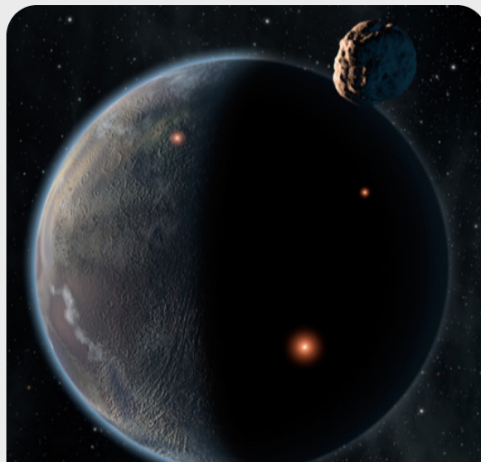
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GRAVITY SPY



PLANET HUNTERS



DISK DETECTIVE

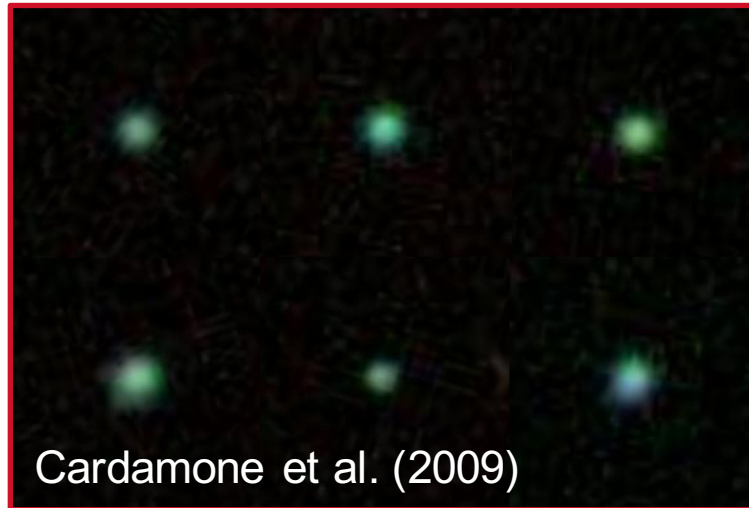


GALAXY ZOO



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Green Pea Galaxies



Google Maps Horse Boy



Hanny's Voorwerp



Zorilla



CLASSIFY

SCIENCE

TEAM



FEEDBACK

DISCUSS

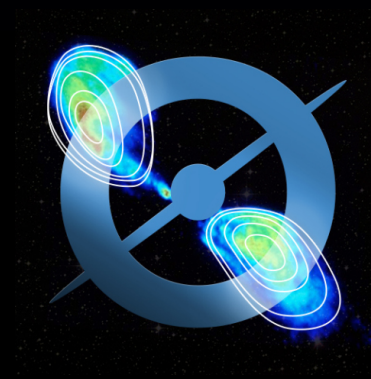
BLOG

In Search of Erupting Black Holes

Help astronomers discover supermassive black holes observed by the Australia Telescope Large Area Survey.

Search for Black Holes

Black holes are found at the center of most, if not all, galaxies. The bigger the galaxy, the bigger the black hole and the more sensational the effect it can have on the host galaxy. These supermassive black holes drag in nearby material, growing to billions of times the mass of our sun and occasionally producing spectacular jets of material traveling nearly as fast as the speed of light. These jets often can't be detected in visible light, but are seen using radio telescopes. Astronomers need your help to find these jets and match them to the galaxy that hosts them.

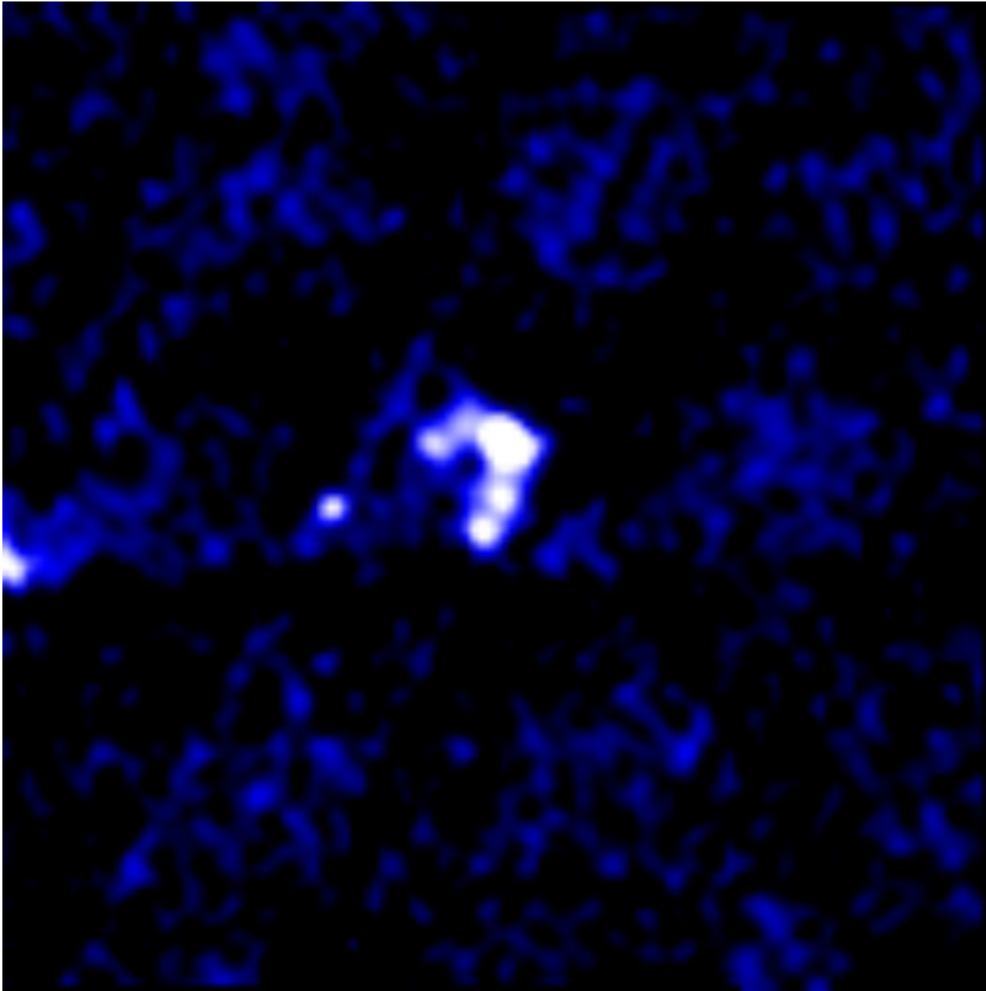
[Begin Hunting](#)

NASA, ESA, S. Baum and C. O'Dea (RIT), R. Perley and W. Cotton (NRAO/AUI/NSF), and the Hubble Heritage Team (STScI/AURA)

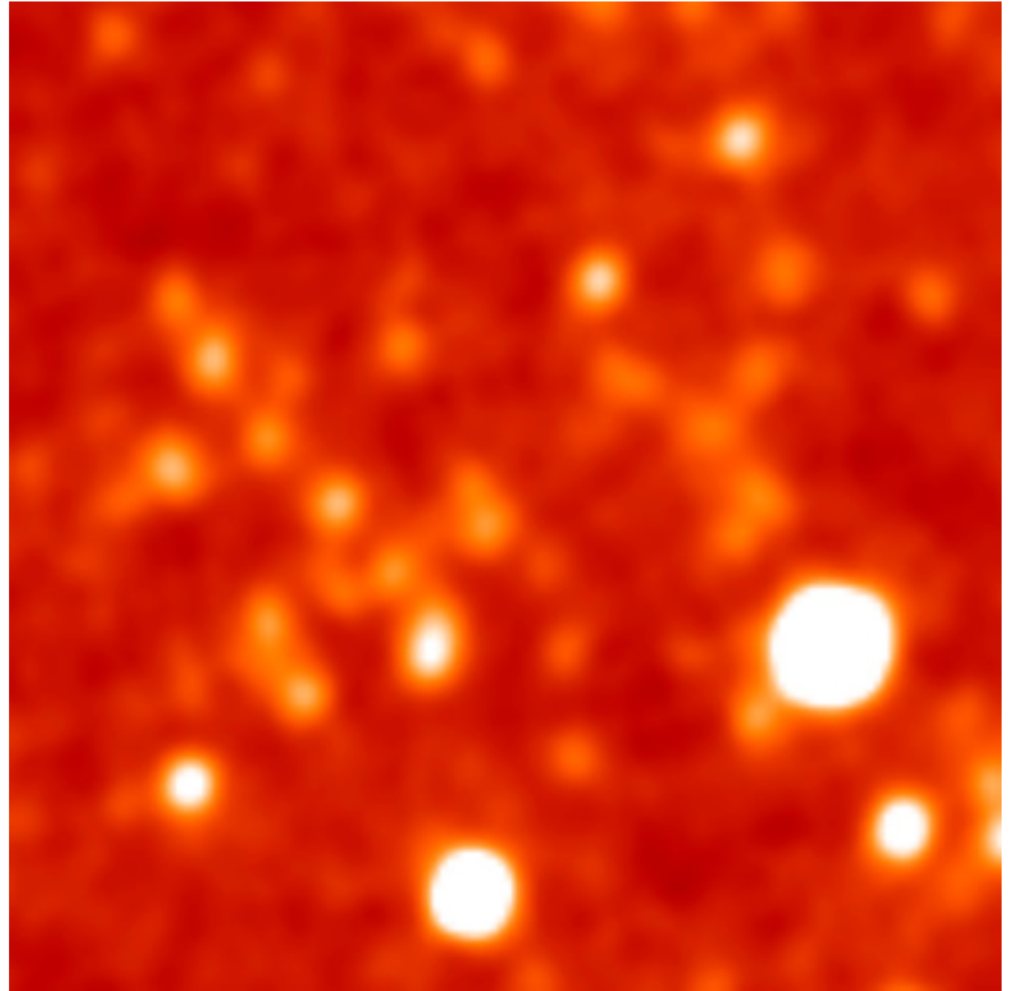
radio.galaxyzoo.org



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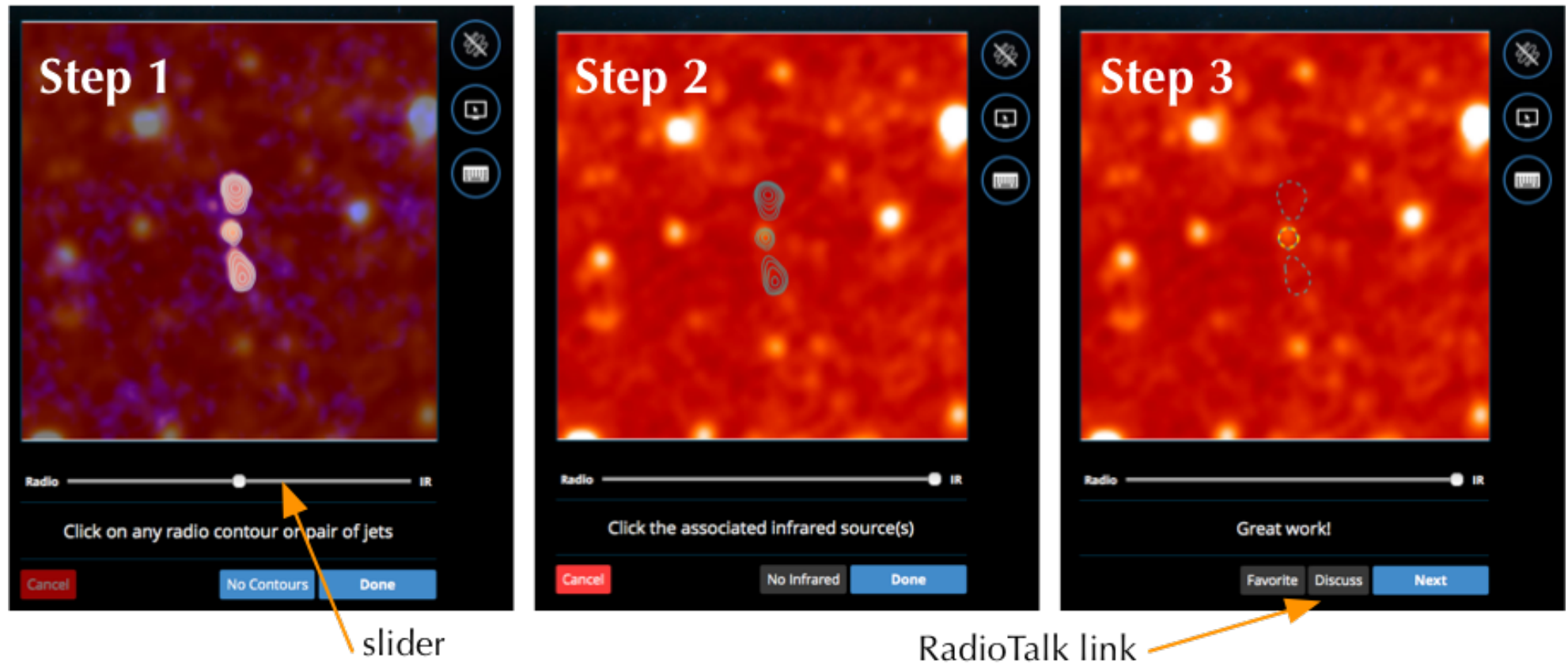


Radio
FIRST



Infrared
WISE

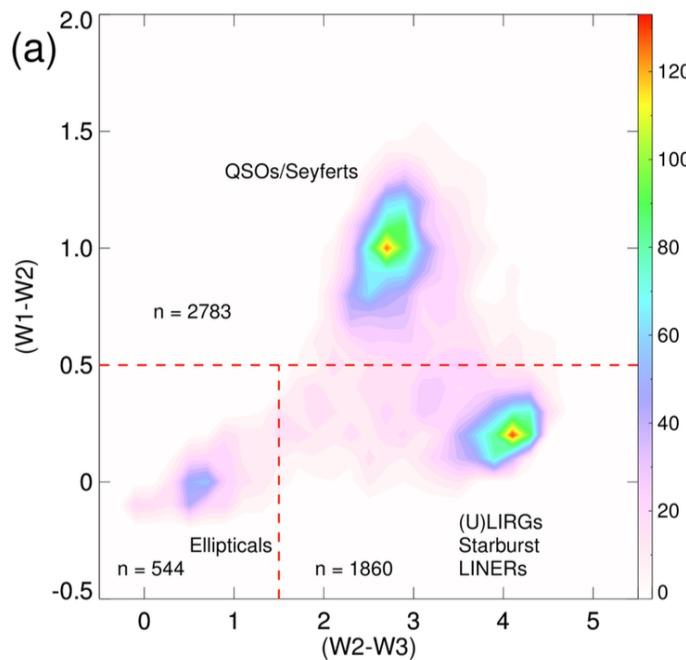
Interface



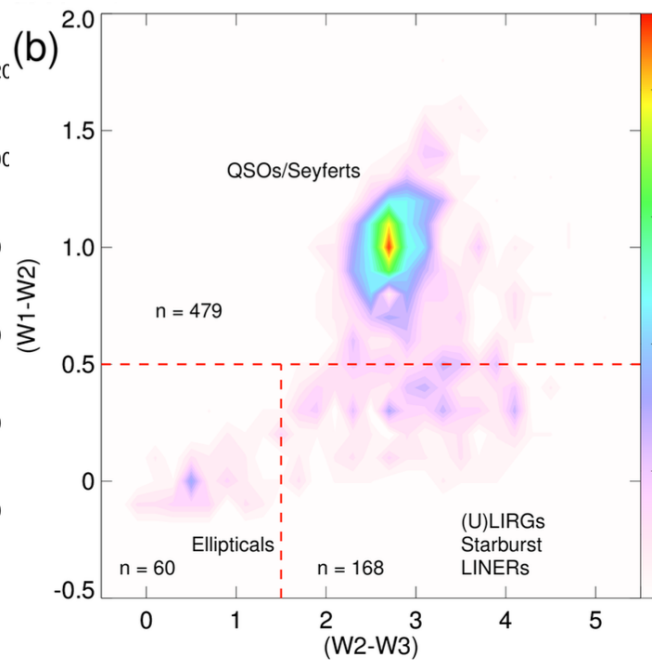
- › FIRST matched to WISE
- › ATLAS CDFS matched to Spitzer

- › 1,955,067 classifications
- › 11,214 registered citizen scientists
- › Data Release 1 will have over 74,000 radio sources

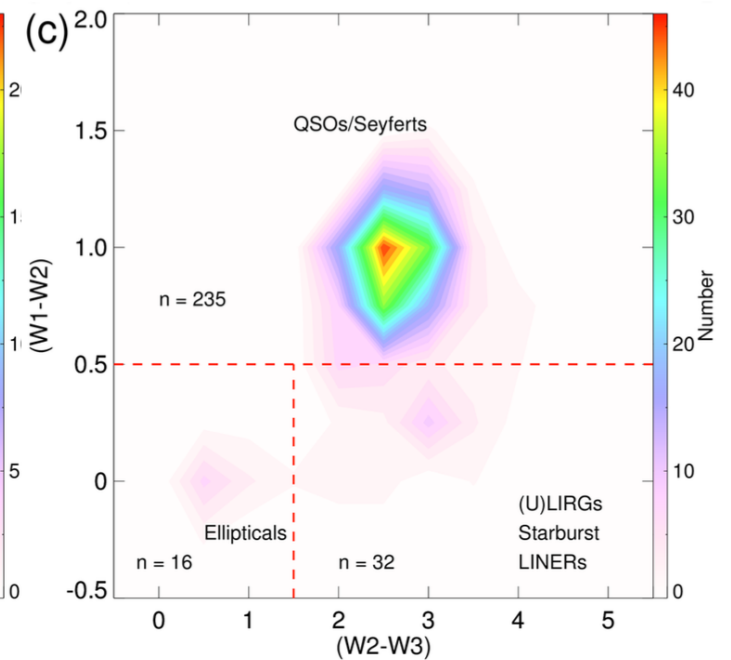
1-component



2-components



3-components



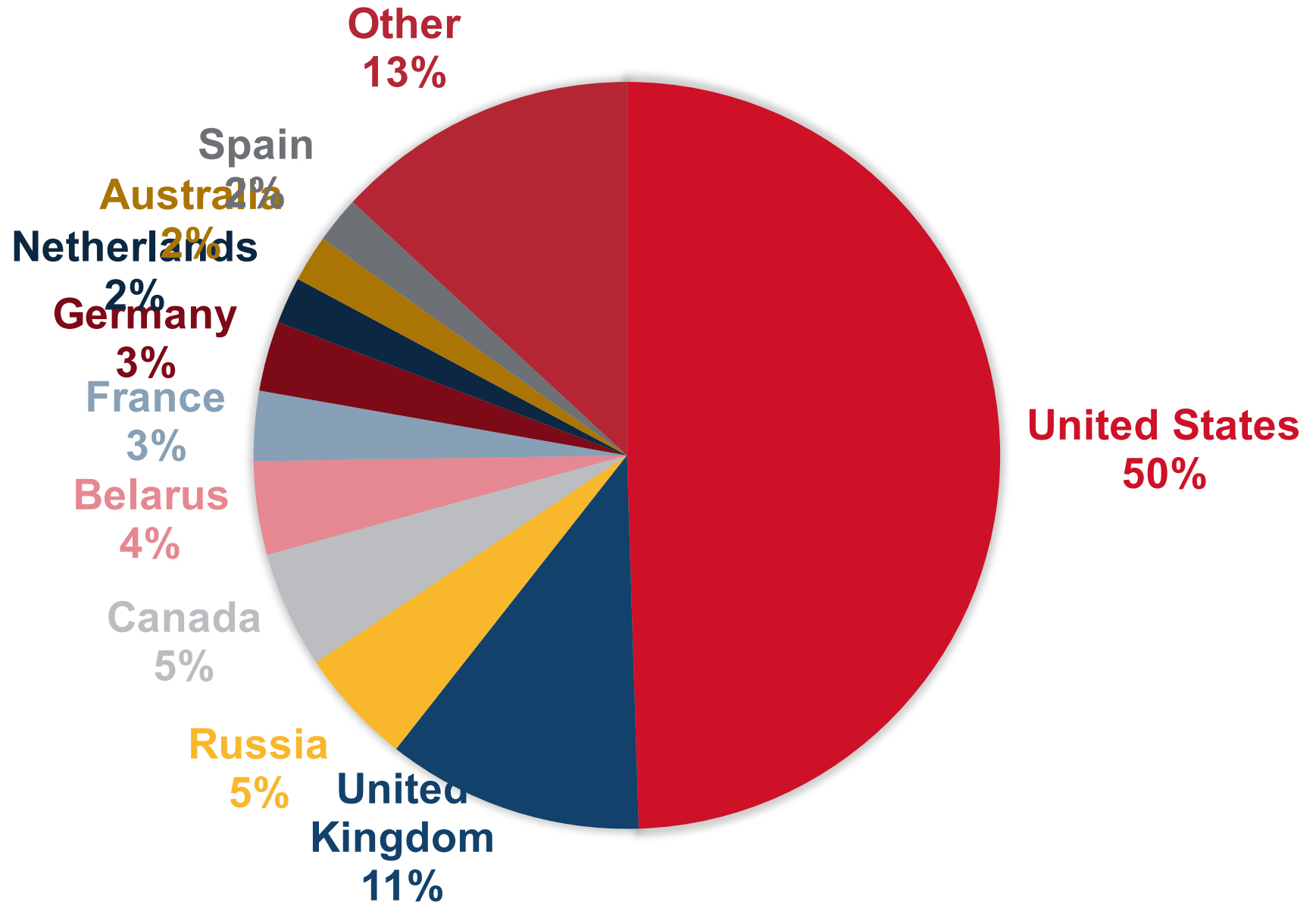
Wong et al. (in prep)



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Total Classifications: 1,881,289

CLASSIFICATIONS PER COUNTRY





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Total Classifications: 1,881,289

Spanish
3%

CLASSIFICATION BY LANGUAGE

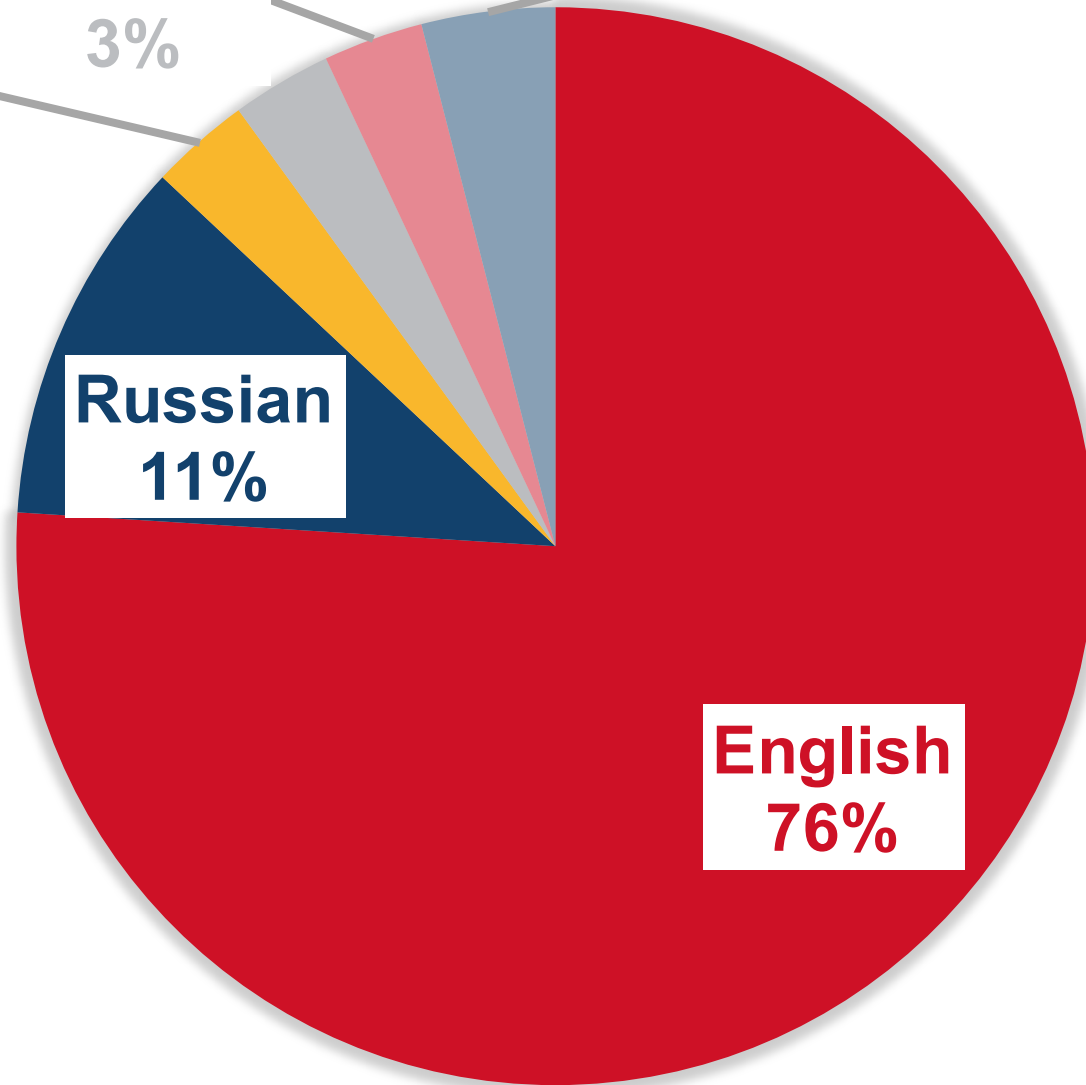
Other
4%

German
3%

French
3%

Russian
11%

English
76%





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RGZ Interface

 **Talk Galaxy Zoo: Radio**

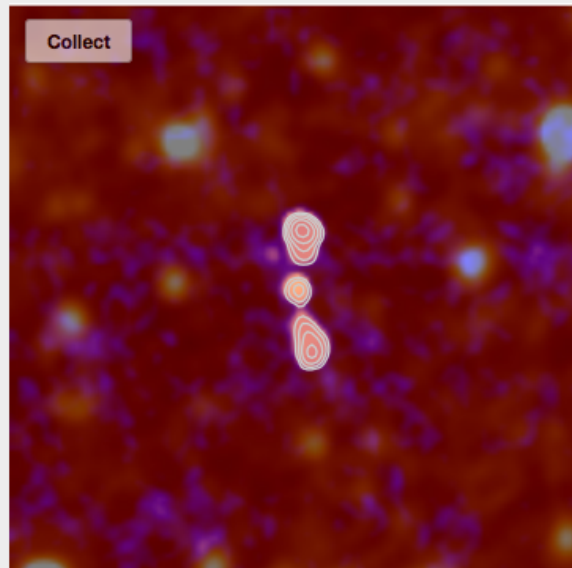
[Following](#) [Recent](#) [Discussion boards](#) [Search](#) [Profile](#)

[Return to classifying](#)

[Sign out](#)

[Image ARG0002598](#)

[Follow](#)



Survey Id: FIRSTJ120505.8+232050

RA: 181.274

Dec: 23.347

[FIRST](#)

[NVSS](#)

[SDSS](#)

[WISE](#)

Say something, or mark with a #hashtag

140 characters

[Comment](#)

Collections

No collections

Tags

No hashtags

Science

Want to start a new science discussion?

[Create a New Post](#)

Help

Want to start a new help discussion?

[Create a New Post](#)

Chat

Want to start a new chat discussion?

[Create a New Post](#)





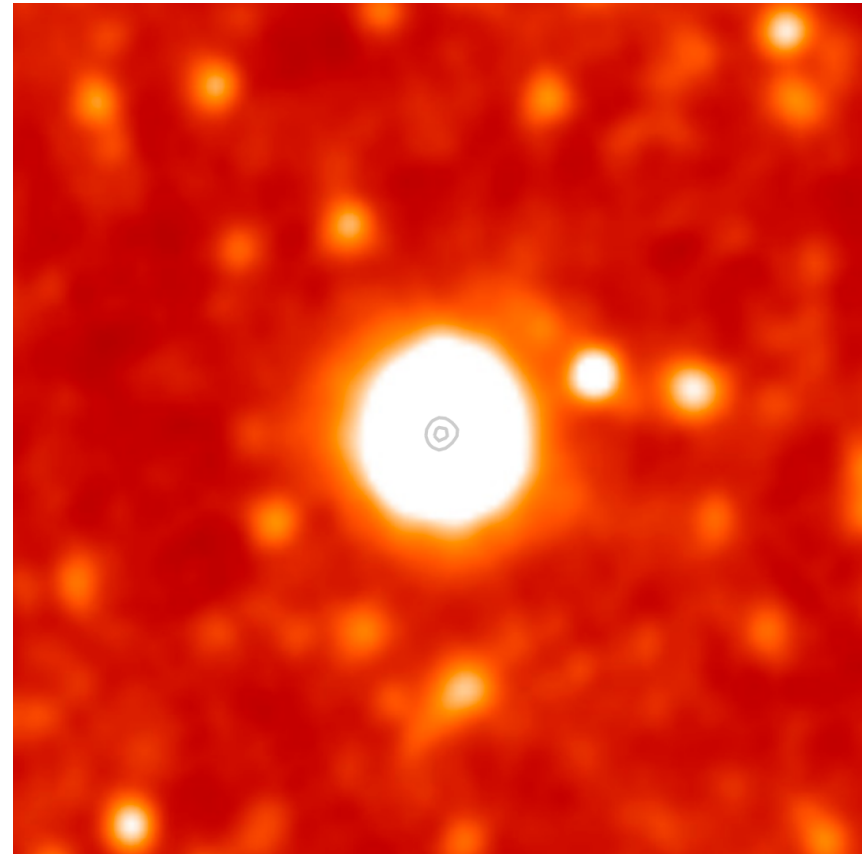
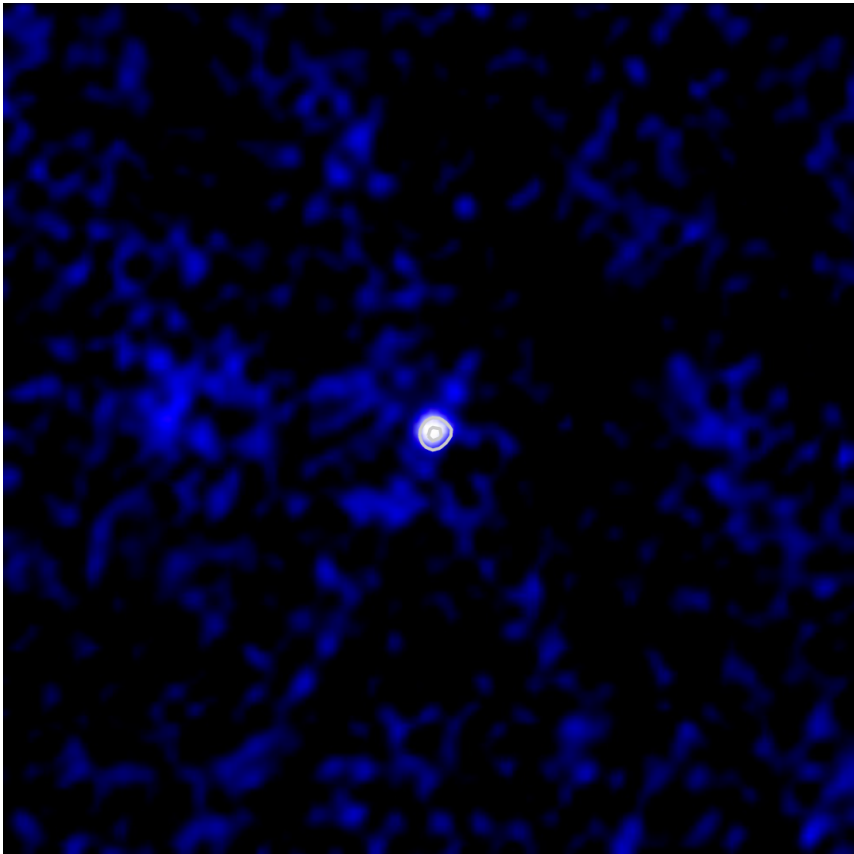
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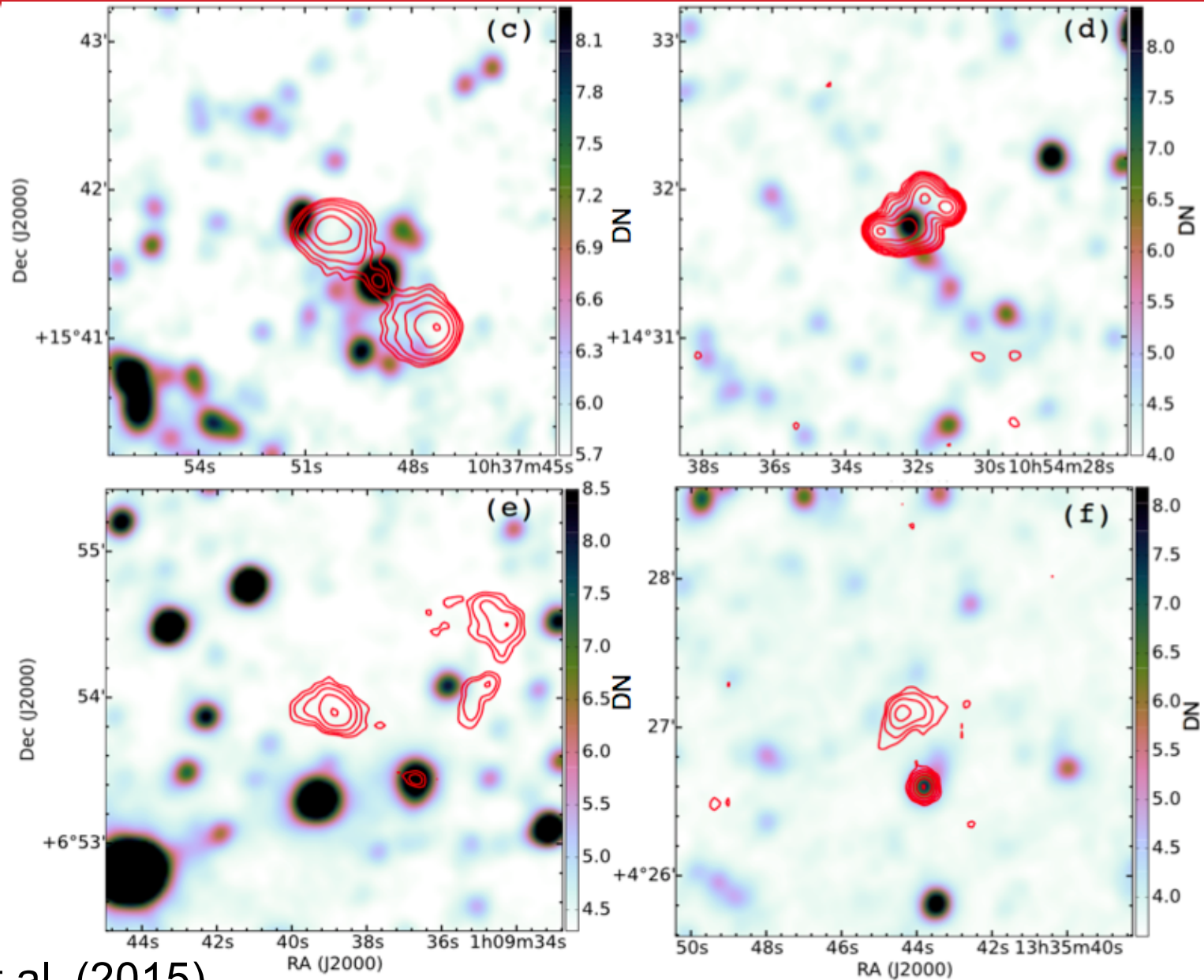


Bowyer et al. (2016)



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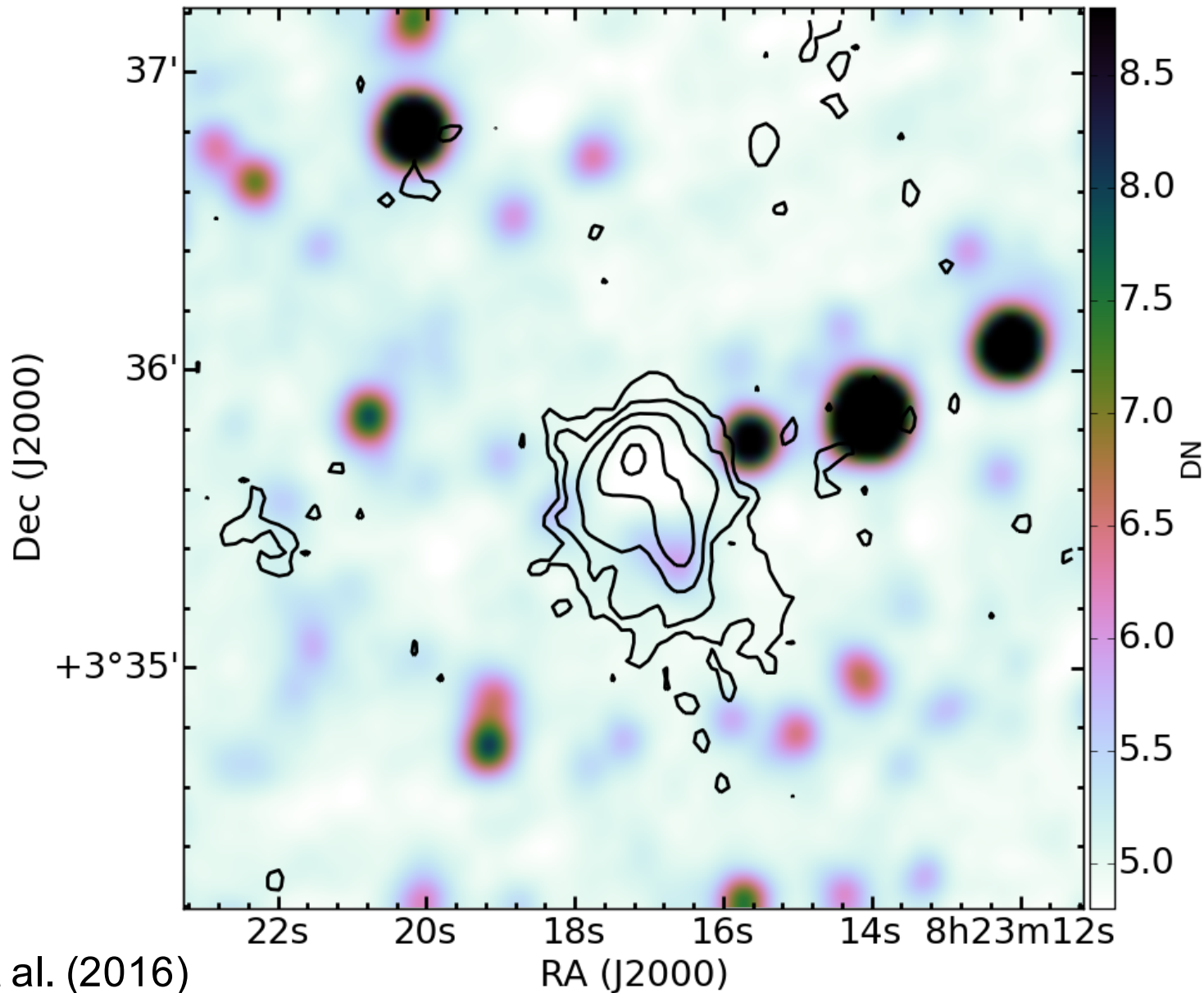


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Discoveries

Matorny-Terentev Cluster

RGZ-CL J0823.2+0333

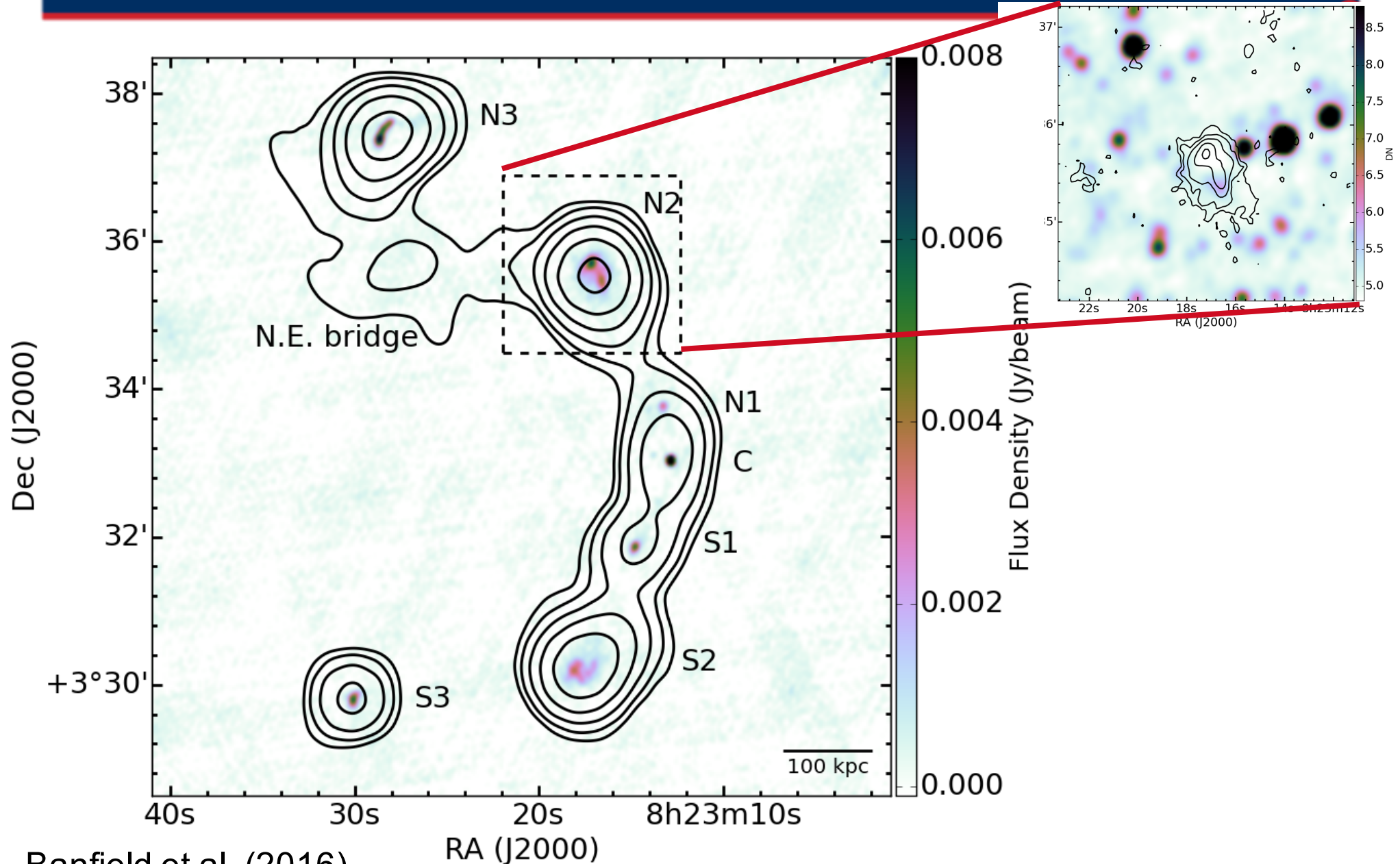




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Matorny-Terentev Cluster

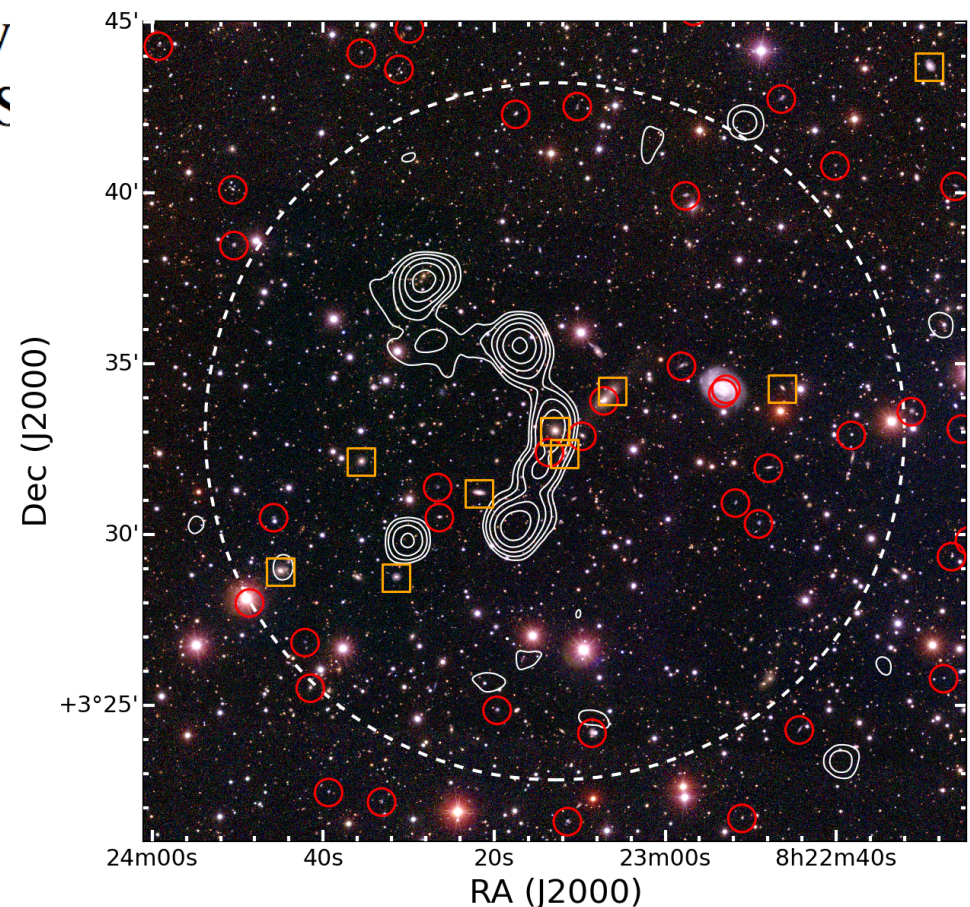
RGZ-CL J0823.2+0333



Banfield et al. (2016)

Radio Galaxy Zoo: discovery of a poor cluster through a giant wide-angle tail radio galaxy

J.K. Banfield^{1,2★}, H. Andernach³, A.D. Kapińska^{4,2}, L. Rudnick⁵, M.J. Hardcastle⁶,
G. Cotter⁷, S. Vaughan⁷, T.W. Jones⁵, I. Hey
T. Matorny¹¹, I.A. Terentev¹¹ Á. R. López-S
S.S. Shabala¹⁶, K.W. Willett⁵

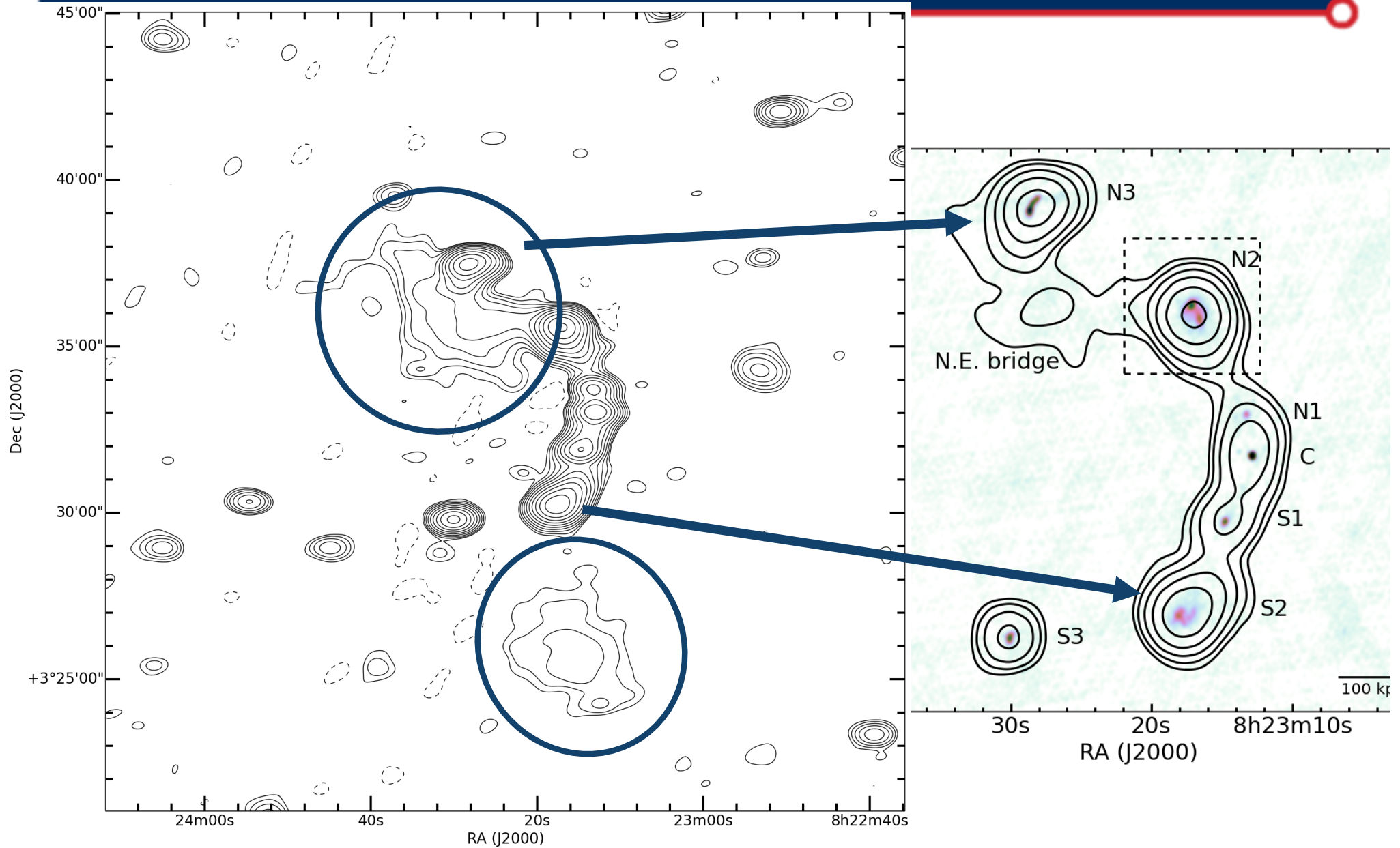




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Matorny-Terentev Cluster

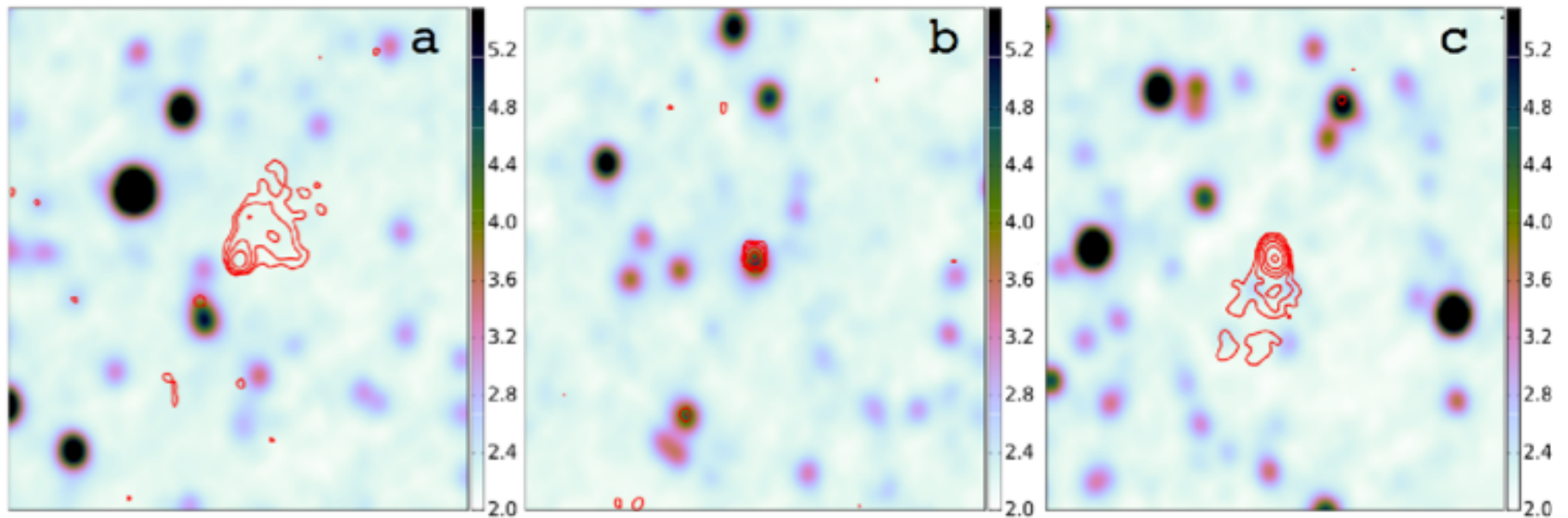
RGZ-CL J0823.2+0333





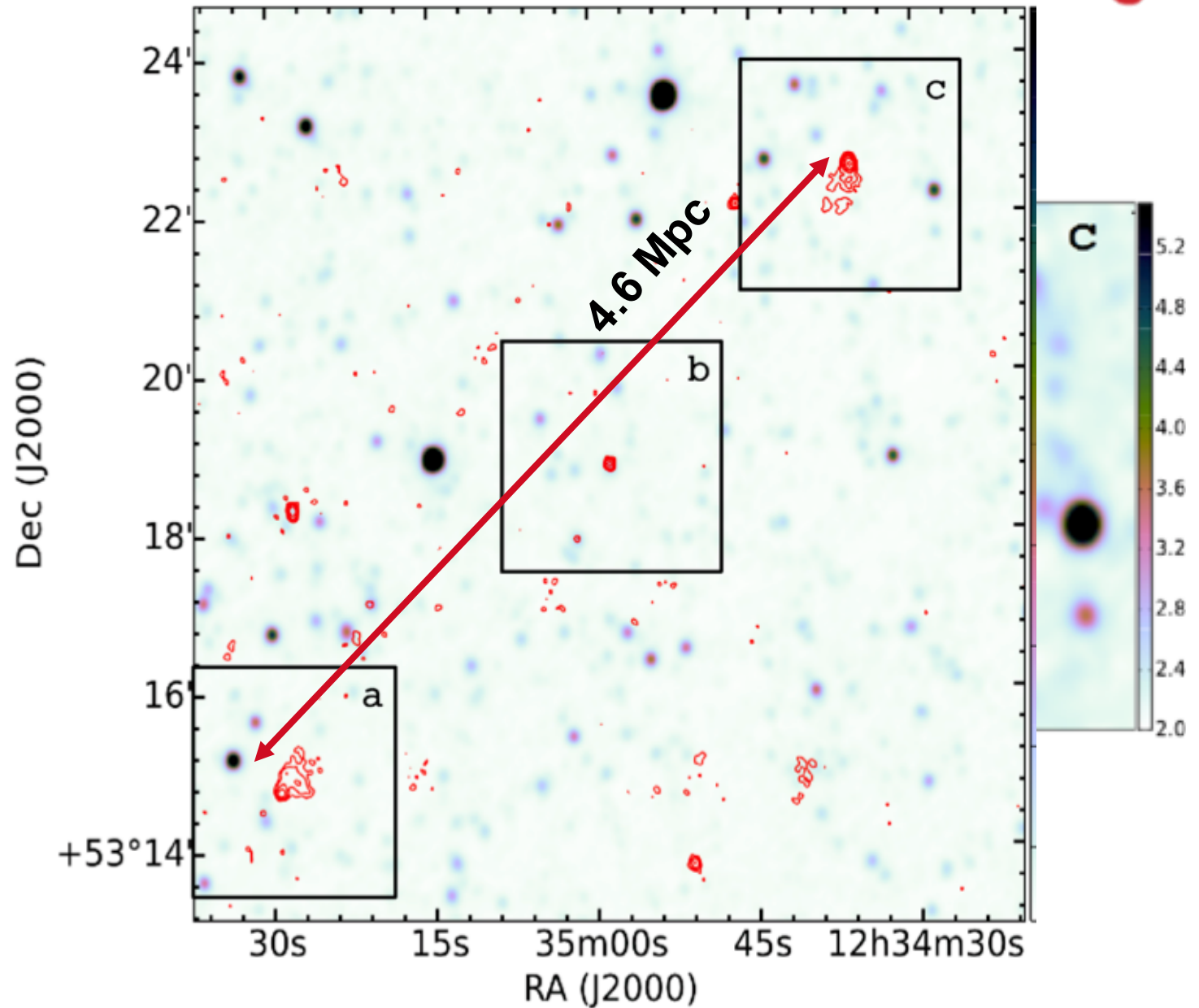
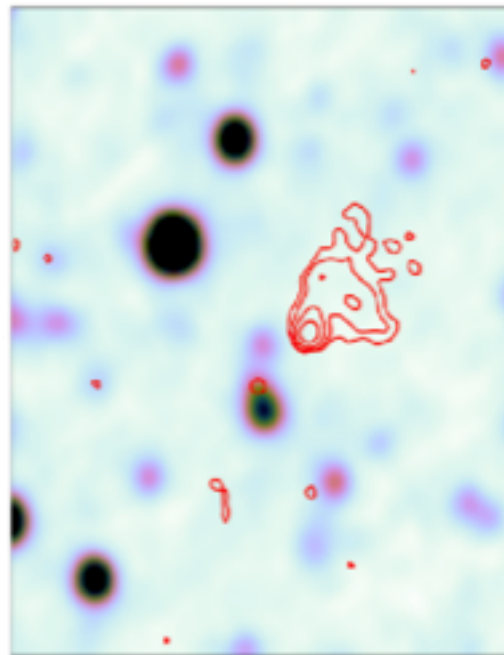
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Giant Radio Galaxies



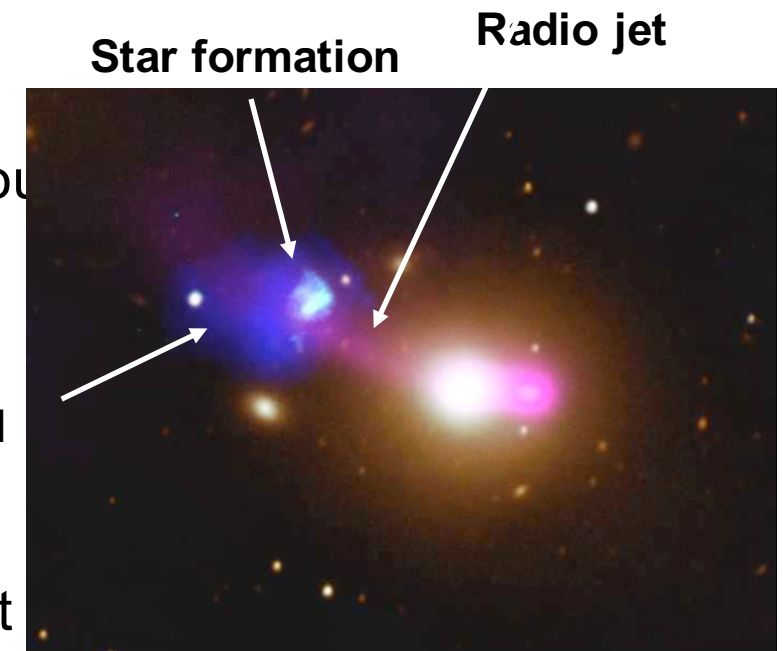
Banfield et al. (2015)

Giant Radio Galaxies

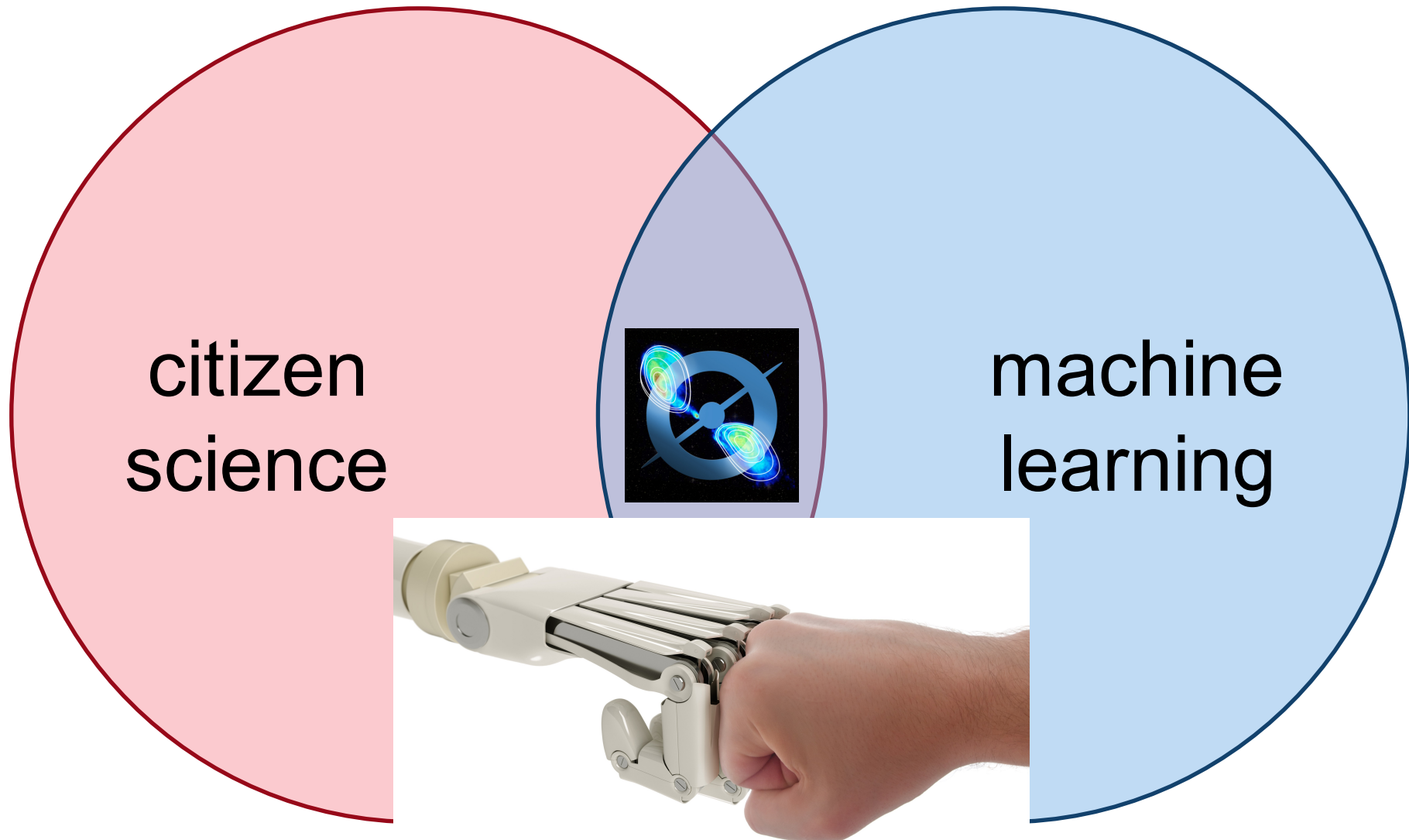


- › Giant Radio Galaxies (P.I. Andernach)
- › Hybrid radio galaxy (P.I. Kapinska *under review*)
- › Cosmic alignment of radio galaxies (P.I. Contigiani *under review*)
- › Cousins to Minkowski's object at high z (P.I. Banfield)
- › Machine learning methods (Alger, Lukic *in circulation*)
- › Spiral galaxies (disk galaxies) hosting radio-loud active galactic nuclei (P.I. citizen scientists)

Minkowski's Object



Radio Galaxy Zoo



Wright, Lintott, Smartt et al. (2017) arXiv: 1707.05223

Summary

- › Radio Galaxy Zoo is a citizen science project where volunteers select the host galaxy to the radio emission from active galactic nuclei.
- › Over 11,000 volunteers and 1.8+ million classifications.
- › Serendipitous discoveries through visual inspection
- › Successfully applied supervised machine learning to a subset of the radio galaxy zoo data.

