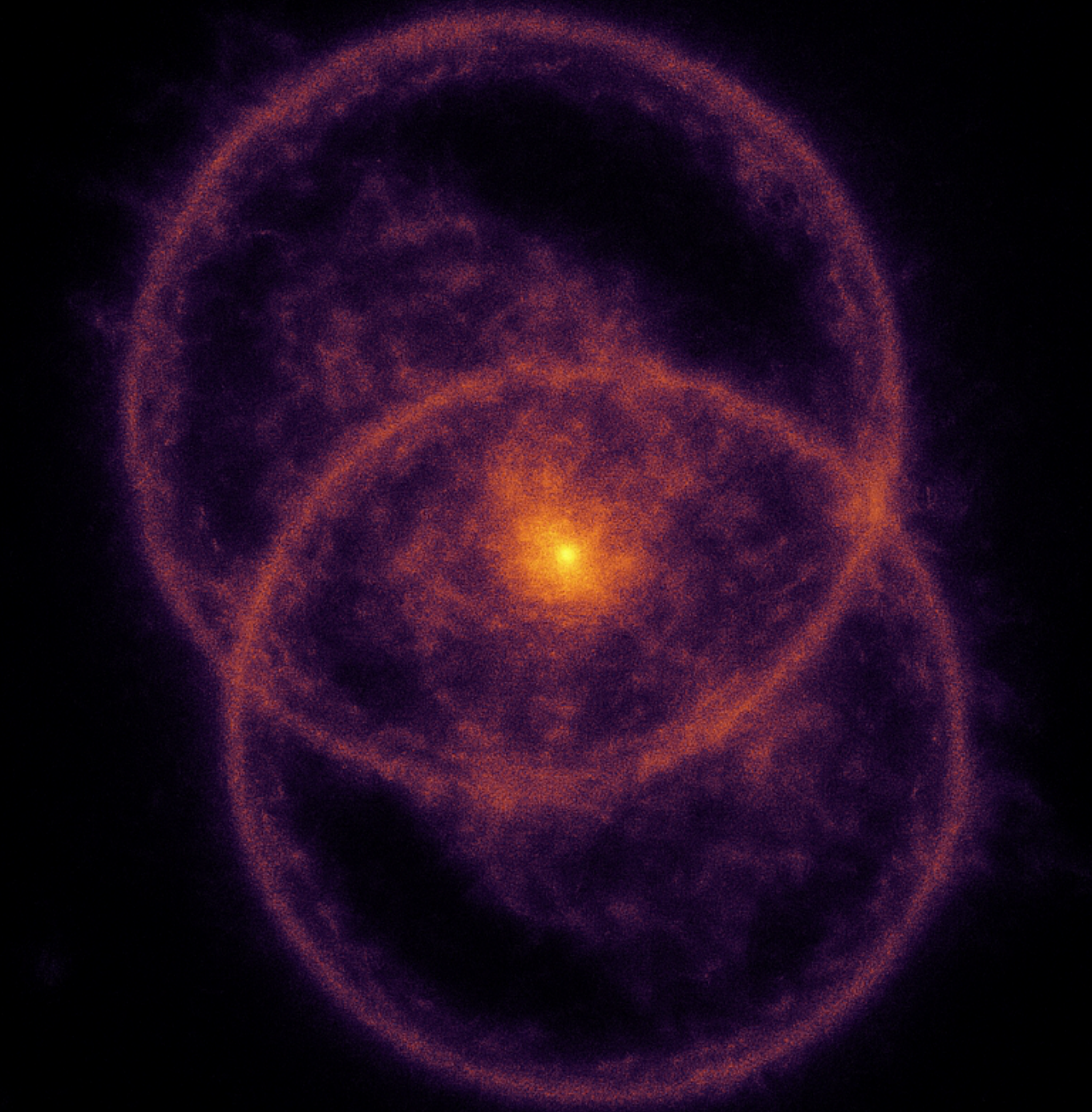


# Discovery of extragalactic radio rings & Odd radio circles



Pratik Dabhade  
(NCBJ, Poland)





# Discover the Universe from Home: The RAD@home Model



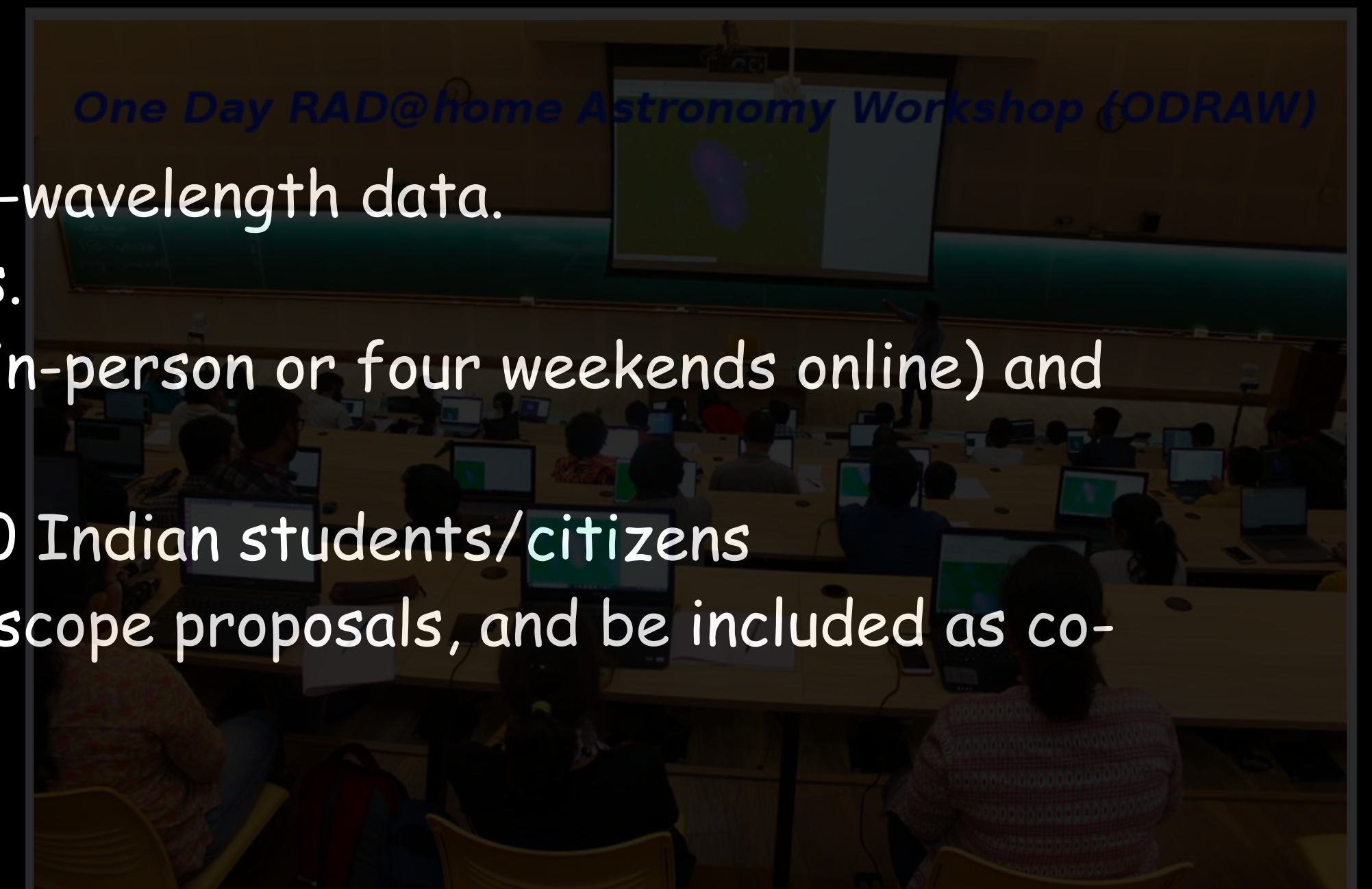
## India's first astronomy citizen science collaboratory

- It is an internationally-acclaimed, nationwide, Inter-University collaboratory
- The model is zero-funded and zero-infrastructure
- Its mostly online using social media tools since 2013.
- To study Extragalactic objects, mainly using radio and other multi-wavelength data.

<https://www.radathomeindia.org/>

#ABCDresearch  
Any BSc/BE Can Do Research

- The model is zero-funded and zero-infrastructure
- Most training is done online using social media tools since 2013.
- To study Extragalactic objects, mainly using radio and other multi-wavelength data.
- The model has produced over a thousand trained citizen scientists.
- Training methods include RAD@home Discovery Camps (one week in-person or four weekends online) and Astronomy Workshops (one/two days online/in-person)
- The online group currently has ~1500 active learners out of ~5000 Indian students/citizens
- Successful participants can contribute to discoveries, submit telescope proposals, and be included as co-authors in publications
- Recognised by IAU & SKAO.







# Citizen science driven discoveries

Monthly Notices

of the

ROYAL ASTRONOMICAL SOCIETY



MNRAS **543**, 1048–1057 (2025)

Advance Access publication 2025 October 2

<https://doi.org/10.1093/mnras/staf1531>

## **RAD@home discovery of extragalactic radio rings and odd radio circles: clues to their origins**

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# The Odd radio circles (ORCs)



Credit: Science

An artist's impression of an odd radio circle. The mysterious rings could be the result of gas blasted out of a central galaxy after a burst of star formation.CSIRO

## Vast & Circular

They appear as huge edge-brightened circles  
On the sky (~ few arcminutes in diameter)

## Radio- Only

Only visible in radio continuum and no multi-wavelength counterpart of the circular structures

## Extragalactic origin

Away from galactic plane and sky distribution rules out local origin.



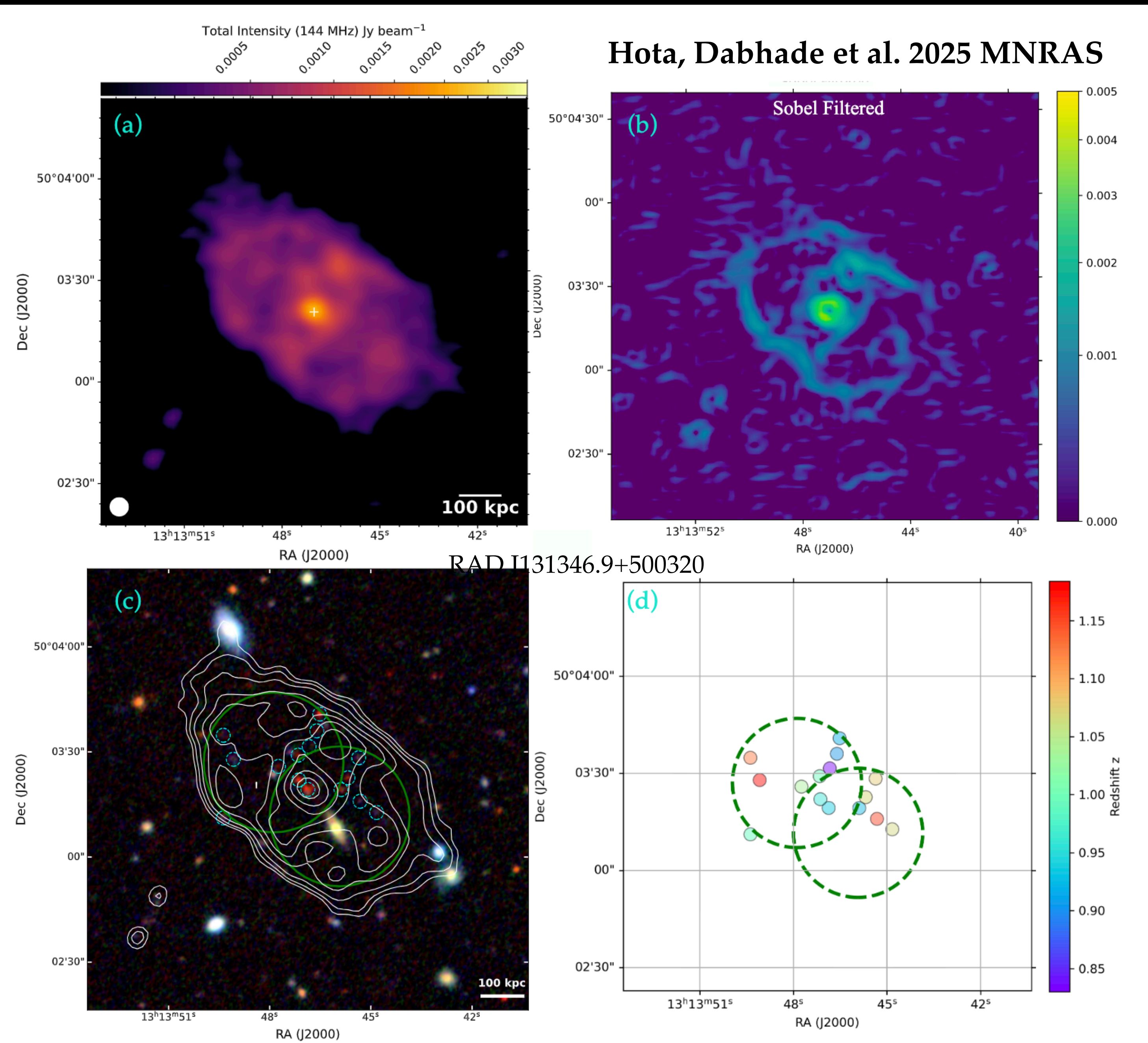
# Odd Radio Circles

- First discovered in 2019
- Only about a dozen examples known to date.

## RAD J131346.9+500320

### The Double-Ring Odd Radio Circle

- Discovery: By RAD@home citizen scientists using LOFAR (LoTSS) data
- Redshift:  $\approx 0.94$
- Physical size:  $\sim 865$  kpc
- Structure: Two intersecting rings - only the second known double-ring ORC
- Environment: Dense galaxy group/cluster; multiple nearby galaxies at similar redshift
- Radio power: Most powerful and most distant ORC known so far.
- Significance: First ORC discovered via citizen science and first found using LOFAR in the northern sky

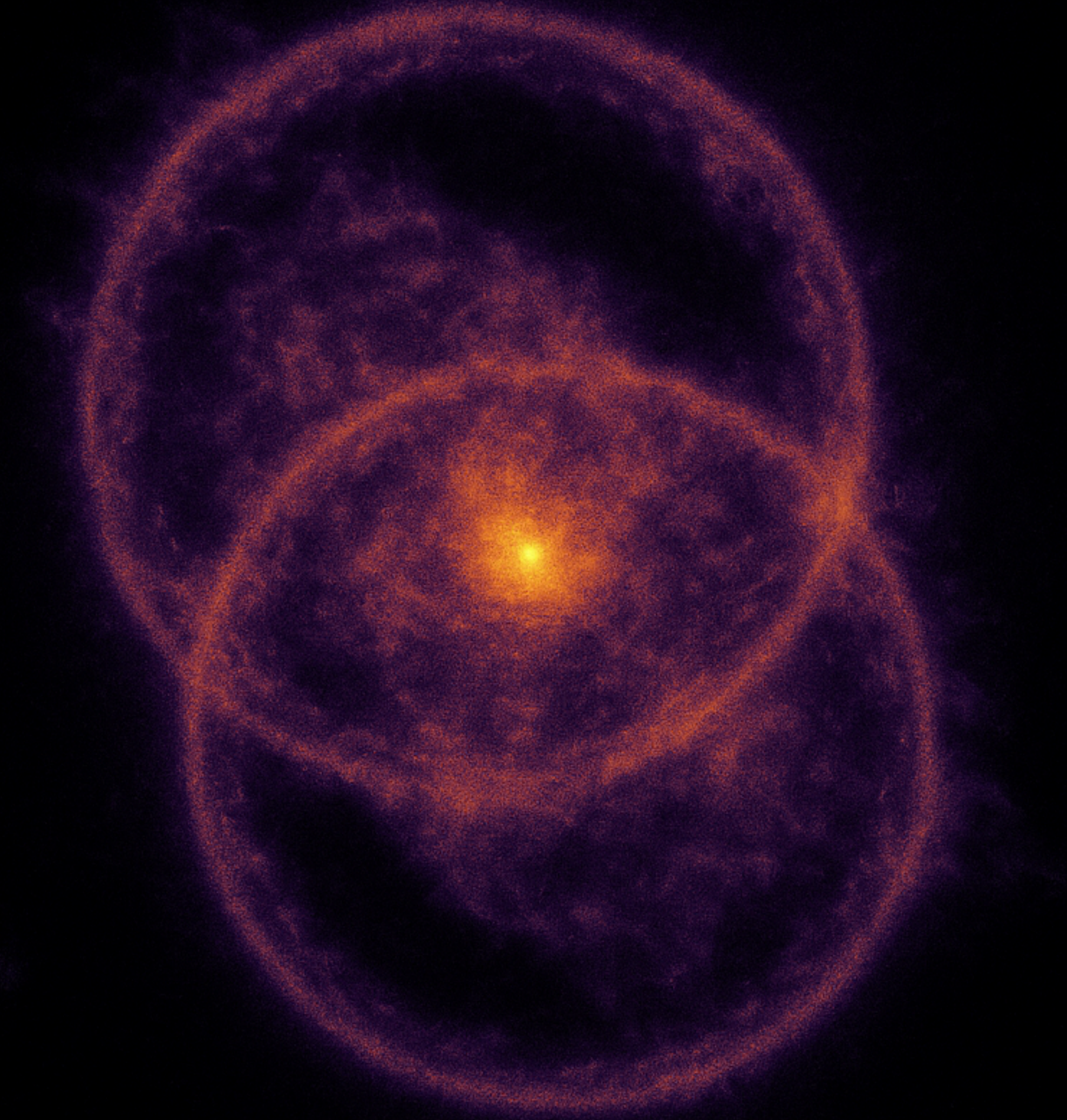




# Possible causes for Odd Radio Circles ?

- **Merging black holes or galaxies:** Expanding shockwaves from mergers light up old plasma, forming giant radio rings.
- **Powerful superwinds:** Explosive outflows from starbursts or active galactic nuclei sweep up material into spherical shells seen as rings.
- **Relic radio lobes:** Faded lobes from past jet activity become ring-like when re-energised or compressed.
- **Cluster environment effects:** Interaction between radio plasma and hot intracluster gas sculpts ring or arc-shaped structures.
- **Projection of 3D structures:** Spherical or helical outflows appear as circular rings when viewed from Earth.

Artist's visualisation of ORC 'RAD J131346.9+500320'



Credit: Pratik Dabhade & RAD@home astronomy collaboratory



# RAD@home discovery of extragalactic radio rings and odd radio circles: clues to their origins

Overview of attention for article published in Monthly Notices of the Royal Astronomical Society, October 2025



SUMMARYNewsBlogsXFacebookWikipediaBluesky

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Title	RAD@home discovery of extragalactic radio rings and odd radio circles: clues to their origins		
Published in	Monthly Notices of the Royal Astronomical Society		October 2025
DOI	10.1093/mnras/stz1234		
Authors	Pratik Dabhade, Aarti Muley, ... <a href="#">[show]</a>		

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OCTOBER 2, 2025

## Most powerful 'odd radio circle' to date discovered

by Royal Astronomical Society

edited by Lisa Lock, reviewed by Robert Egan

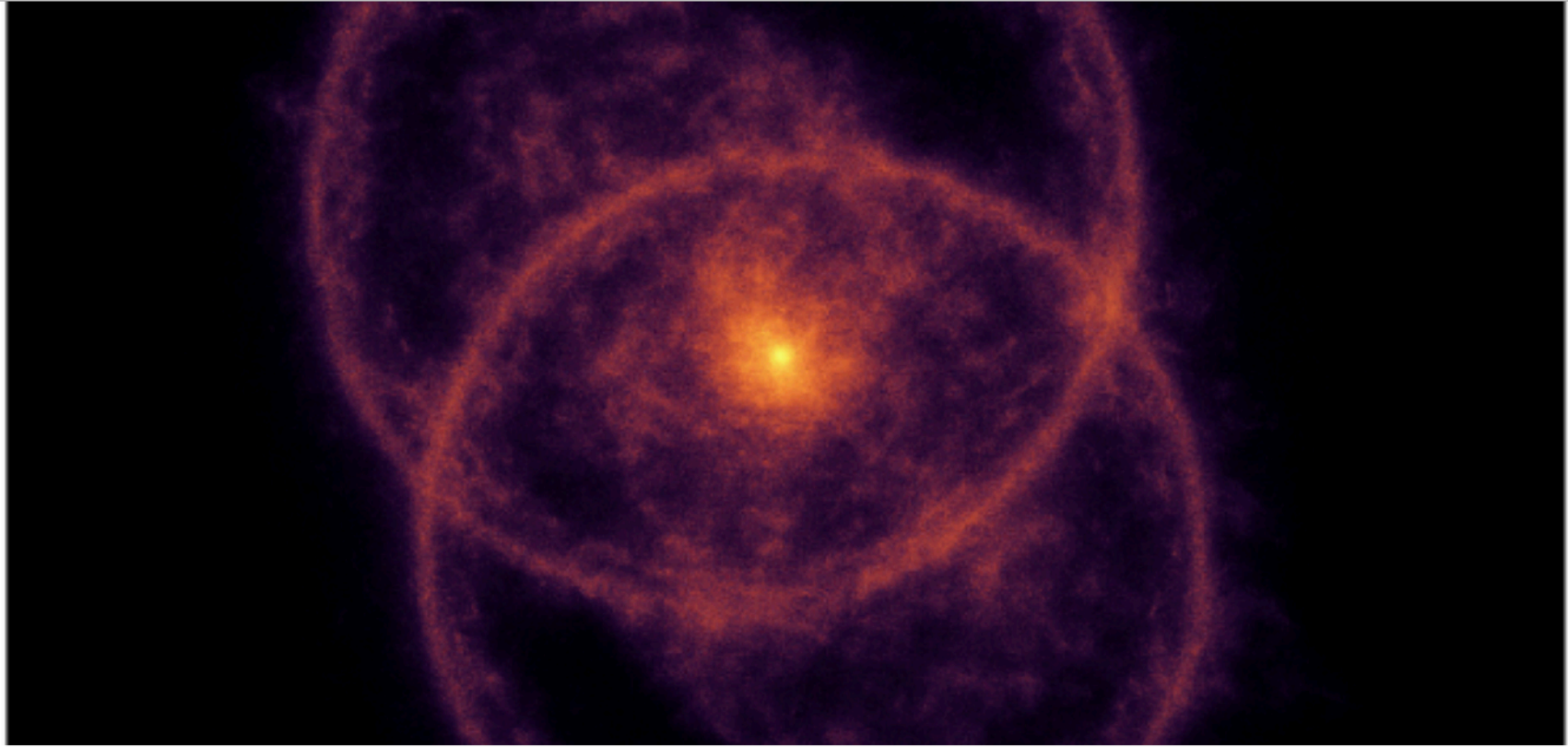
Editors' Choice

CNN science

## Astronomers discover rare radio circle in space

OCT 14, 2025

By Ashley Strickland



Astrofizyk NCBJ jednym z odkrywców największego „nietypowego kręgu radiowego”

nature india

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RESEARCH HIGHLIGHT | 09 October 2025

## Most powerful ‘Odd Radio Circle’ so far discovered

Farthest example of relatively new astronomical phenomenon spotted with help of citizen scientists.

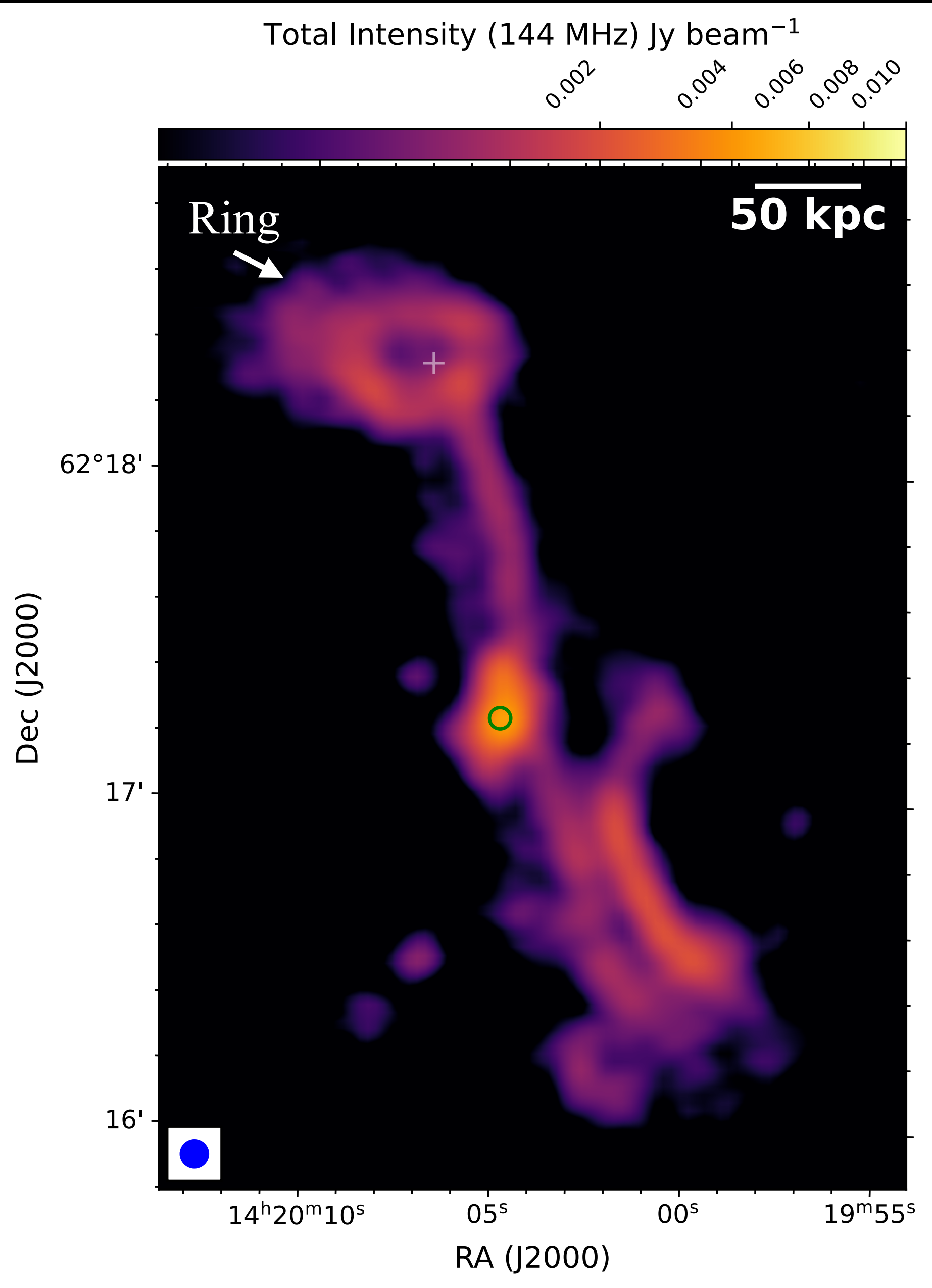
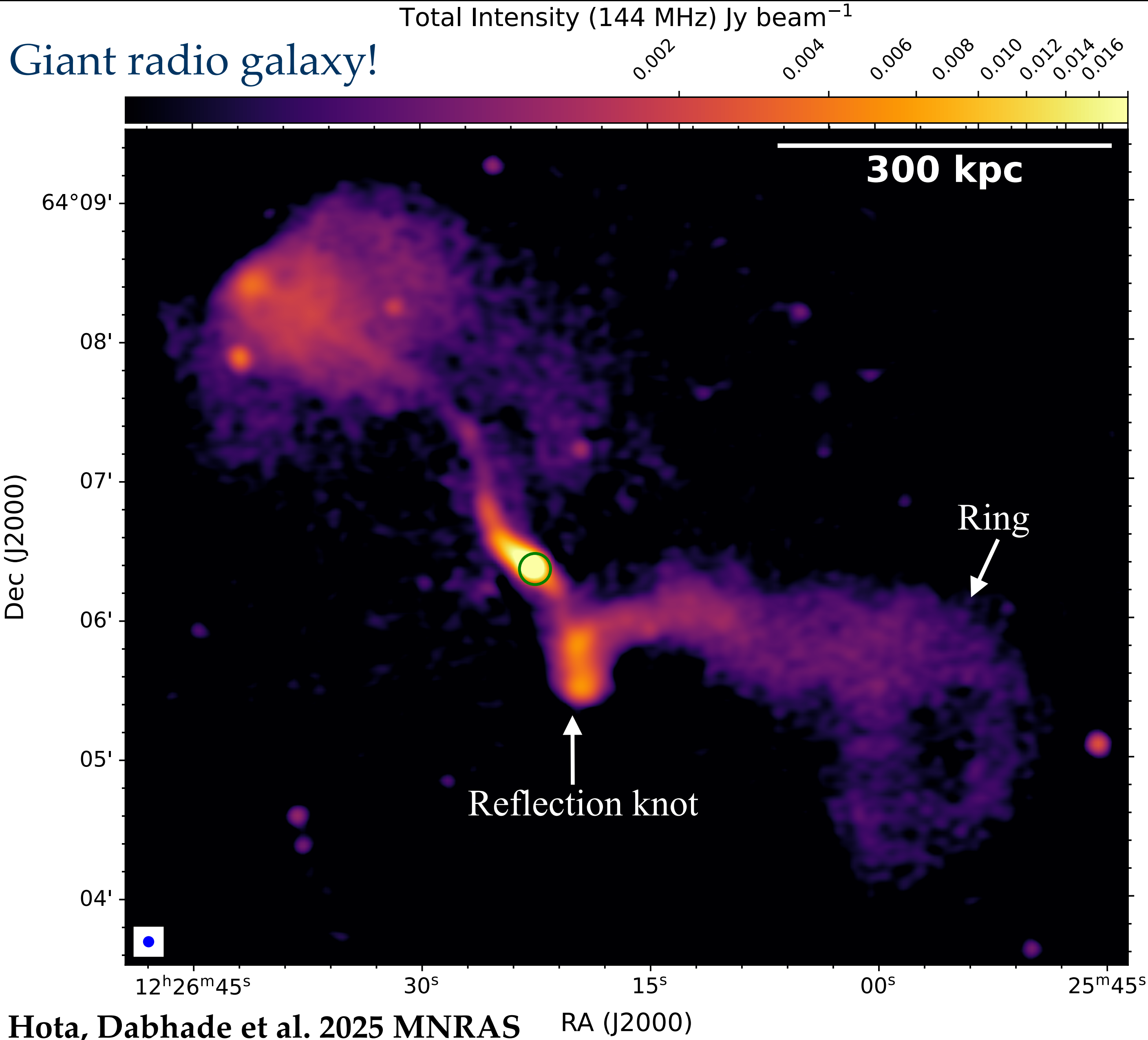
In the Spotlight of International Press



Rare radio rings in radio galaxies

→

Strong interaction with turbulent cluster environment





- Current deep radio surveys are revealing objects hidden for over 7 decades!
- Next generation surveys (radio + Optical) will challenge us with lot of data & puzzling objects.

**Automated algorithms - Machine learning!**

**+**

**Citizen Science !**

**Thank you**