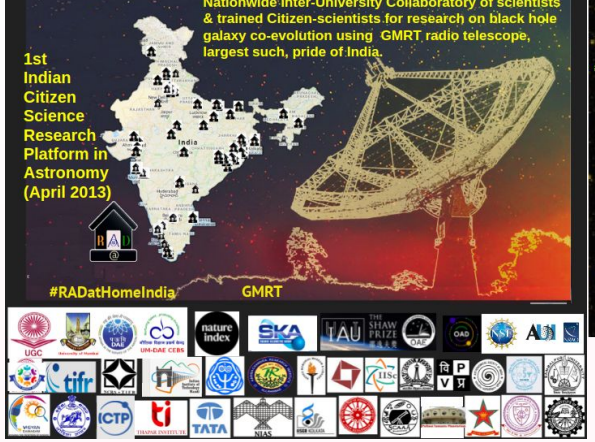
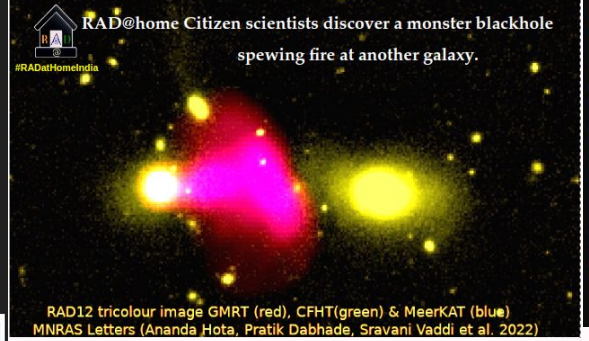




International expansion of RAD@home citizen science collaboratory for black hole galaxy co-evolution

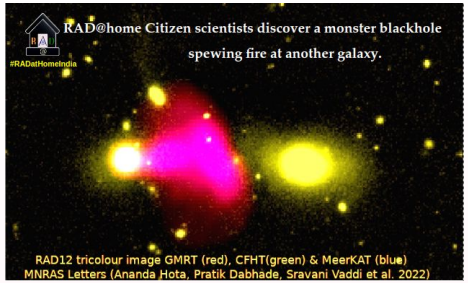
Dr. Ananda Hota

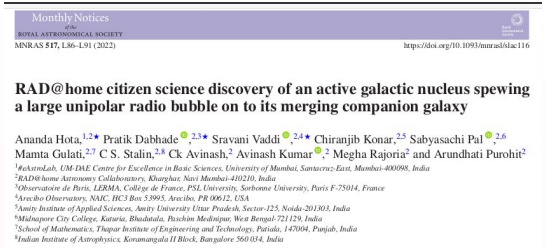
UGC faculty, UM-DAE Centre for Excellence in Basic Sciences, University of Mumbai, &

Director & Principal Investigator, RAD@home Astronomy Collaboratory, India

12th SEAAN meeting (1-2 Feb 2023) https://indico.narit.or.th/event/175/

#RADatHomeIndia https://radathomeindia.org/ radathomeindia@gmail.com





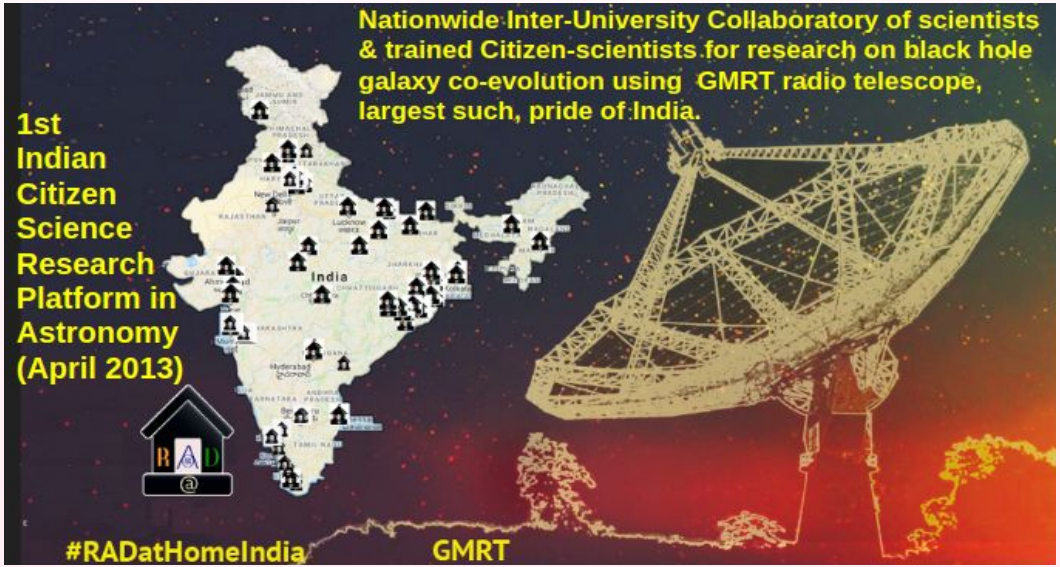
Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY

MNRAS **517**, L86–L91 (2022) https://doi.org/10.1093/mnrasl/slac116

RAD@home citizen science discovery of an active galactic nucleus spewing a large unipolar radio bubble on to its merging companion galaxy

Ananda Hota,[1,2]★ Pratik Dabhade,[2,3]★ Sravani Vaddi,[2,4]★ Chiranjib Konar,[2,5] Sabyasachi Pal,[2,6] Mamta Gulati,[2,7] C S. Stalin,[2,8] Ck Avinash,[2] Avinash Kumar,[2] Megha Rajoria[2] and Arundhati Purohit[2]

[1]#AstroLab, UM-DAE Centre for Excellence in Basic Sciences, University of Mumbai, Santacruz-East, Mumbai-400098, India
[2]RAD@home Astronomy Collaboratory, Kharghar, Navi Mumbai-410210, India
[3]Observatoire de Paris, LERMA, Collège de France, PSL University, Sorbonne University, Paris F-75014, France
[4]Arecibo Observatory, NAIC, HC3 Box 53995, Arecibo, PR 00612, USA
[5]Amity Institute of Applied Sciences, Amity University Uttar Pradesh, Sector-125, Noida-201303, India
[6]Midnapore City College, Kuturia, Bhadatala, Paschim Medinipur, West Bengal-721129, India
[7]School of Mathematics, Thapar Institute of Engineering and Technology, Patiala, 147004, Punjab, India
[8]Indian Institute of Astrophysics, Koramangala II Block, Bangalore 560 034, India



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International recognitions to #RADatHomeIndia

nature INDEX
www.natureindex.com/

SKA
SQUARE KILOMETRE ARRAY

IAU
100 YEARS: UNDER ONE SKY

RAD@home is 1 of 7 citizen science research programme in the world in radio astronomy f

www.go.nature.com/2ZJraif

https://www.iau.org/public/callforonlineresources/

https://www.skatelescope.org/outreachandeducation/outreach-resources/citizen-science/

#RADatHomeIndia a Collaboratory Model of Citizen Science Research

(Big-data is a big-resource for development if citizen science follows a Collaboratory approach)

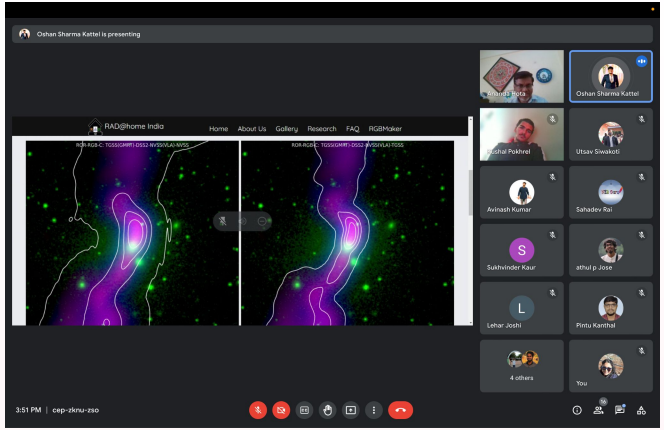
Speaker: Ananda Hota, UGC-faculty, UM-DAE Centre for Excellence in Basic Sciences, RAD@home Astronomy Collaboratory, India

RAD@home (#RADatHomeIndia) is a nationwide, Inter-University Collaboratory of professional astronomers, trained citizen scientists and technical/administrative facilitators. It is the only Indian citizen science research platform in astronomy. Nearly 30 institutes and similar number of professionals have contributed to its growth since 2013. In a "flying pyramid" model, scientists and facilitators are its wings, and large number trained citizen-scientists (e-/i-astronomers) at multiple levels of expertise make the multi-layer pyramid. It has 150 e-astronomers, 1000 i-astronomers, 2500 active learners, 4700 total members. This way citizens achieve GMRT telescope time, co-authorship in papers on galaxy evolution and MS/PhD selections abroad or all round growth.

Talk link: https://youtu.be/VMZzP4BPCsU

IAU OAE THE SHAW PRIZE 邵逸夫獎

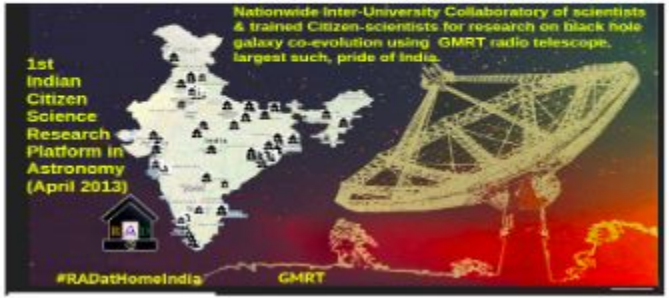
#RADatHomeIndia https://radathomeindia.org/ radathomeindia@gmail.com



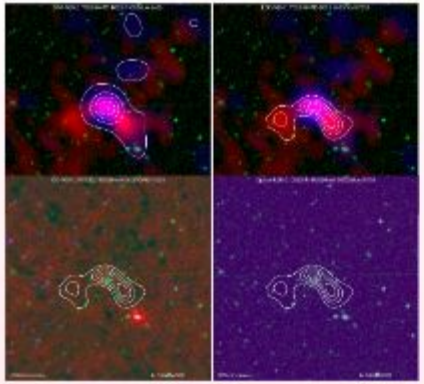
RAD@home participated in the IAU symposium 375: Multi-messenger Chakra of Blazer jets (w/ IAU & UGC grants)

#RADatHomeIndia https://radathomeindia.org/ radathomeindia@gmail.com

RAD@home Inter-University Collaboratory for citizen science in galaxy evolution with multi-wavelength RGB images



By
Megha Rajoria
Head of collaborative Programs
RAD@home India
6 December 2022

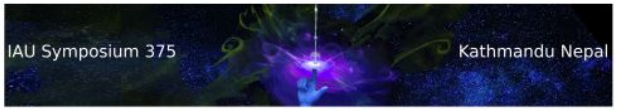


RAD@home RGB-maker tool for citizen science research

In multiwavelength study of AGNs with radio jets

Avinash Kumar
RAD@home India

6 December 2022, RAD@IAUSymposium375, Kathmandu



Certificate of outreach organization

The organisers of IAU symposium 375 are grateful to RAD@home Astronomy Collaboratory (India) and glad to certify that RAD@home members:

1. Contributed three oral presentations to the scientific program of the symposium.
2. Trained nearly a dozen student-participants for citizen science research before the start of the symposium in online weekend e-classes.
3. Conducted one of the three successful in-person outreach events, organized as part to the symposium's activities, with over 100 participants.
4. Attracted more than 200 online registrations who will continue to receive educational/outreach content through emails.

Date: 09/12/22

Professor Vasiliki Pavlidou
Institute of Astrophysics & Physics Department, University of Crete.
Chair of the Scientific Organizing Committee.

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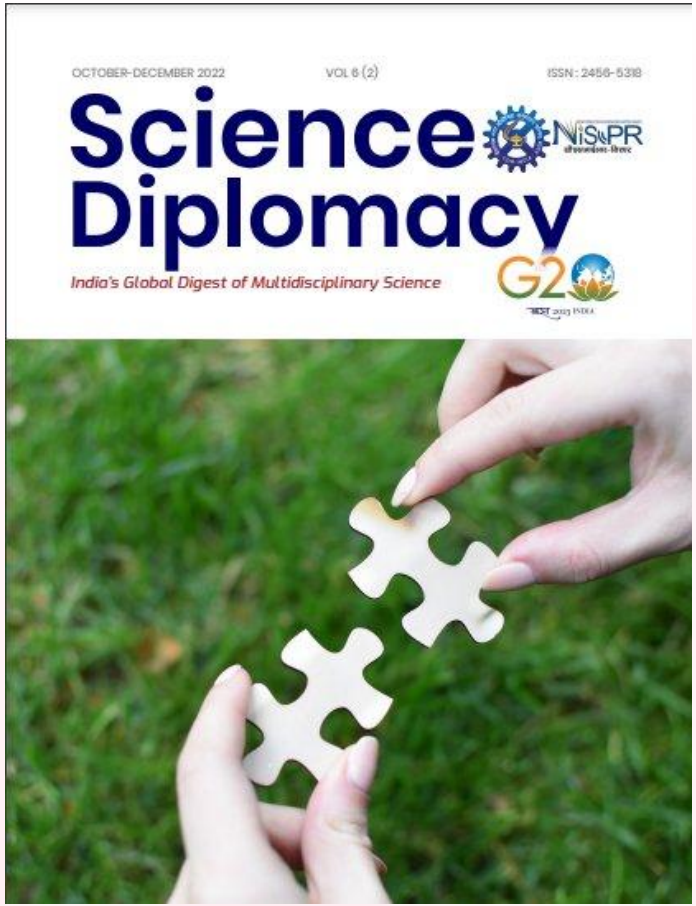


Citizen Science

RAD@home India Citizen Science Diplomacy at the International Astronomical Union Symposium 375, Nepal

Megha Rajoria[a,*], Ananda Hota[a,b]
[a]RAD@home Astronomy Collaboratory, India
[b]UGC-faculty, UM-DAE Centre for Excellence in Basic Sciences, University of Mumbai, India
*Corresponding author: megharajoria3@gmail.com

"When you look at the stars and the galaxy, you feel that you are not just from any particular piece of land, but from the solar system" Kalpana Chawla

The striking words of Kalpana Chawla give us a reason to believe that all of us are just a dot in the Universe. And we are separated by human-made borders, although astronomically, we belong to one of the solar systems. RAD@home Astronomy Collaboratory, which is India's first citizen science research project in astronomy, has gone beyond the Indian border and was part of the International Astronomical Union's (IAU) Symposium 375, "The multi-messenger chakra of blazar jets", held in Kathmandu, Nepal between 5-9 December 2022. Leading members of the Collaboratory presented their recent discovery of a black hole galaxy system RAD12(1-3) and also conducted an Astronomy workshop for Nepali citizens. The collaboratory has been active in India for almost a decade now. It enables the science-educated masses from across the country in discovering Radio Galaxies by training them with the support of various Indian institutes.

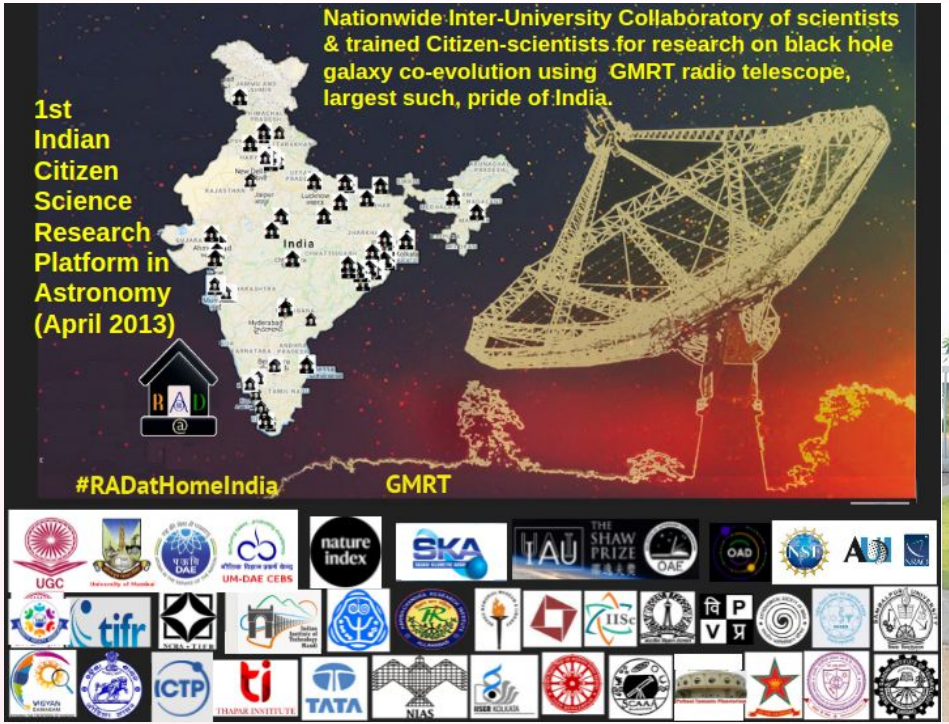
Figure 1. RAD@home Astronomy Workshop, an outreach event as part of IAU symposium 375, Kathmandu, Nepal

October - December 2022 | Science Diplomacy 20

#RADatHomeIndia https://radathomeindia.org/ radathomeindia@gmail.com

RAD@home Inter-University Collaboratory

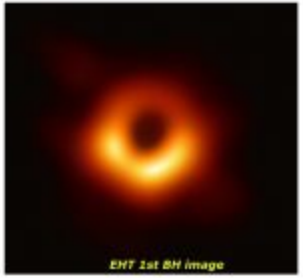
Zero Funded - Zero Infrastructure - Nationwide Human Resource Network



#RADatIAU375 #RADatHomeIndia www.radathomeindia.org

#RADatHomeIndia https://radathomeindia.org/ radathomeindia@gmail.com

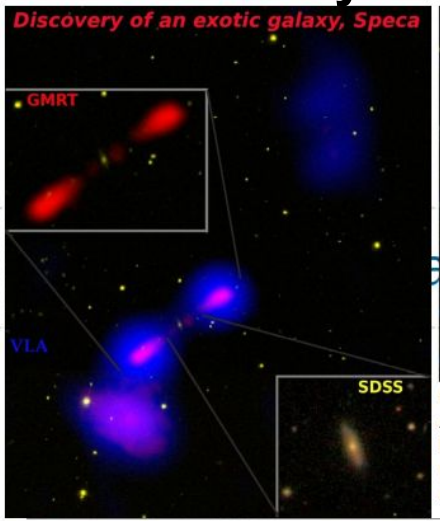
Dream & Reality

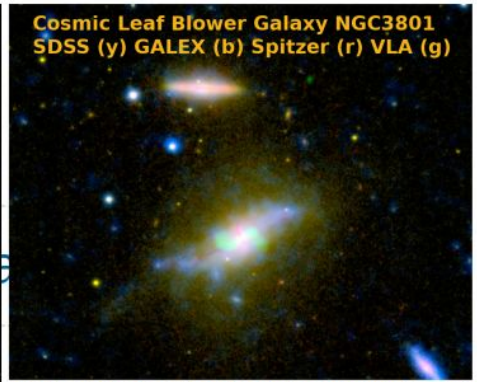


Science Education @University
and Doing Research@home

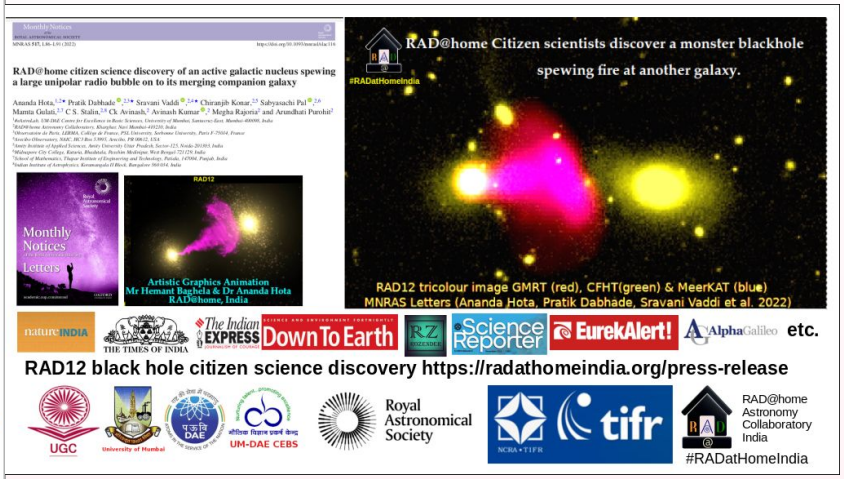
fb.com/groups/RADathome/

Primary Science Goals of RAD@home Collaboratory





Discovery of a spiral-host episodic radio-galaxy
Ananda Hota et al. 2011 MNRAS, 2016 JApA, P.R.
NGC3801 caught in the act: A post-merger starforming early-type galaxy with AGN-jet feedback
Ananda Hota et al. 2012 MNRAS, 2016 JApA, P.R.

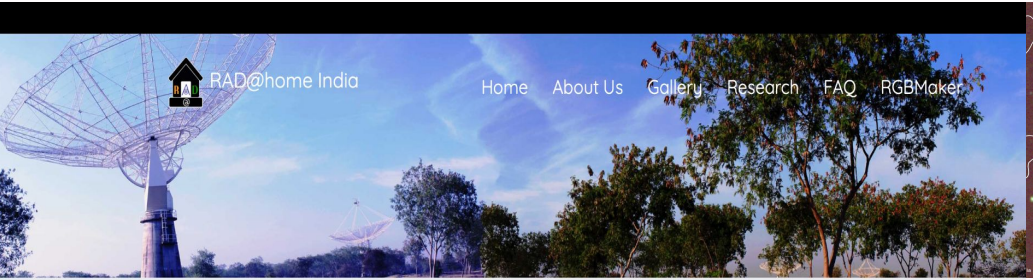


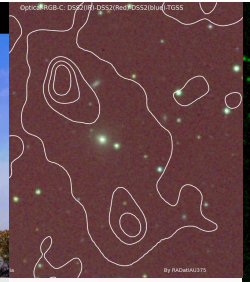
GOOD-RAC (GMRT follow-up)

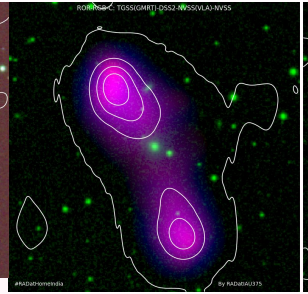
Discovery @ home

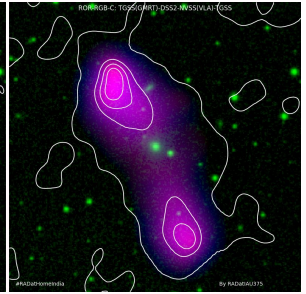
#RADatIAU375 #RADatHomeIndia www.radathomeindia.org

What do we teach? RGB Image Analysis!









#RADatHomeIndia RGB Maker

Name

Your Name

Position

Object Name or Coordinate

Size (in degrees)

0.12

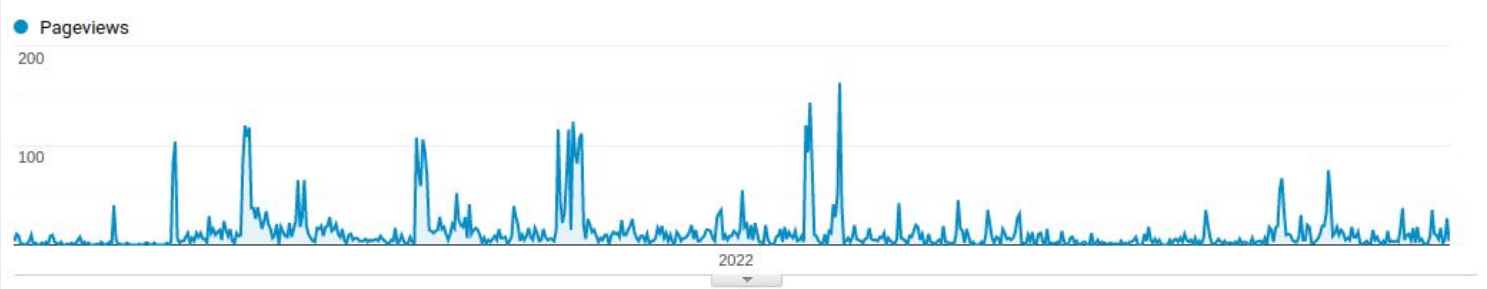
Images (?)

IOU ROR Optical

Archives (?)

None

query



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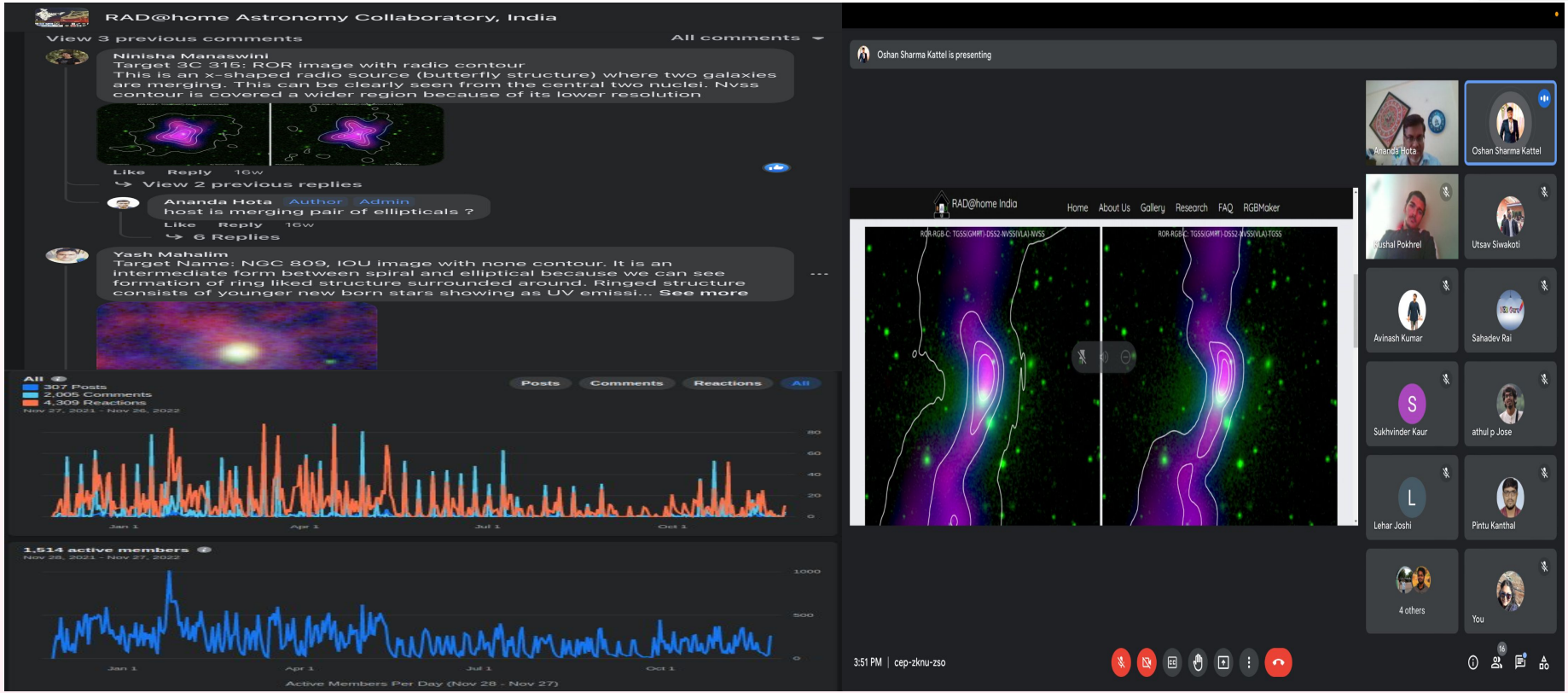
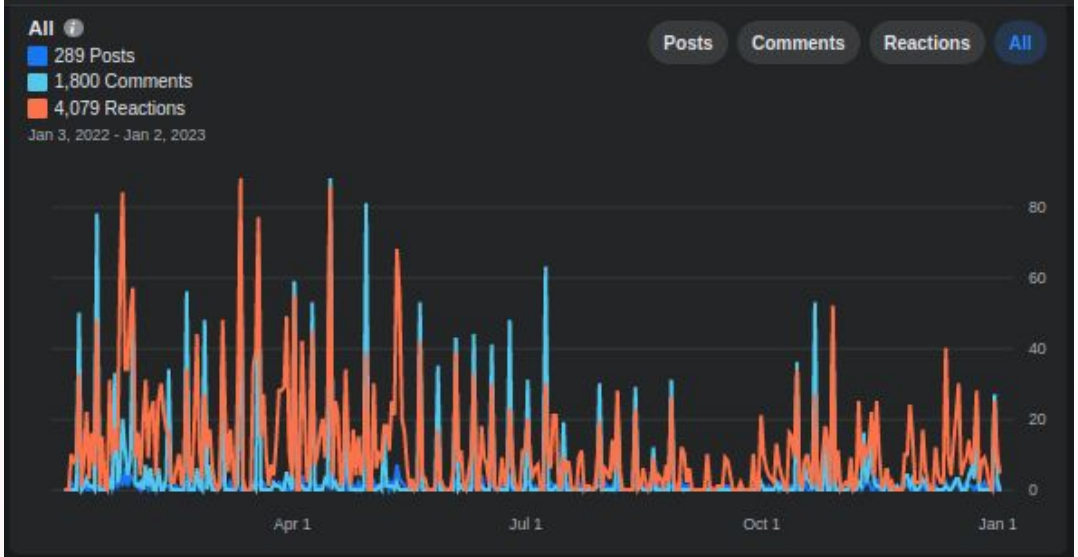
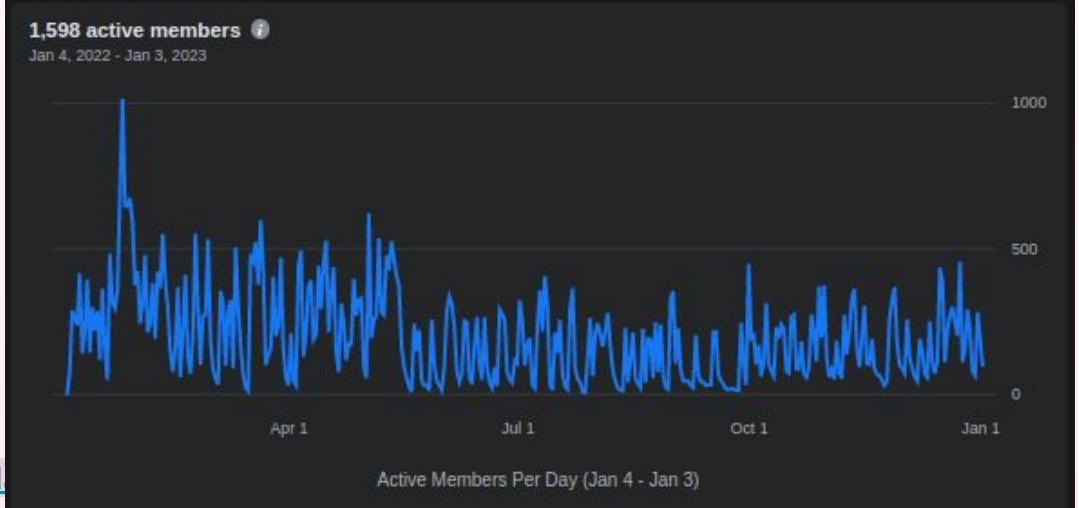
Interactive Learning in Social Media - Weekly e-class



#RADatIAU375 #RADatHomeIndia www.radathomeindia.org

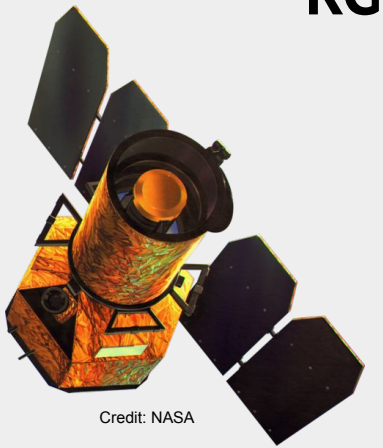
#RADatHomeIndia https://radathomeindia.org/ radathomeindia@gmail.com





#RADatHomeIndia https://rad

RGB Maker : Multiwavelength analysis



Credit: NASA

GALEX - NUV, FUV

Credit: NRAO/AUI/NSF

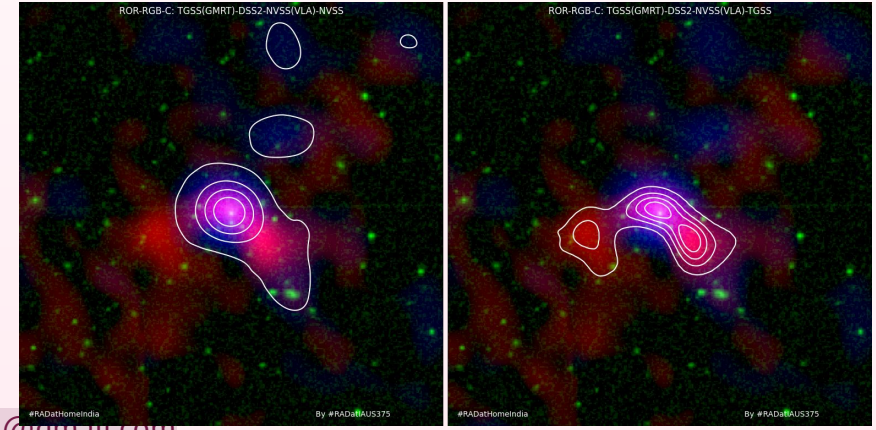
Very Large Array - FIRST, NVSS

Credit: Avi

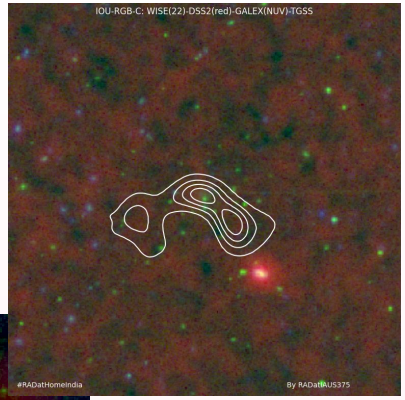
GMRT - TGSS

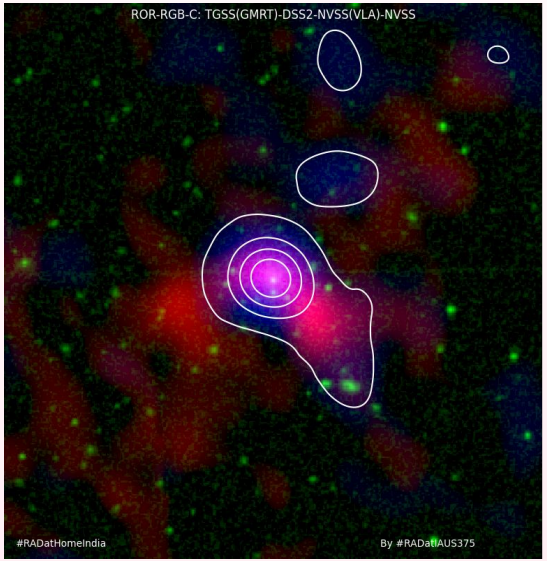
30 dishes, 25 Km Baseline

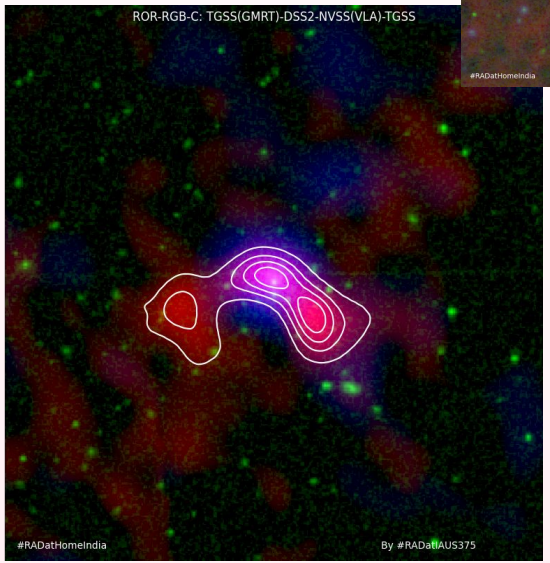
Each RGB image is a combination of these imaging survey data in Red, Green, and Blue color channels, with their respective intensities at each pixel, resulting in a false-colored image.



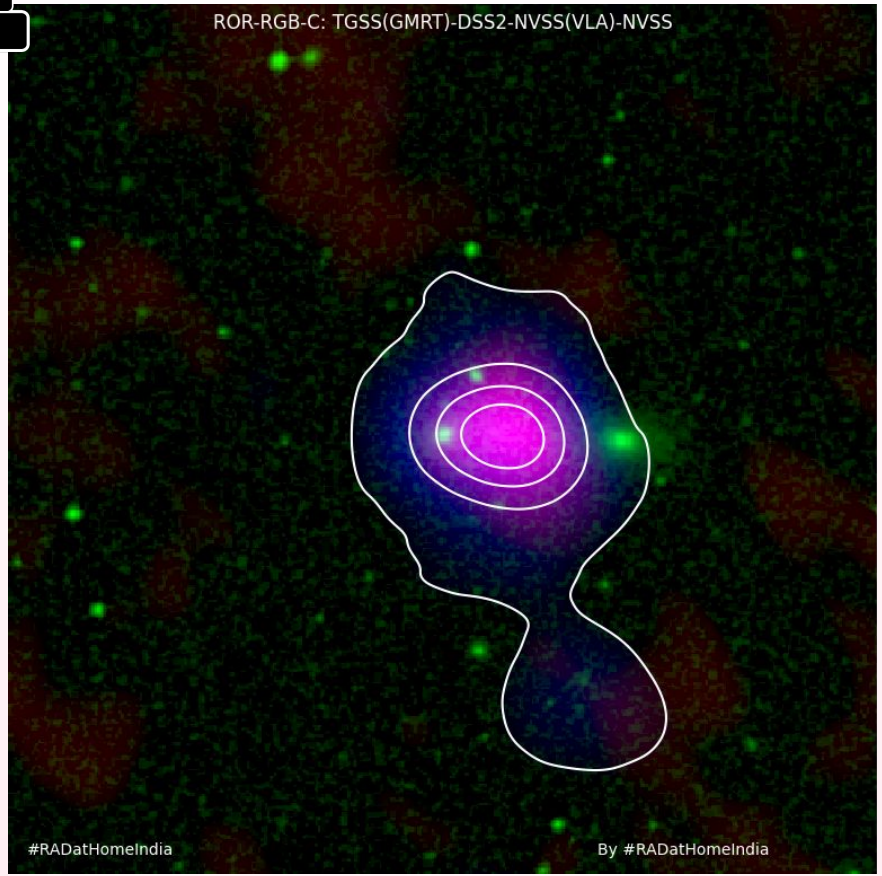
How to Discover ?

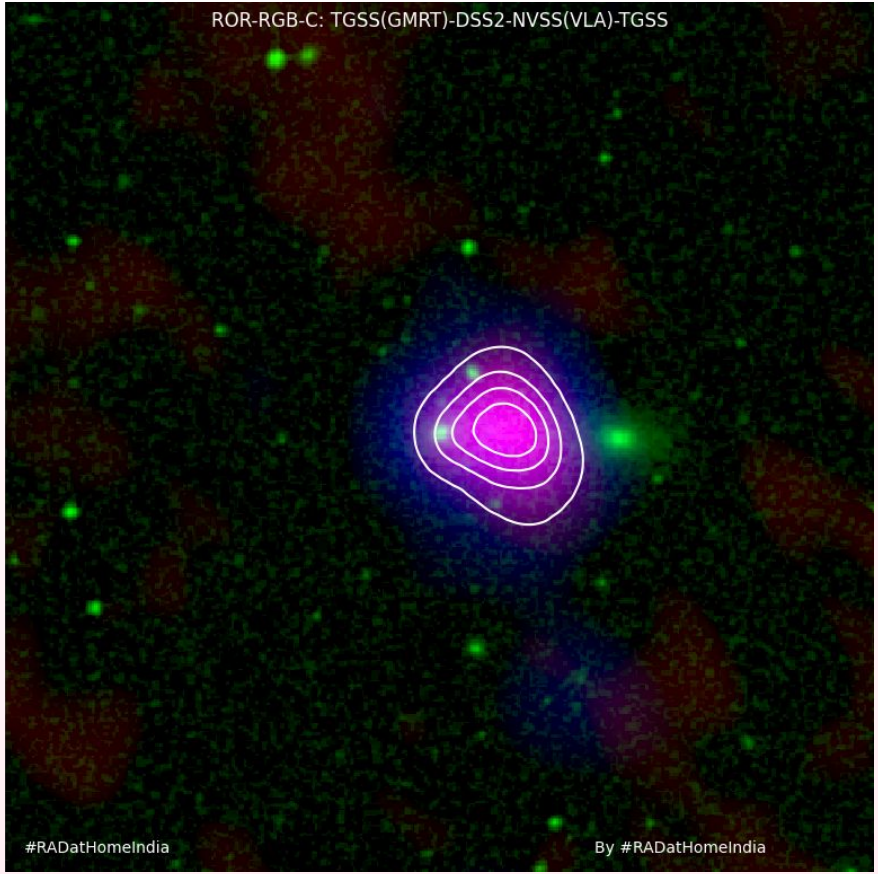






Gut-feeling for RAD-12 from RGB images in 2013 !!





RAD@home Publications with Citizen scientists as co-author(s)

Cornell University Library

arXiv.org > astro-ph > arXiv:1402.3674

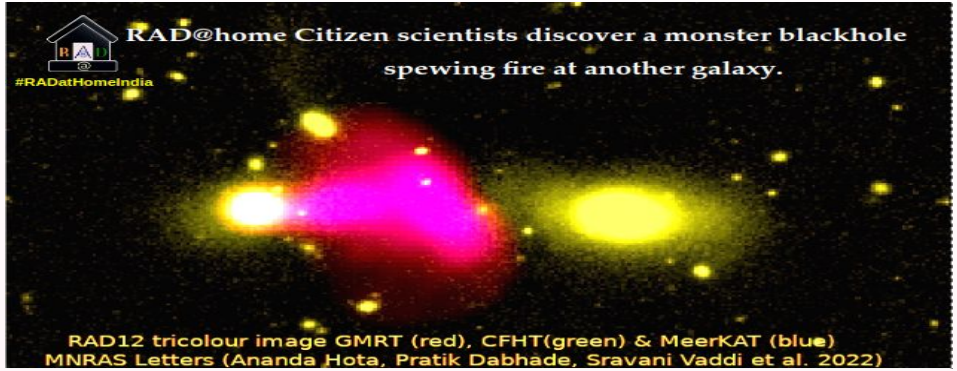
Astrophysics > Astrophysics of Galaxies

New results on the exotic galaxy `Speca' and discovering many more Specas with RAD@home network

Ananda Hota (1, 2), Judith H. Croston (3), Youichi Ohyama (4), C. S. Stalin (5), Martin J. Hardcastle (6), Chiranjib Konar (4), R.P. Aravind (2), Sheena M. Agarwal (2), Sai Arun Dharmik Bhoga (2), Pratik A. Dabhade (2), Amit A. Kamble (2), Pradeepta K. Mohanty (2), Alok Mukherjee (2), Akansha V. Pandey (2), Alakananda Patra (2), Renuka Pechetti (2), Shrishail S. Raut (2), V. Sushma (2), Sravani Vaddi (2), Nishchhal Verma (2) ((1) UM-DAE CBS, India, (2) RAD@home Astronomy Collaboratory, India, (3) U Southampton, UK, (4) ASIAA, Taiwan, (5) IIA, India, (6) U Hertfordshire, UK)

(Submitted on 15 Feb 2014)

We present the first report on an innovative new project named "RAD@home", a citizen-science research collaboratory built on free web-services like Facebook, Google, Skype, NASA Skyview, NED, TGSS etc.. This is the first of its kind in India, a zero-funded, zero-infrastructure, human-resource network to educate and directly involve in research, hundreds of science-




Volume 37 · Number 4 · December 2016

Journal of Astrophysics & Astronomy

Special Issue: Science with the Square Kilometre Array: An Indian Perspective

Indian Academy of Sciences | Springer

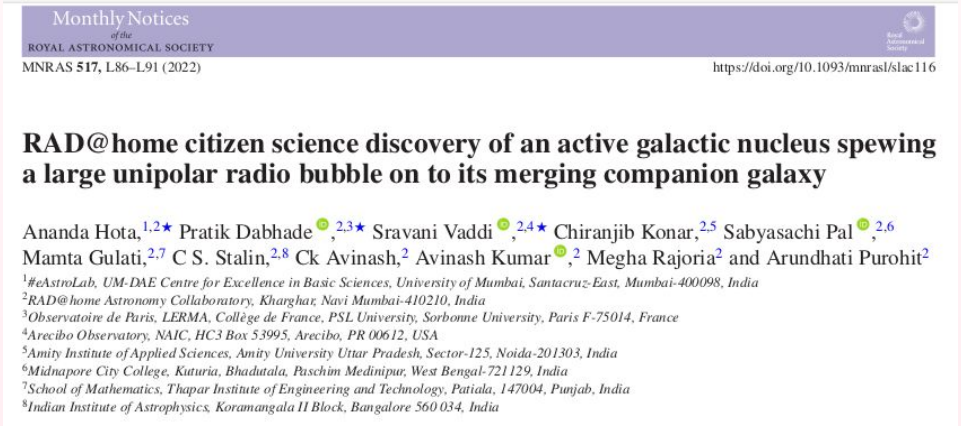
Review

J. Astrophys. Astr. (2016) 37:41
DOI: 10.1007/s12036-016-9415-8

Tracking Galaxy Evolution Through Low-Frequency Radio Continuum Observations using SKA and Citizen-Science Research using Multi-Wavelength Data

Ananda Hota[1,2,*], C. Konar[2,3], C. S. Stalin[4], Sravani Vaddi[5], Pradeepta K. Mohanty[2], Pratik Dabhade[2], Sai Arun Dharmik Bhoga[2], Megha Rajoria[2] & Sagar Sethi[2]

[1]#eAstroLab, UM-DAE Centre for Excellence in Basic Sciences, Vidyanagari, Mumbai 400 098, India.
[2]RAD@home Astronomy Collaboratory, Mumbai, India.
[3]Amity Institute of Applied Sciences, Amity University Uttar Pradesh, Sector-125, Noida, India.
[4]Indian Institute of Astrophysics, Koramangala, Bangalore 560 034, India.
[5]National Centre for Radio Astrophysics, Tata Institute of Fundamental Research, Ganeshkhind, Post Bag No. 3, Pune 411 007, India.
*e-mail: hotaananda@gmail.com

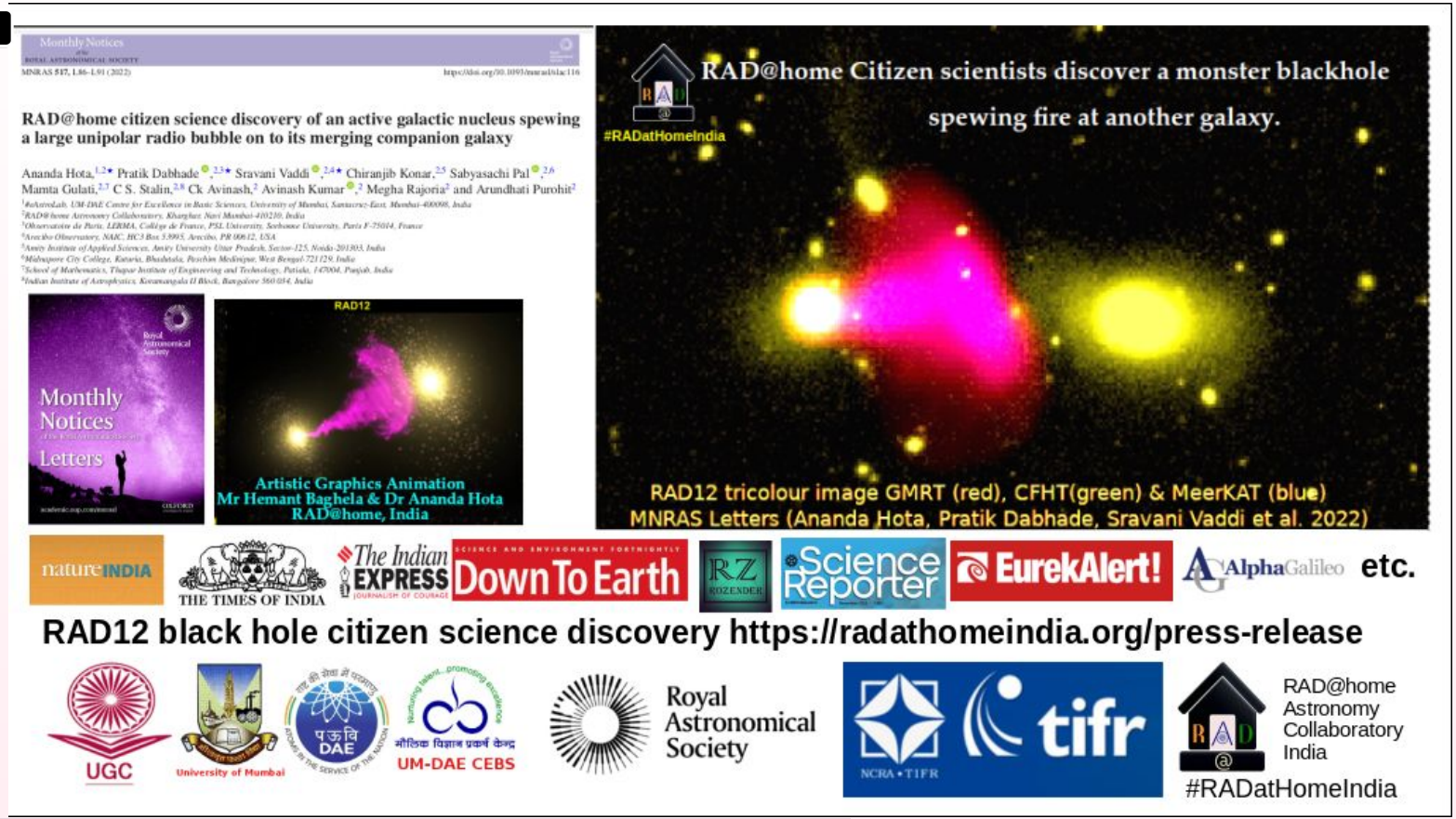

Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY

MNRAS 517, L86–L91 (2022) https://doi.org/10.1093/mnrasl/slac116

RAD@home citizen science discovery of an active galactic nucleus spewing a large unipolar radio bubble on to its merging companion galaxy

Ananda Hota,[1,2★] Pratik Dabhade,[2,3★] Sravani Vaddi,[2,4★] Chiranjib Konar,[2,5] Sabyasachi Pal,[2,6] Mamta Gulati,[2,7] C S. Stalin,[2,8] Ck Avinash,[2] Avinash Kumar,[2] Megha Rajoria[2] and Arundhati Purohit[2]

[1]#eAstroLab, UM-DAE Centre for Excellence in Basic Sciences, University of Mumbai, Santacruz-East, Mumbai-400098, India
[2]RAD@home Astronomy Collaboratory, Kharghar, Navi Mumbai-410210, India
[3]Observatoire de Paris, LERMA, Collège de France, PSL University, Sorbonne University, Paris F-75014, France
[4]Arecibo Observatory, NAIC, HC3 Box 53995, Arecibo, PR 00612, USA
[5]Amity Institute of Applied Sciences, Amity University Uttar Pradesh, Sector-125, Noida-201303, India
[6]Midnapore City College, Kuturia, Bhadutala, Paschim Medinipur, West Bengal-721129, India
[7]School of Mathematics, Thapar Institute of Engineering and Technology, Patiala, 147004, Punjab, India
[8]Indian Institute of Astrophysics, Koramangala II Block, Bangalore 560 034, India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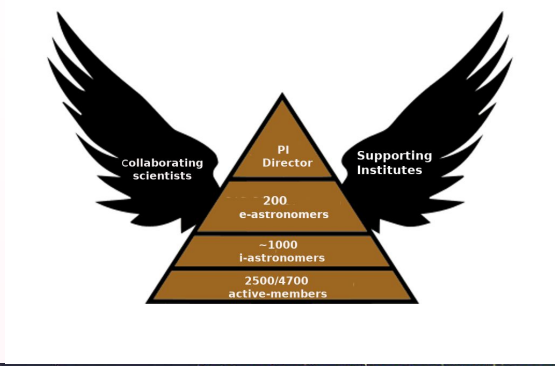
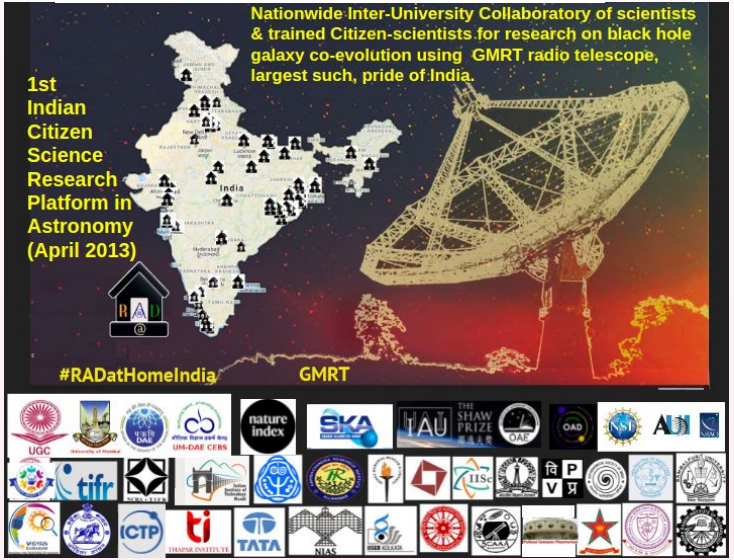
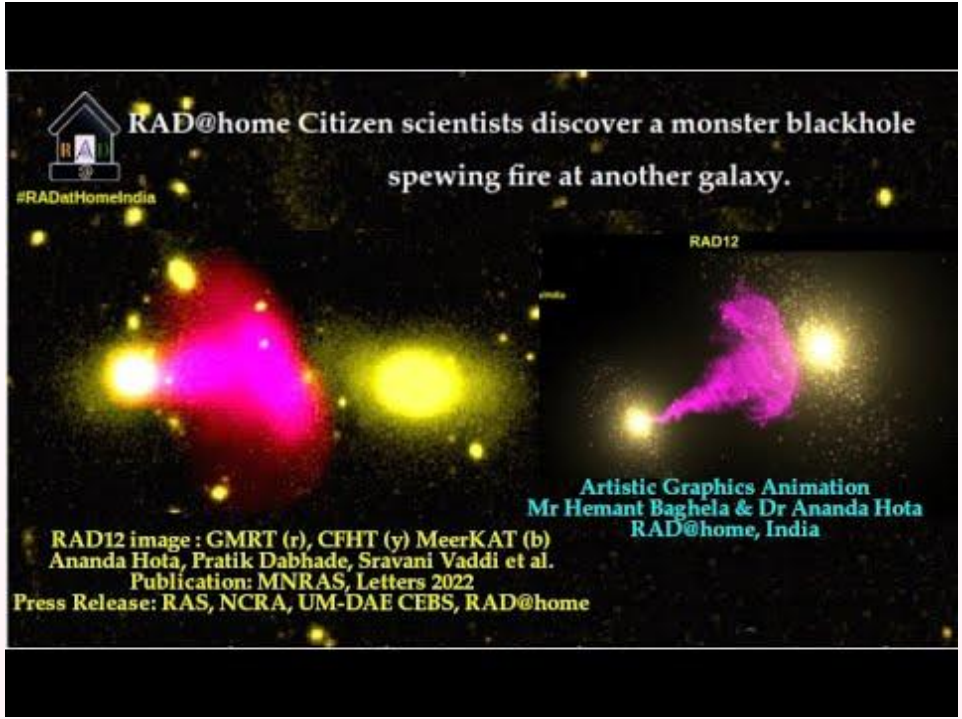
Monthly Notices Letters
RAD12
Artistic Graphics Animation
Mr Hemant Baghela & Dr Ananda Hota
RAD@home, India
#RADatHomeIndia
RAD@home Citizen scientists discover a monster blackhole spewing fire at another galaxy.
RAD12 tricolour image GMRT (red), CFHT(green) & MeerKAT (blue)
MNRAS Letters (Ananda Hota, Pratik Dabhade, Sravani Vaddi et al. 2022)
nature INDIA
THE TIMES OF INDIA
The Indian EXPRESS
Down To Earth
Science Reporter
EurekAlert!
AlphaGalileo
etc.
RAD12 black hole citizen science discovery https://radathomeindia.org/press-release
UGC
University of Mumbai
UM-DAE CEBS
Royal Astronomical Society
tifr
NCRA • TIFR
RAD@home Astronomy Collaboratory India
#RADatHomeIndia



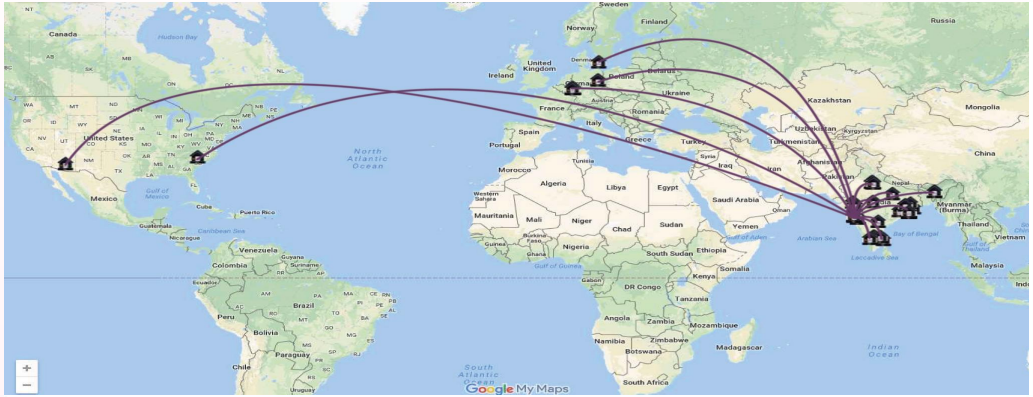


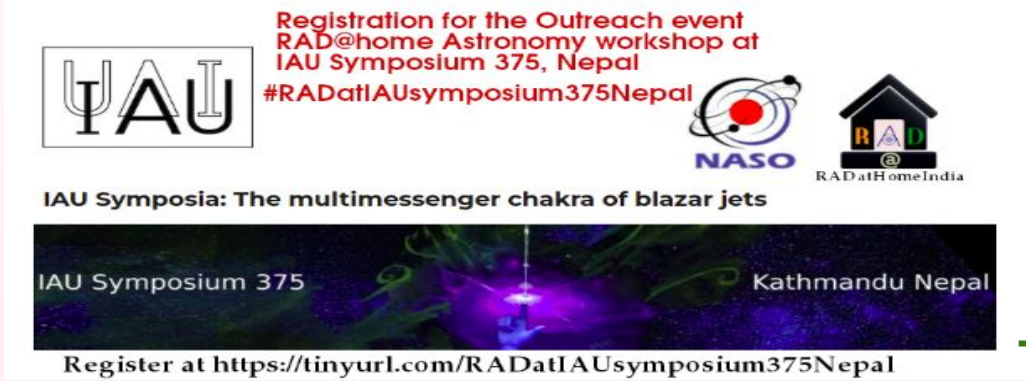


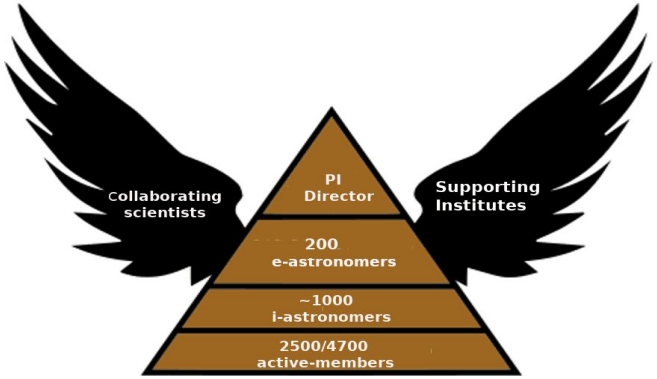
https://youtu.be/BwnfUq5mCEE

#RADatHomeIndia https://radathomeindia.org/ radathomeindia@gmail.com

International Expansion with RAD@IAU375





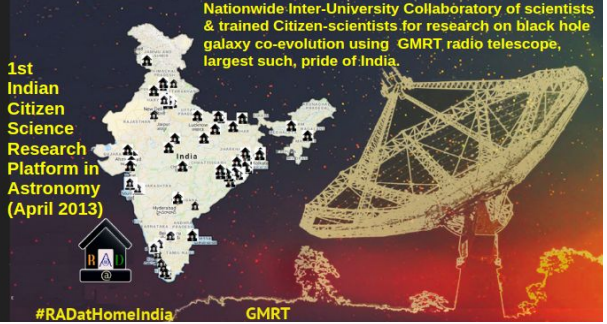


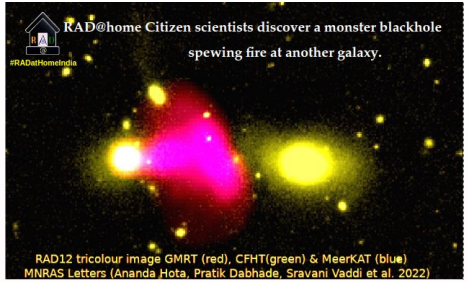
Let's collaborate!
radathomeindia@gmail.com

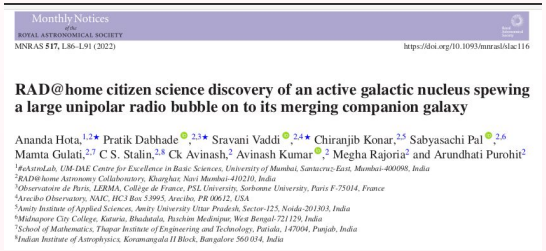
Thank you IAU for the kick-start.

#RADatIAU375 #RADatHomeIndia www.radathomeindia.org

#RADatHomeIndia https://radathomeindia.org/ radathomeindia@gmail.com







Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY

MNRAS 517, L86–L91 (2022) https://doi.org/10.1093/mnrasl/slac116

RAD@home citizen science discovery of an active galactic nucleus spewing a large unipolar radio bubble on to its merging companion galaxy

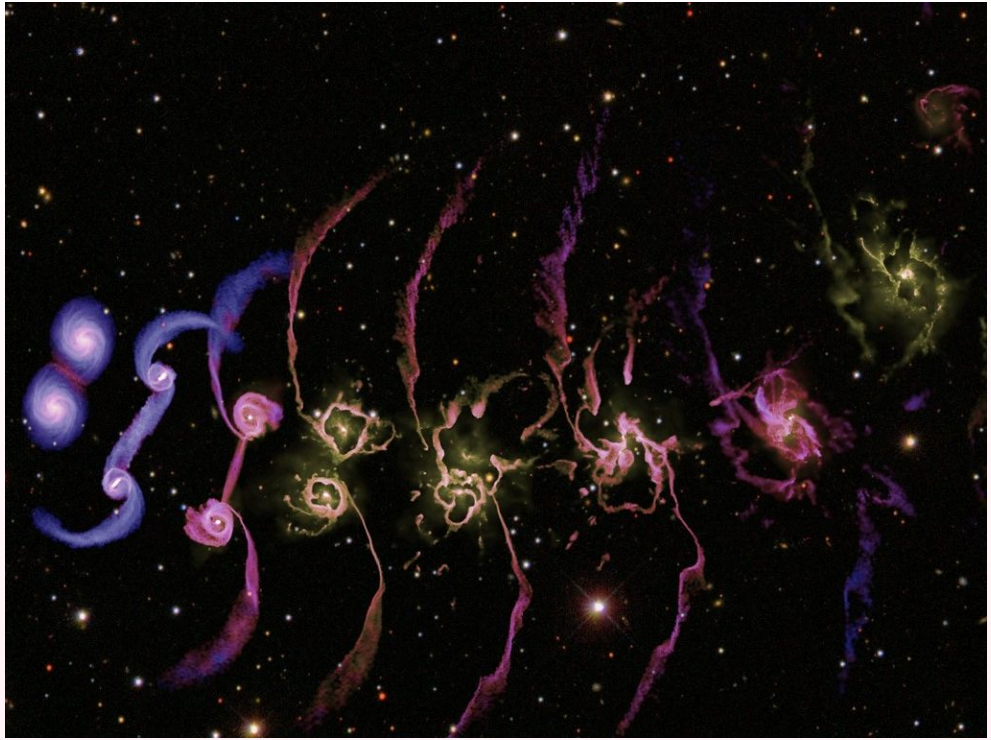
Ananda Hota,[1,2]★ Pratik Dabhade,[2,3]★ Sravani Vaddi,[2,4]★ Chiranjib Konar,[2,5] Sabyasachi Pal,[2,6] Mamta Gulati,[2,7] C S. Stalin,[2,8] Ck Avinash,[2] Avinash Kumar,[2] Megha Rajoria[2] and Arundhati Purohit[2]

[1]*ReAstroLab, UM-DAE Centre for Excellence in Basic Sciences, University of Mumbai, Santacruz-East, Mumbai-400098, India*
[2]*RAD@home Astronomy Collaboratory, Kharghar, Navi Mumbai-410210, India*
[3]*Observatoire de Paris, LERMA, Collège de France, PSL University, Sorbonne University, Paris F-75014, France*
[4]*Arecibo Observatory, NAIC, HC3 Box 53995, Arecibo, PR 00612, USA*
[5]*Amity Institute of Applied Sciences, Amity University Uttar Pradesh, Sector-125, Noida-201303, India*
[6]*Midnapore City College, Kuturia, Bhadatala, Paschim Medinipur, West Bengal-721129, India*
[7]*School of Mathematics, Thapar Institute of Engineering and Technology, Patiala, 147004, Punjab, India*
[8]*Indian Institute of Astrophysics, Koramangala II Block, Bangalore 560034, India*

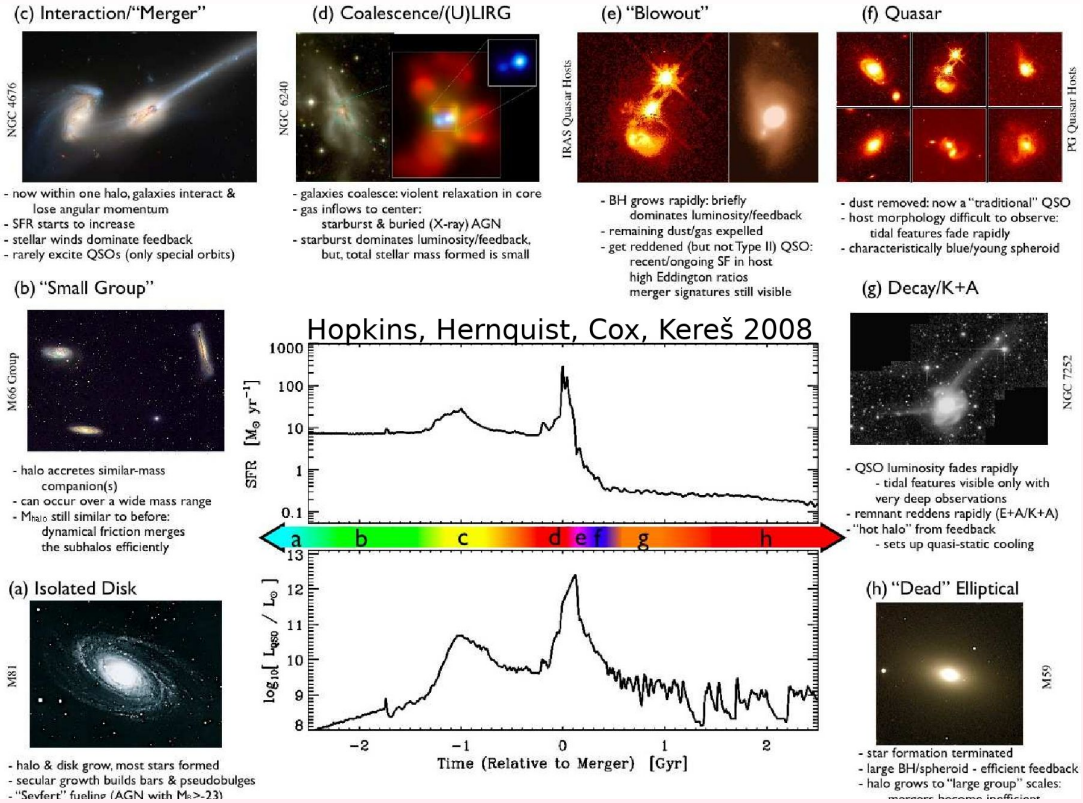
Thank you

Lets Collaborate....

#RADatHomeIndia https://radathomeindia.org/ radathomeindia@gmail.com



Feedback during major galaxy merger (Springel et al. 2005)



What about radio jets ?

Oh, they are powerful but
In BCGs and massive ellipticals.

NO .....

Picture is changing....

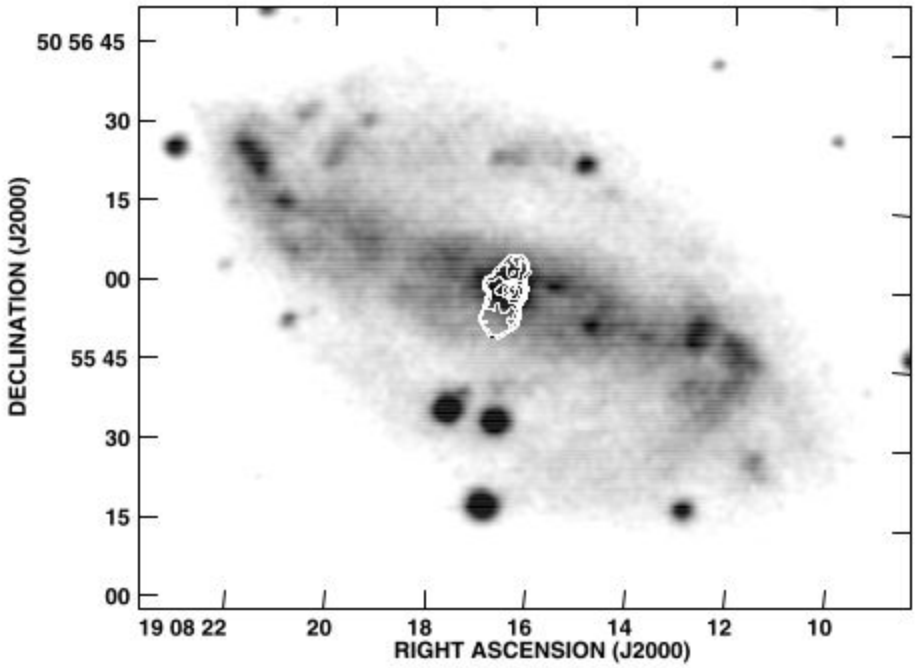
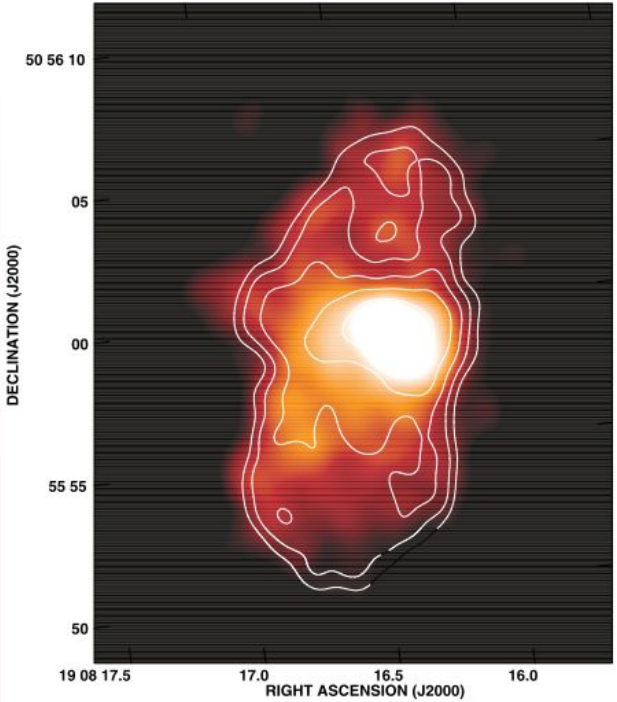


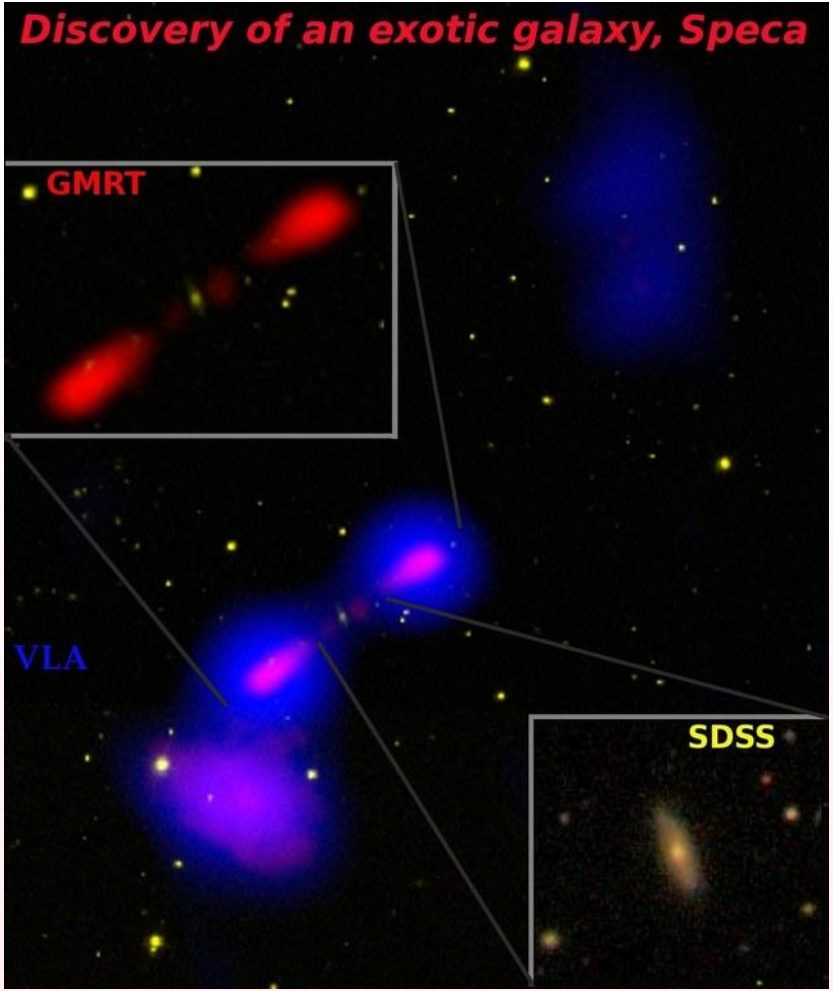
FIG. 1.—Shows 1.4 GHz radio contours of NGC 6764 overlaid on a DSS-2 optical image of the host galaxy. The radio map is made from VLA archival data as published in HS06. Contour levels are $(1.5 \times 10^{-4}) \times 1, 2, 4, \ldots, 512$ Jy beam^{-1}.

Hota & Saikia 2006, Croston et al. 2008



Chandra X-ray on VLA radio contours
Croston et al. 2008 & Hota & Saikia 2006

Prevalence of kpc-scale jet/bubble can be up to 50% in Seyfert galaxies .... If low frequency & diffuse sensitivity !
NGC6764 or Cen A, energy imparted can be comparable to binding energy of the ISM !



Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY LETTERS

Mon. Not. R. Astron. Soc. (2011) doi:10.1111/j.1745-3933.2011.01115.

Discovery of a spiral-host episodic radio galaxy

Ananda Hota,[1★] S. K. Sirothia,[2] Youichi Ohyama,[1] C. Konar,[1] Suk Kim,[3] Soo-Chang Rey,[3] D. J. Saikia,[2] J. H. Croston[4] and Satoki Matsushita[1,5]

[1]*Academia Sinica Institute of Astronomy and Astrophysics, PO Box 23-141, Taipei 106, Taiwan*
[2]*National Centre for Radio Astrophysics, TIFR, Post Bag 3, Ganeshkhind, Pune 411007, India*
[3]*Department of Astronomy and Space Science, Chungnam National University, Daejeon 305-764, South Korea*
[4]*School of Physics and Astronomy, University of Southampton, Southampton SO17 1BJ*
[5]*Joint ALMA Office, Alonso de Córdova 3107, Vitacura, Santiago, Chile*

1st suspected case 0313–192 by
Ledlow, Owen & Keel (1998)

1st Confirmed (due to episodic nature) giant radio galaxy
Hota et al. 2011 (after 12 years !!)

Subaru follow up, confirms a massive disk

XMM-Newton follow up confirms not a BCG

RAD@home launched Speca-2 hunting in 2013

~ 6 Speca-like galaxies for 10 years then

~18 more wit Galaxy Zoo and Zoo Gems (HST)

Gems of the Galaxy Zoos—A Wide-ranging Hubble Space Telescope Gap-filler Program*

William C. Keel[1], Jean Tate[14,2], O. Ivy Wong[3,4], Julie K. Banfield[5], Chris J. Lintott[6], Karen L. Masters[7], Brooke D. Simmons[8], Claudia Scarlata[9], Carolin Cardamone[10], Rebecca Smethurst[6] + Show full author list

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An Elusive Population of Massive Disk Galaxies Hosting Double-lobed Radio-loud AGNs

Zihao Wu,[1] Luis C. Ho,[2,1] and Ming-Yang Zhuang[1,2]

A population of galaxy-scale jets discovered using LOFAR

B. Webster[1★], J. H. Croston[1], B. Mingo[1], R. D. Baldi[2,3,4,5], B. Barkus[1], G. Gürkan[6] M. J. Hardcastle[7], R. Morganti[8,9], H. J. A. Röttgering[10], J. Sabater[11], T. W. Shimwell[8,10], C. Tasse[12,13] and G. J. White[1,14]

Still looking for “smoking gun evidence “ of AGN–jet feedback in any sample

Can we find smoking gun evidence where the relic of the radio jet has an age comparable to Time since the decline of star formation ???

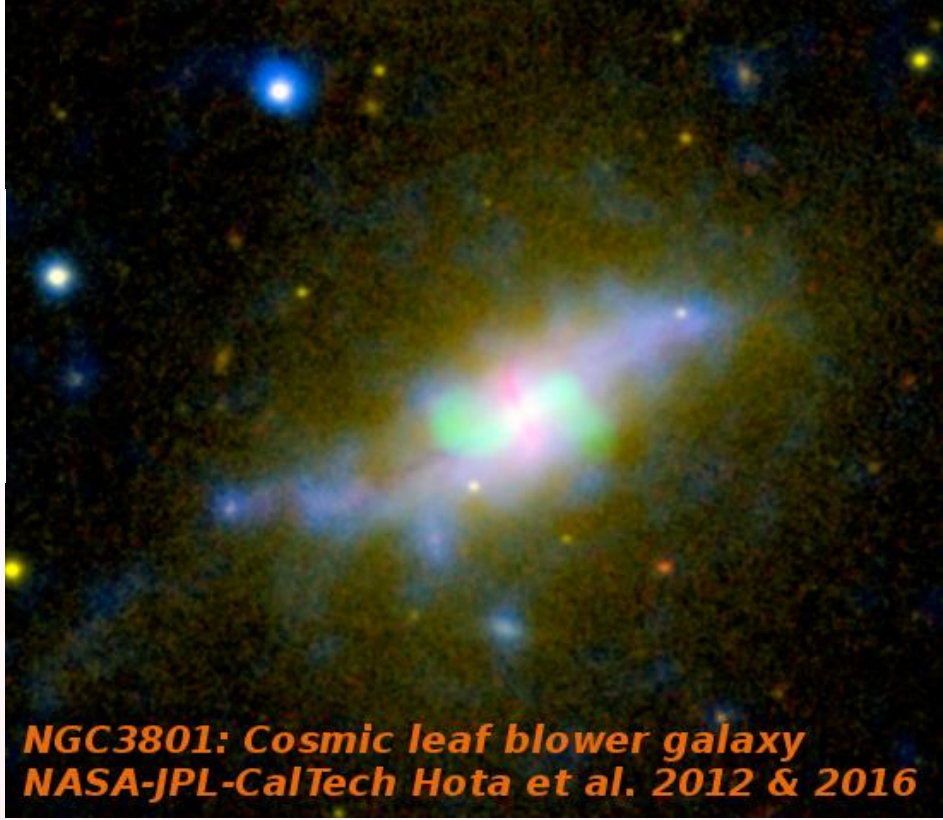
Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY LETTERS

Mon. Not. R. Astron. Soc. **422,** L38–L42 (2012) doi:10.1111/j.1745-3933.2012.01231.x

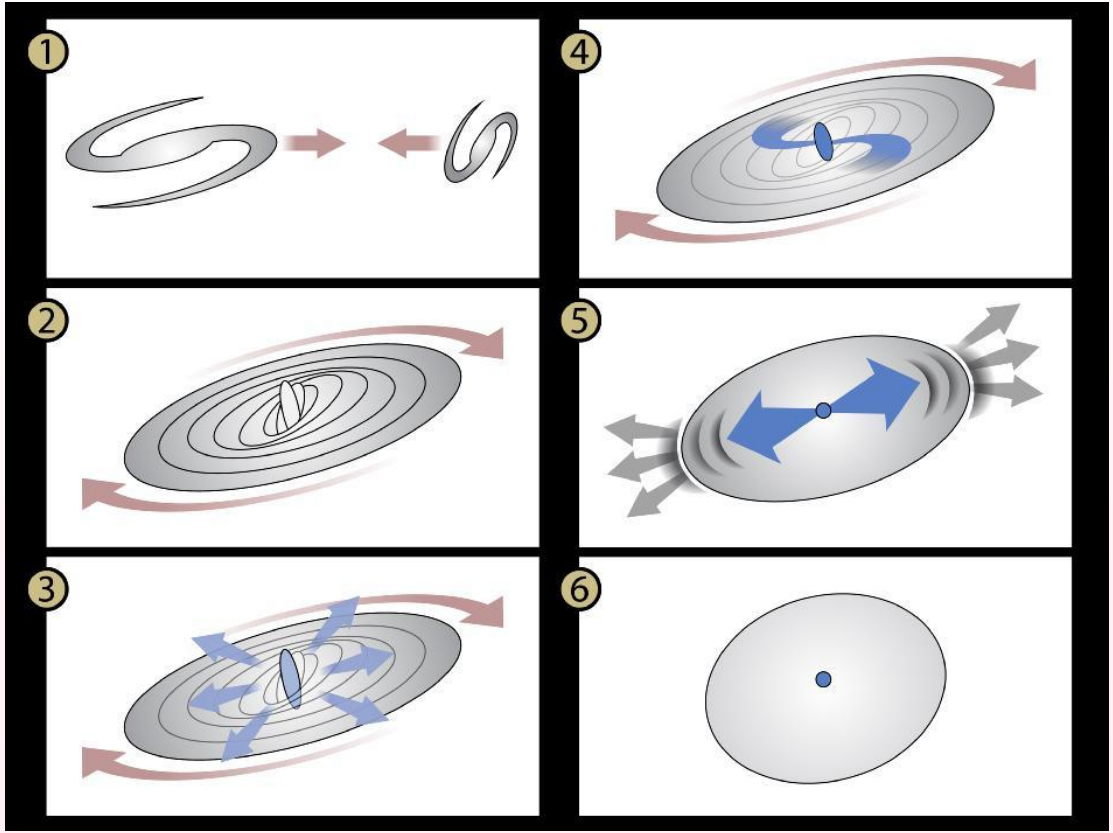
NGC 3801 caught in the act: a post-merger star-forming early-type galaxy with AGN–jet feedback

Ananda Hota,[1★] Soo-Chang Rey,[2★] Yongbeom Kang,[2,3] Suk Kim,[2] Satoki Matsushita[1] and Jiwon Chung[2]

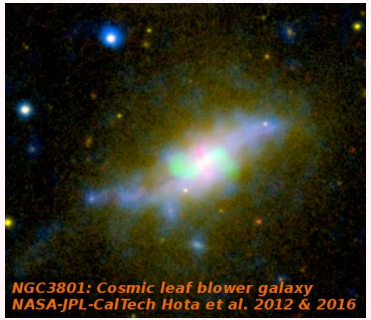
GALEX (blue)
VLA Green)
SDSS (yellow)
Spitzer (red)



NGC 3801 caught in the act: a post-merger star-forming early-type galaxy with AGN–jet feedback



Star formation
declined 300 Myr back
Before the jet is fired
3 M yr back



Positive vs Negative
Feedback ??

RAD@home discovery RAD12: jet-galaxy interaction

Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY

MNRAS **517**, L86–L91 (2022) https://doi.org/10.1093/mnrasl/slac116

RAD@home citizen science discovery of an active galactic nucleus spewing a large unipolar radio bubble on to its merging companion galaxy

Ananda Hota,[1,2★] Pratik Dabhade,[2,3★] Sravani Vaddi,[2,4★] Chiranjib Konar,[2,5] Sabyasachi Pal,[2,6] Mamta Gulati,[2,7] C S. Stalin,[2,8] Ck Avinash,[2] Avinash Kumar,[2] Megha Rajoria[2] and Arundhati Purohit[2]

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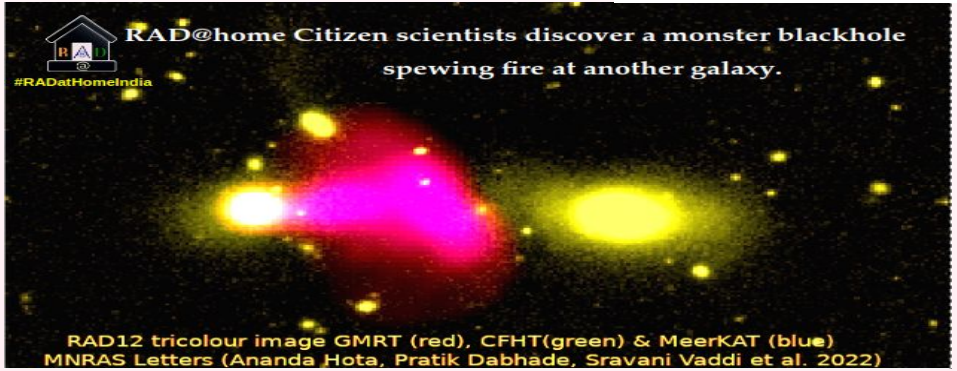
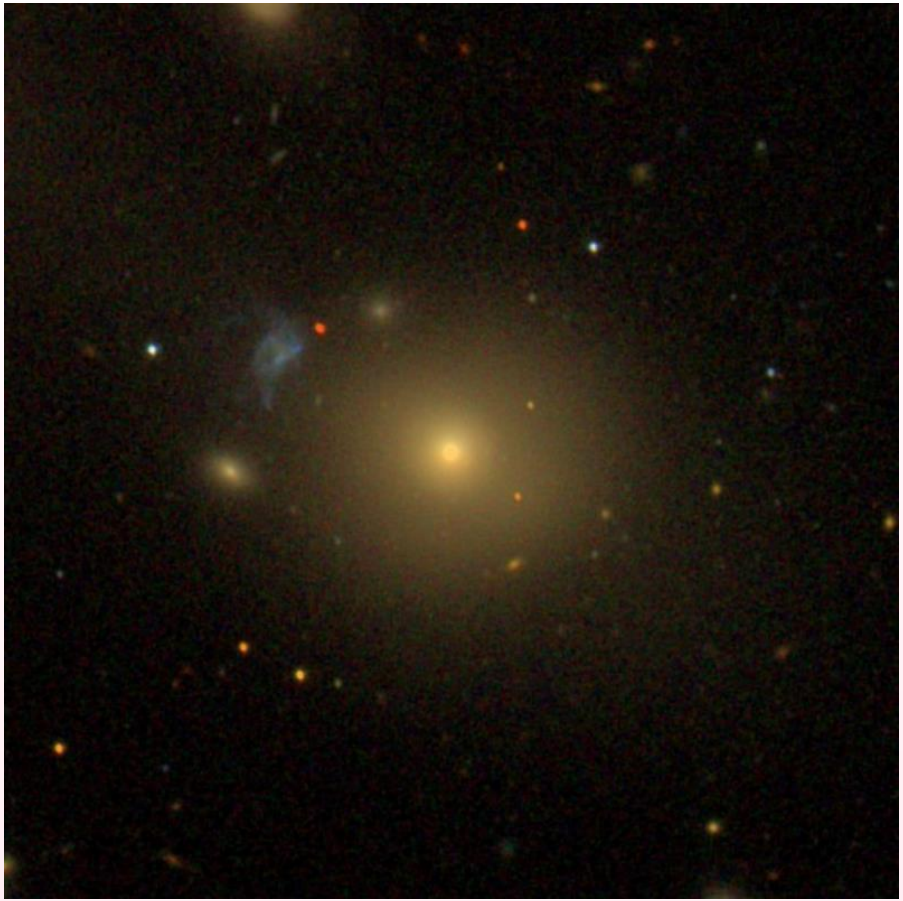
[4]*Arecibo Observatory, NAIC, HC3 Box 53995, Arecibo, PR 00612, USA*
[5]*Amity Institute of Applied Sciences, Amity University Uttar Pradesh, Sector-125, Noida-201303, India*
[6]*Midnapore City College, Kuturia, Bhadutala, Paschim Medinipur, West Bengal-721129, India*
[7]*School of Mathematics, Thapar Institute of Engineering and Technology, Patiala, 147004, Punjab, India*
[8]*Indian Institute of Astrophysics, Koramangala II Block, Bangalore 560 034, India*



Minkowski's Object (positive feedback)

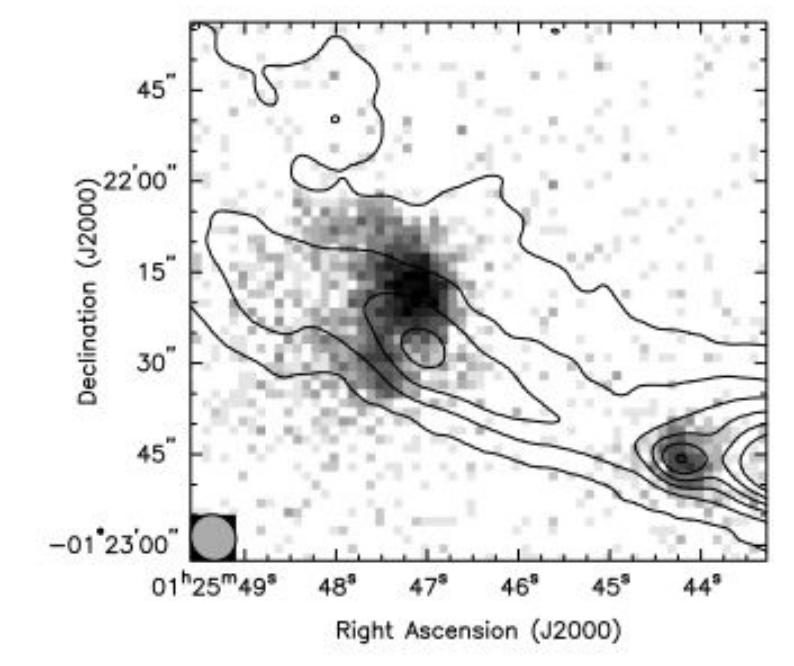


Possibly a short-term Positive

Long-term Negative

Need of detailed jet-galaxy interaction

Radiojet hitting HI cloud triggering young star formation



Radio contours + GALEXFUV

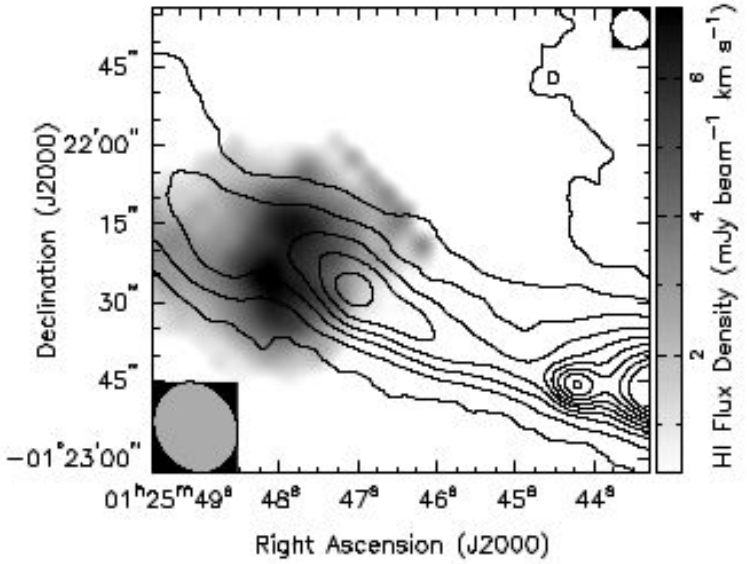
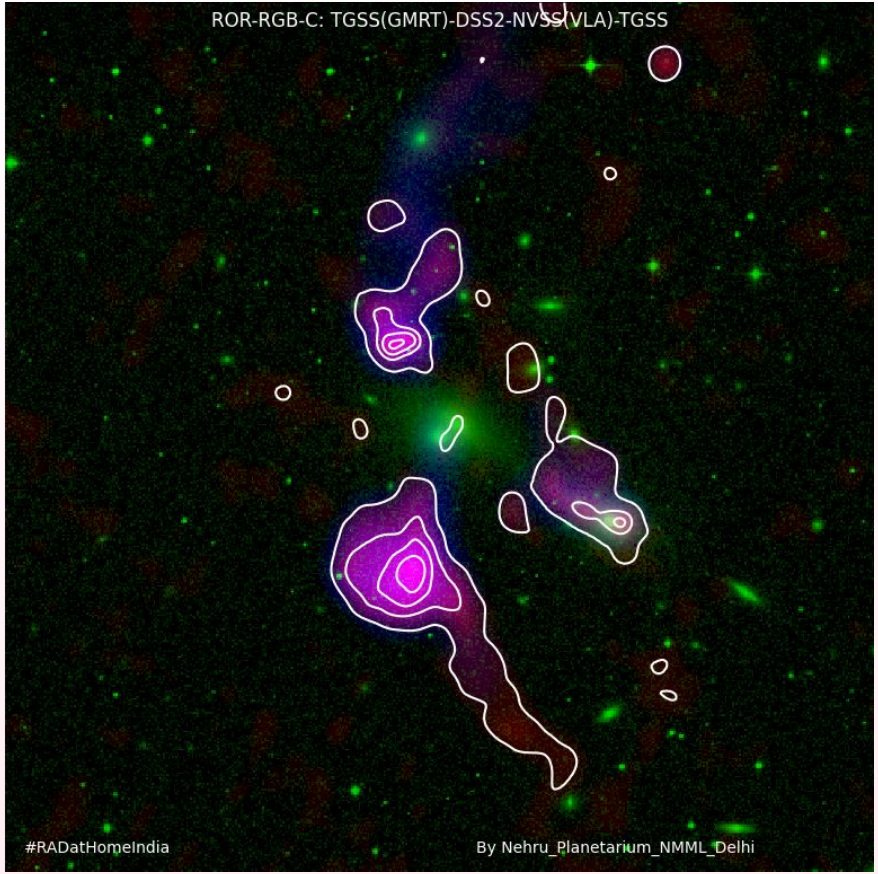
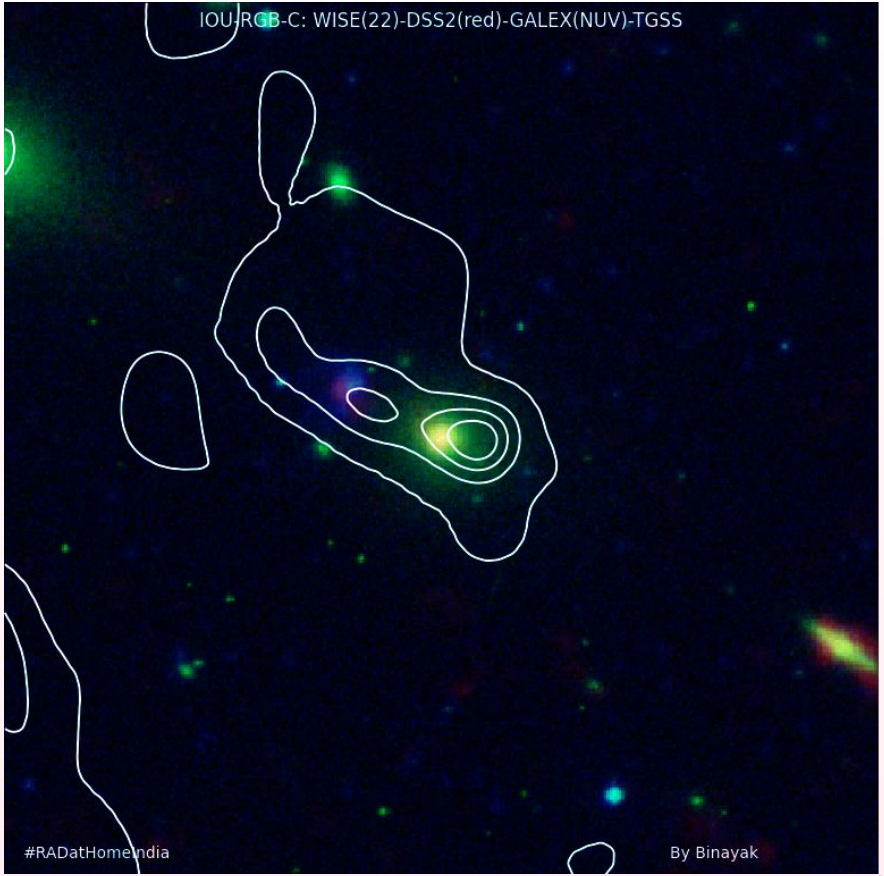


FIG. 9.—Map of the H I cloud adjoining MO, with radio continuum contours from the VLA overlaid. The H I cloud is shown with a linear scaling from 0.3–7 mJy beam^{-1} km s^{-1}, corresponding to the gray-scale wedge at right. Continuum contours are from 1–17 mJy beam^{-1} at 2 mJy beam^{-1} intervals. The H I beam is shown as a gray ellipse (*lower left*), and the continuum beam is shown as a white ellipse (*upper right*).

Croft et al. ApJ, 2006

RAD-RGB style: Minkowski's Object (jet - galaxy interaction)





A few rare Jet minor-galaxy interactions

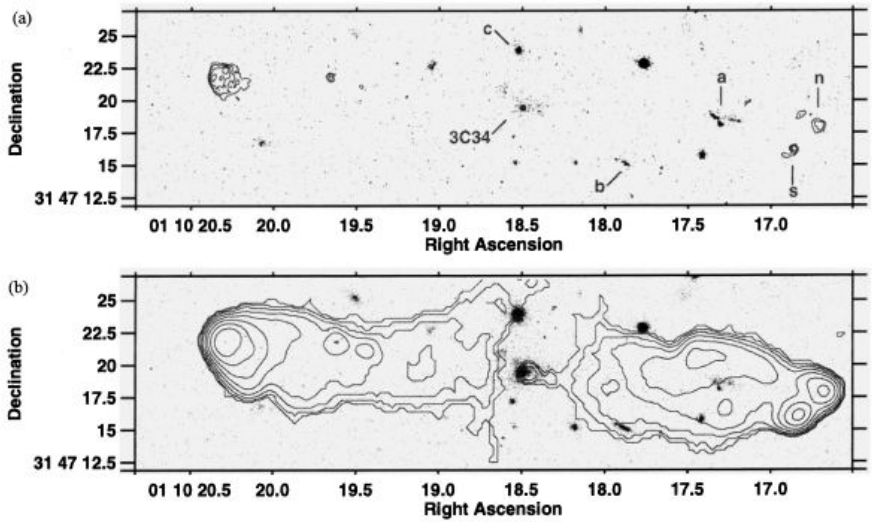
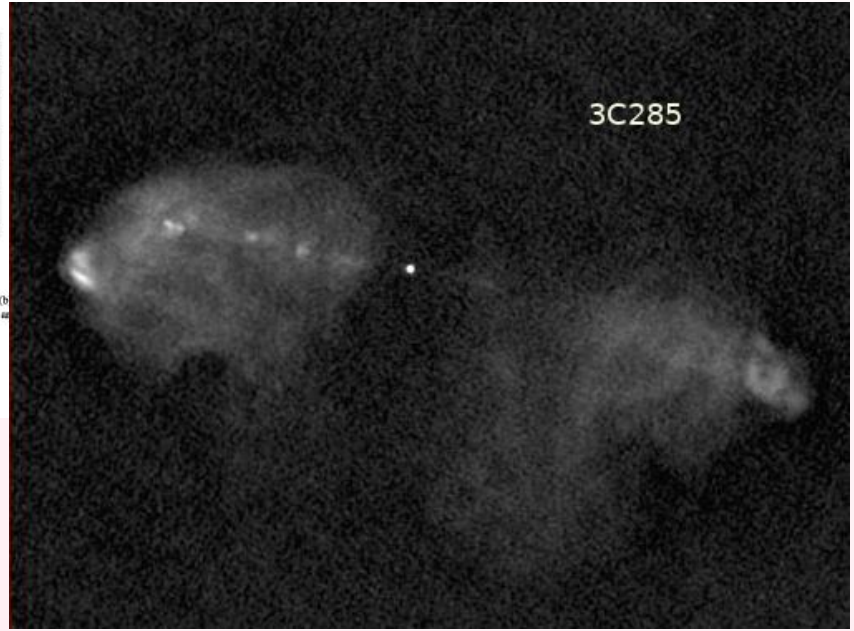


Figure 1. (a) (Top) An image of 3C 34 at 545 nm taken using the *Hubble Space Telescope*, with contours of the VLA A-array radio emission at 8.4 GHz overlaid. Contour levels are 120 μJy × (2, 4, 8, 16). (b) An *HST* image of 3C 34 at 865 nm, overlaid with contours of the radio emission at 4.8 GHz as seen using B- and C-arrays of the VLA (Johnson, Leahy & Garrington 1995). Contour levels are × (1, 2, 4, 8, 16, 32, 64, 128). All coordinates are measured in equinox J2000.

3C34 Best, Longair Rottgering 1997



A few rare Jet minor-galaxy interactions

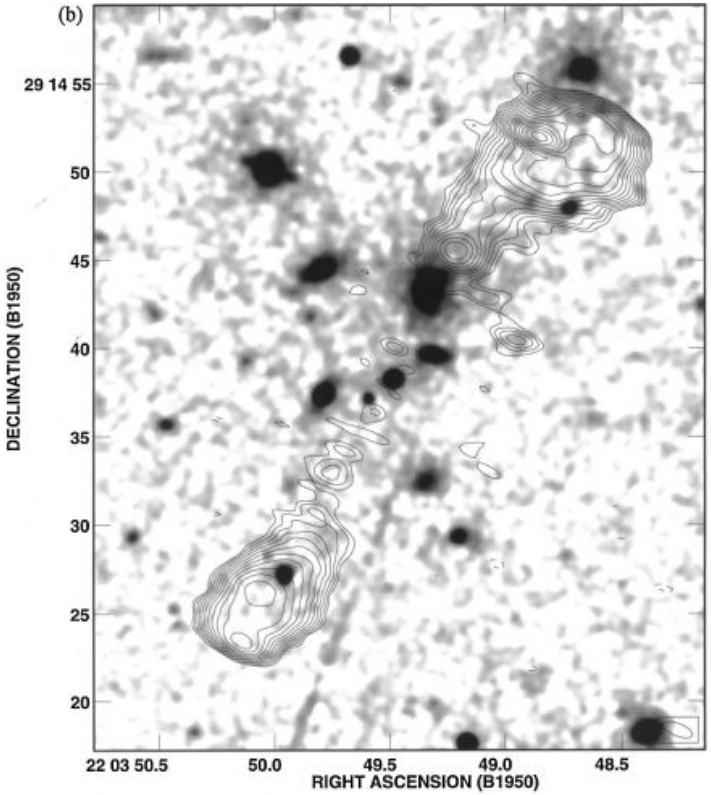


Figure 1 – *continued*

3C441 Lacy, Rawlings, Blundell & Ridgway 1998

A few rare Jet minor-galaxy interactions

JET/COMPANION-GALAXY INTERACTION IN 3C 321

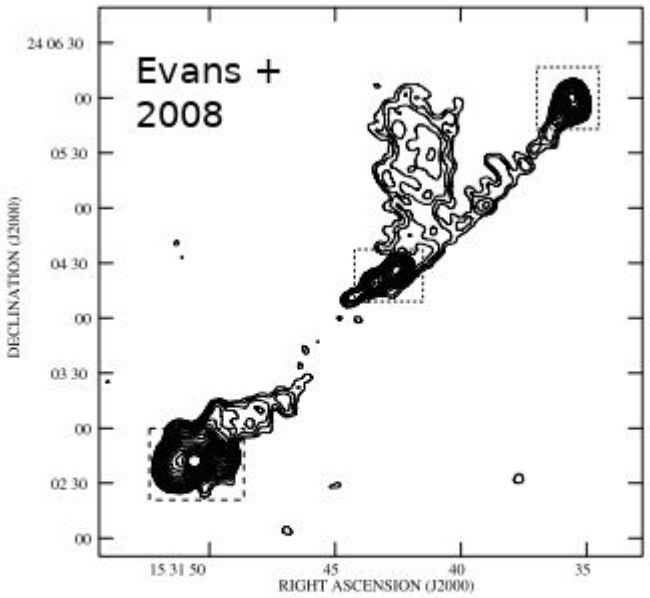
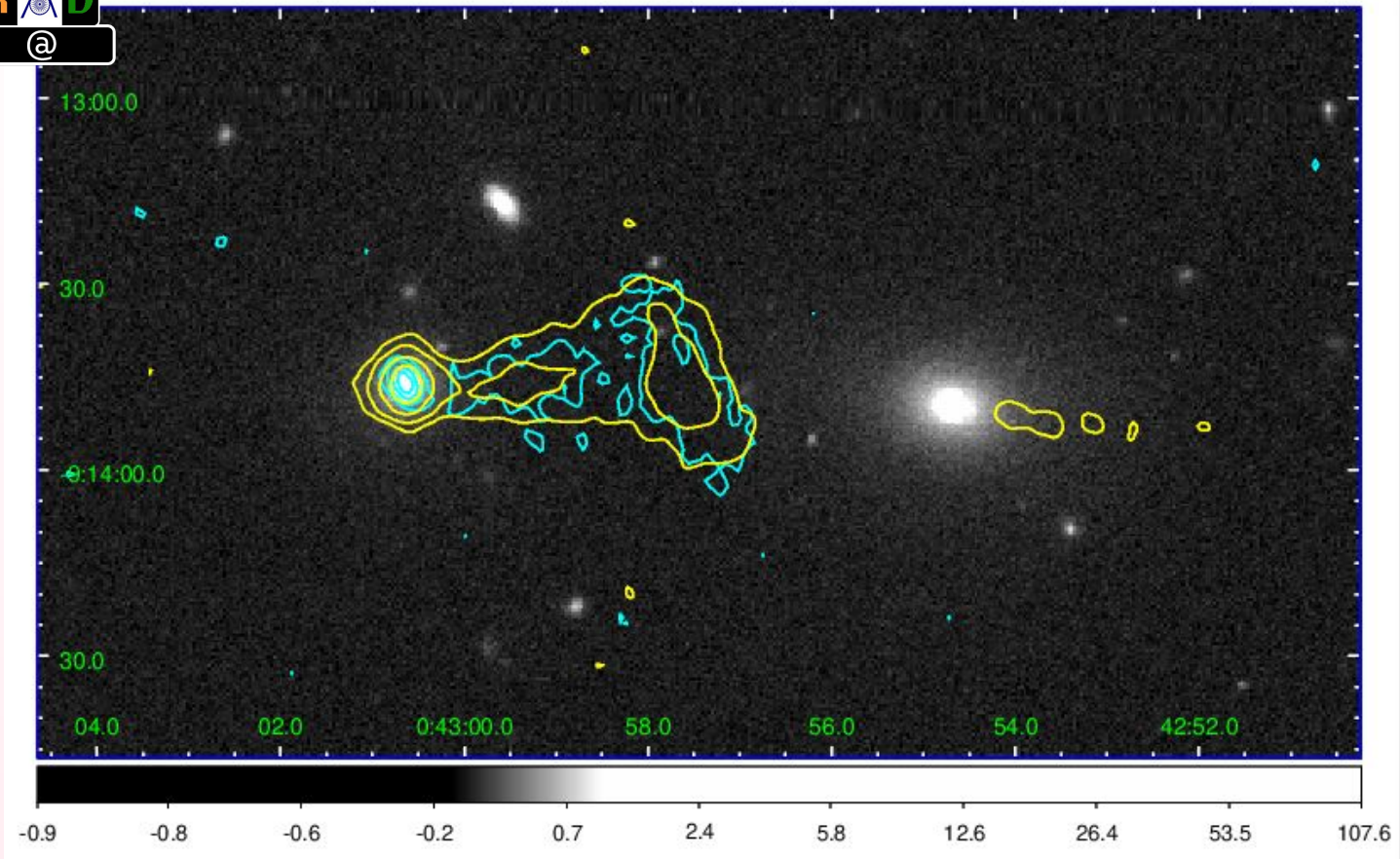


FIG. 1.—A 1.5 GHz VLA A + B + C array image at 6″ resolution of the entire extent of 3C 321. Prominent radio emission is detected from the core, inner jet, and hot spots, together with a transverse extension to the radio lobe that lies to the north. The dashed boxes mark the approximate regions we used to image in detail the inner jet and hot spots in subsequent figures. Contours are at $0.8 \times (1, 2, 4, \ldots)$ mJy beam^{-1}.

Animation: Chandra website

Gut-feeling for RAD-12 from RGB images in 2013 !!

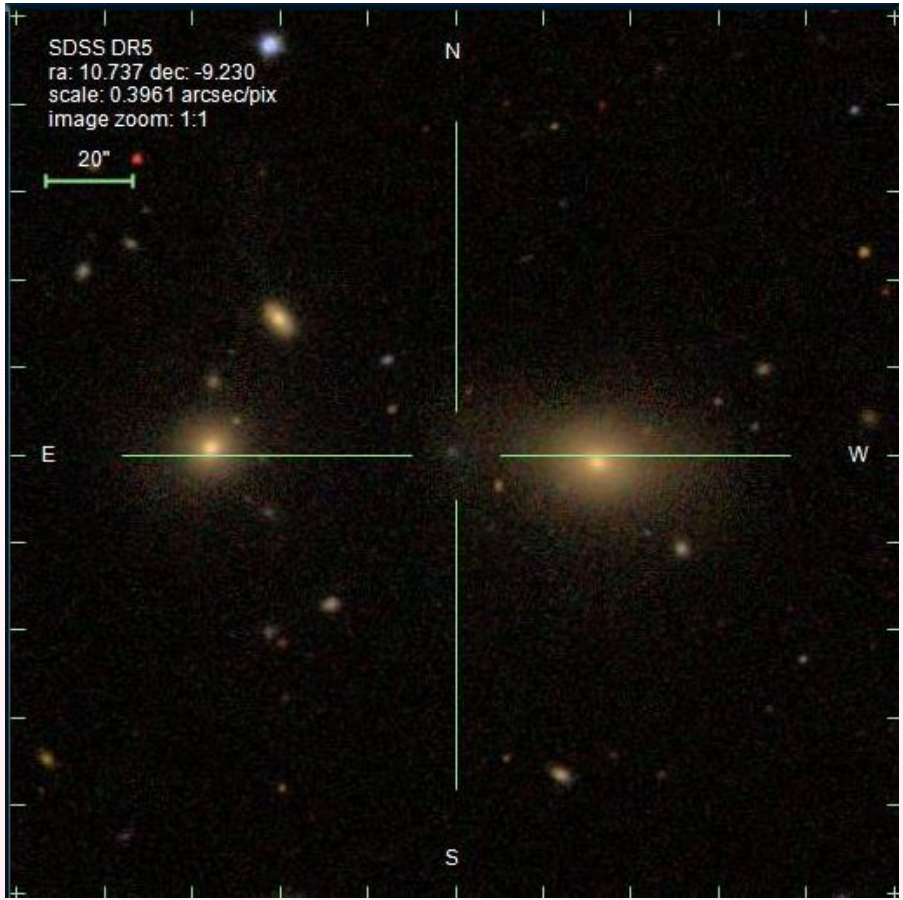


SDSS

FIRST (yellow)

VLASS (cyan)

RAD12 or J004300.63−091346.3



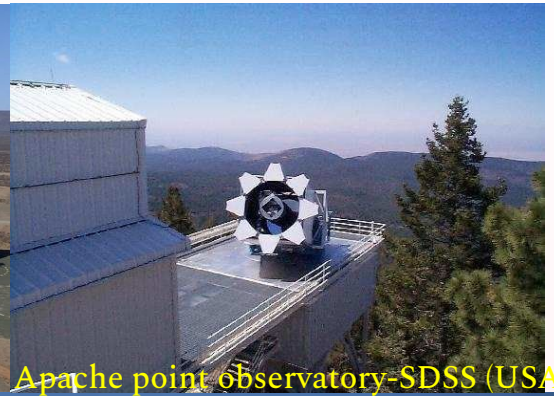
GMRT was used for follow up observation of RAD-12 through the GTAC-approved proposal, GOOD-RAC

GMRT Observation of Objects Discovered by the RAD@home Astronomy Collaboratory

Giant Meterwave Radio Telescope, Khodad (NCRA-TIFR, Pune)

Along with GMRT following telescopes were also used

MeerKAT (South Africa)



Apache point observatory-SDSS (USA)

Very Large Array (USA)

Canada France Hawaii Telescope (USA)

RAD12: GMRT, MeerKAT, VLA

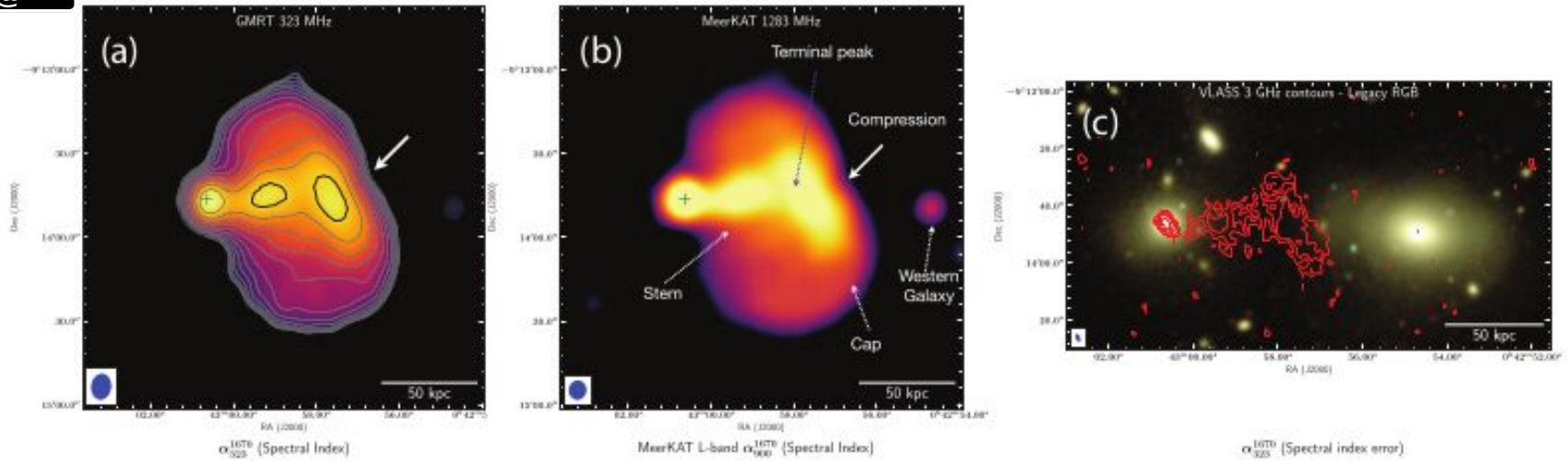
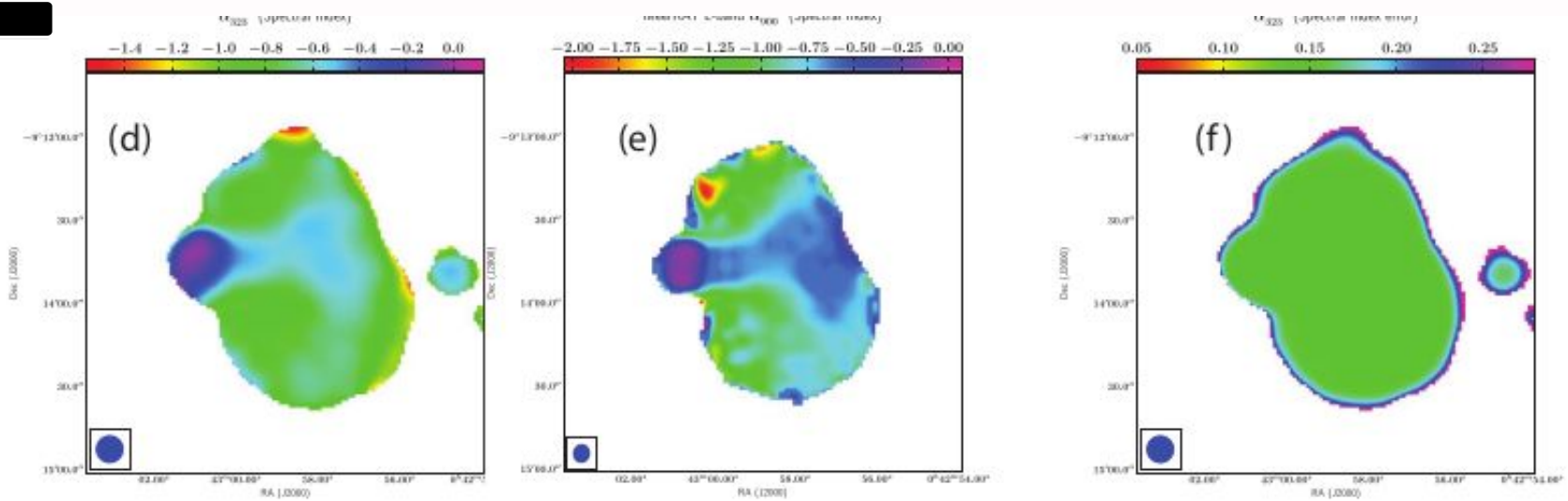


Figure 1. RAD12 images. (a) GMRT 323 MHz colour image with contour levels of 0.0007, 0.0008, 0.0009, 0.0011, 0.0014, 0.0018, 0.0025, 0.0036, 0.0053, 0.0080, 0.0124, 0.0193, and 0.0302 Jy beam^{-1}, with beam of 10.2 × 7.9 arcsec, −6.4°. (b) MeerKAT *L*-band image with beam of 7.7 × 7.1 arcsec, −8.2°. (c) Optical colour image from Legacy survey is superposed with 3 GHz contours (levels: 0.0004, 0.00066, 0.0013, 0.003, 0.008, 0.022, 0.057, and 0.153 Jy beam^{-1}) from Very Large Array Sky Survey (VLASS) (3.77 × 2.29 arcsec, 20.61°). (d) 11 × 11 arcsec, 0° spectral index map made using *GMRT* 323 MHz and MeerKAT *L* band. (e) In-band spectral index from 900 to 1670 MHz (MeerKAT *L* band) with beam same as the MeerKAT map. (f) Error in the spectral index map from *GMRT* and MeerKAT data. Cross mark in green colour in subfigures a and b marks the position of the optical nucleus of the host galaxy of RAD12. The centre of the western optical galaxy is also detected in both the radio bands.

RAD12: GMRT & MeerKAT, spectral index



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RAD12: GMRT on CFHT

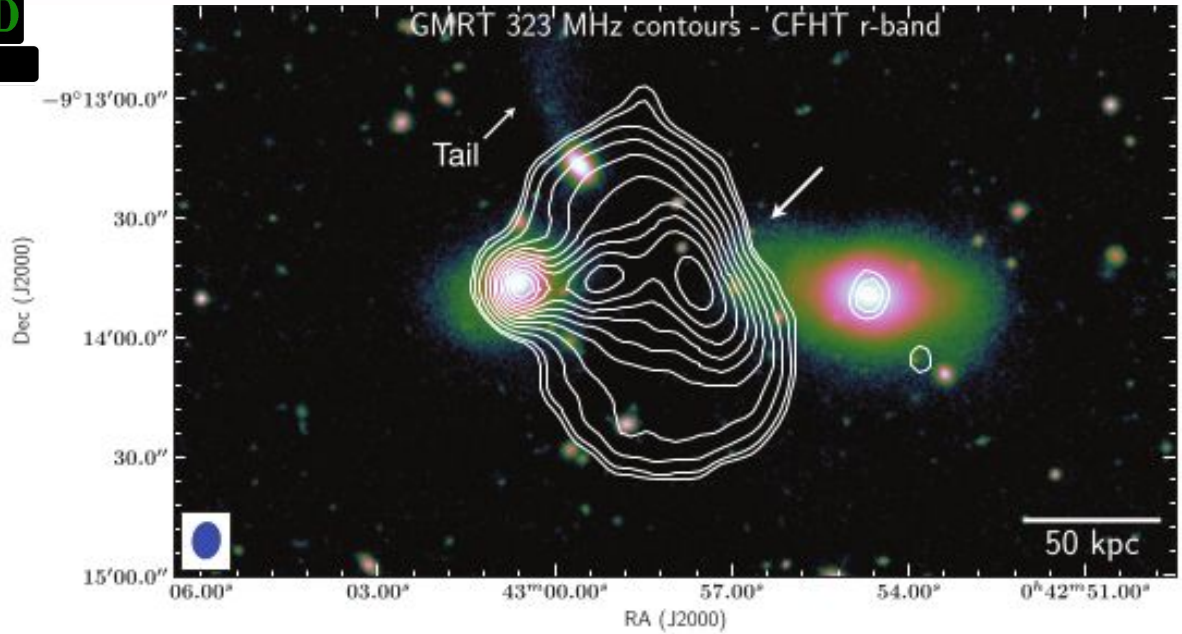


Figure 2. Optical *r*-band image from the *CFHT* of galaxies SDSS J004300.63–091346.3, host of RAD12 (left-hand panel) and companion galaxy SDSS J004254.69–091349.4 (right-hand panel) overlaid with *GMRT* 323 MHz contours.

One-sided jet ?

No positive feedback

1st case of major merger

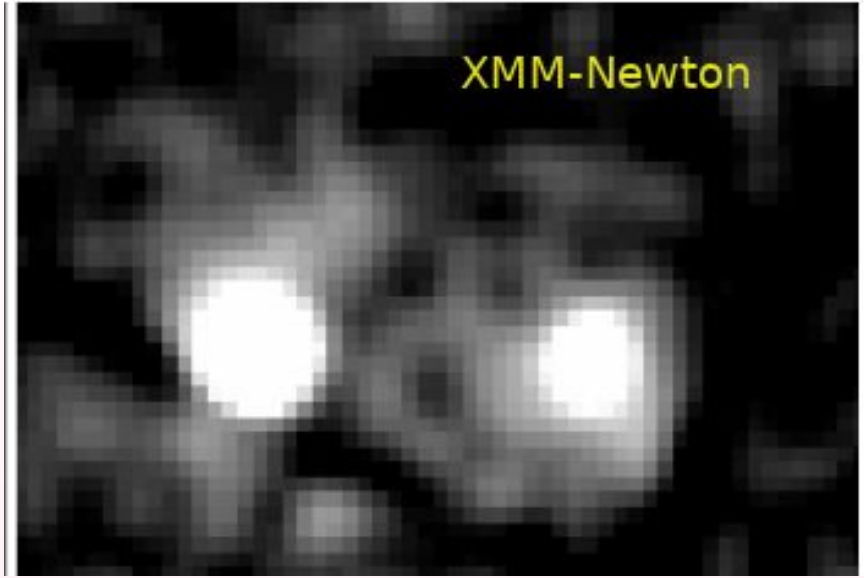
Jet feedback bouncing back

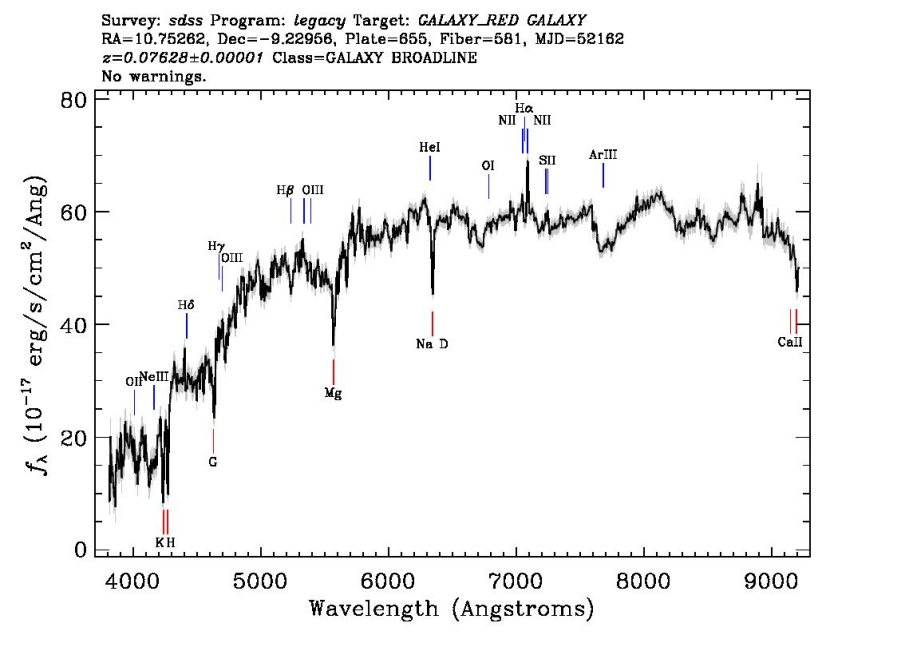
Mushroom bubble 137 kpc

Expanding out of merger plane ?

Any other gas driven out ?

Future investigations...





Personal discussion with Lawrence Rudnick

The RAD12 tem


Ananda Hota


Pratik Dabhade

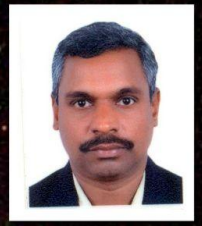

Sravani Vaddi


Chiranjib Konar


Sabyasachi Pal

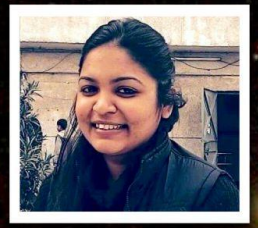

Mamta Gulati

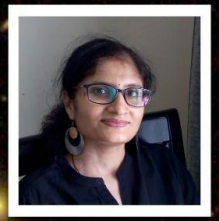
Team


C S Stalin


Avinash CK


Avinash Kumar


Megha Rajoria


Arundhati Purohit


Jan 4, 2022 - Jan 3, 2023
Download
1,800 comments
Jan 3, 2022 - Jan 2, 2023
Posts
Comments
Reactions
All
80
60
40
20
0
Apr 1
Jul 1
Oct 1
Jan 1
1,598 active members
Jan 4, 2022 - Jan 3, 2023
1000
500
0
Apr 1
Jul 1
Oct 1
Jan 1
Active Members Per Day (Jan 4 - Jan 3)


Jan 4, 2022 - Jan 3, 2023
Download
289 posts
Jan 3, 2022 - Jan 2, 2023
Posts
Comments
Reactions
All
10
5
0
Apr 1
Jul 1
Oct 1
Jan 1
1,598 active members
Jan 4, 2022 - Jan 3, 2023
1000
500
0
Apr 1
Jul 1
Oct 1
Jan 1
Active Members Per Day (Jan 4 - Jan 3)

Thanks IAU for the 3rd Shaw-IAU talk & RAD@IAU375

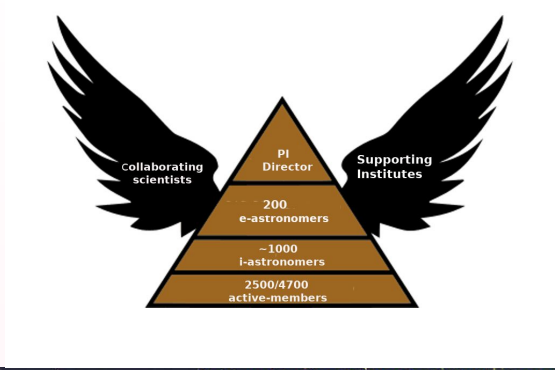
Registration for the Outreach event
RAD@home Astronomy workshop at
IAU Symposium 375, Nepal

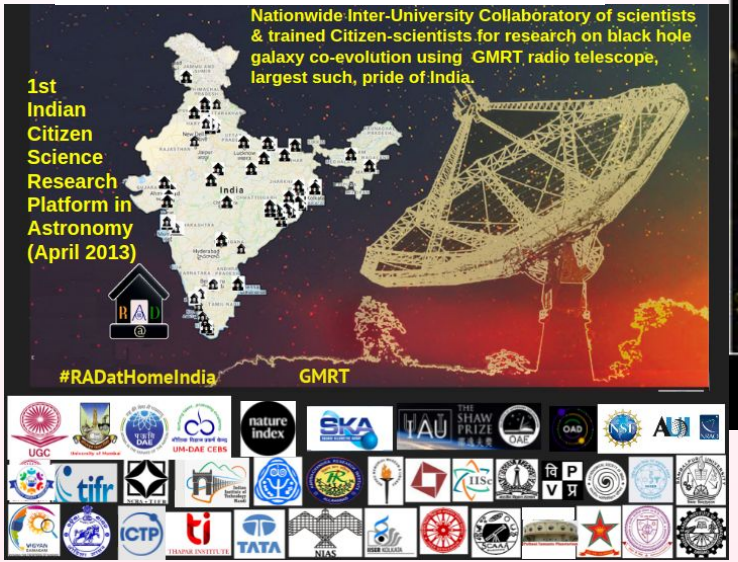
#RADatIAUsymposium375Nepal

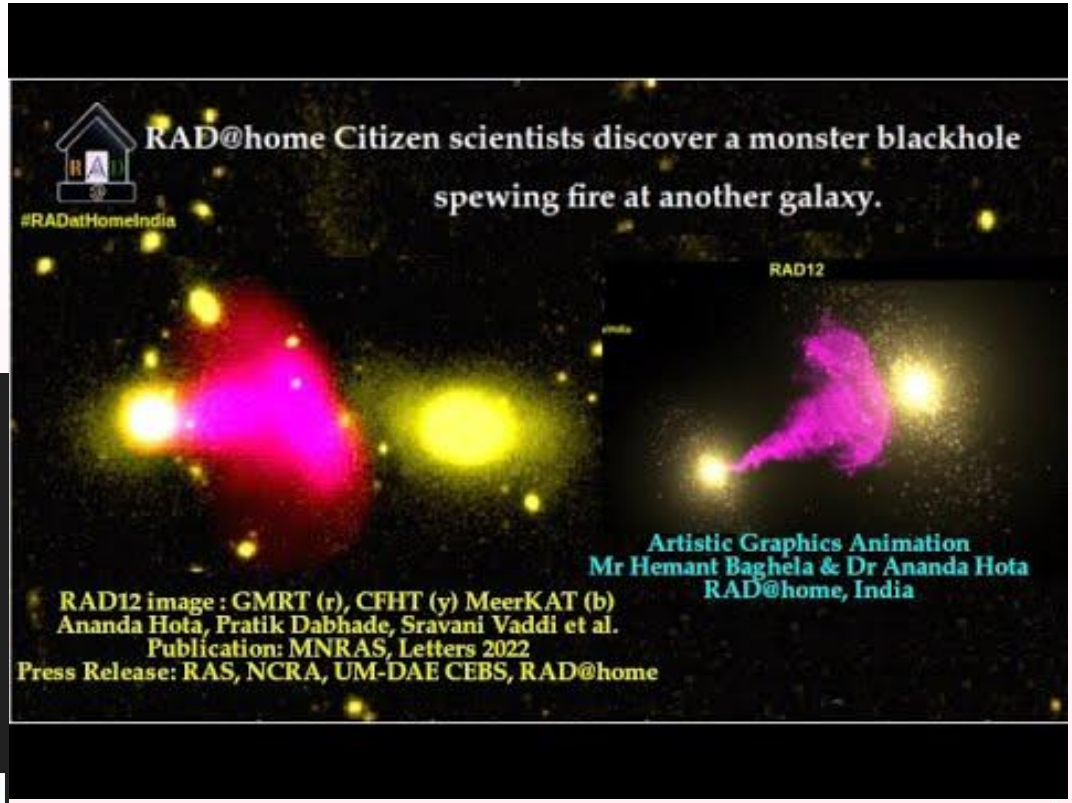
NASO

RADatHomeIndia

IAU Symposia: The multimessenger chakra of blazar jets







Lets Collaborate ...

#RADatHomeIndia https://radathomeindia.org/ radathomeindia@gmail.com