

Concluding remarks - (highlights!)

- Mike Garrett

General & Scientific Director, ASTRON

Also affiliated with Leiden Observatory.

#radsurveys15 - twitterverse



Acknowledgements:



Kyle Willett @kwwillett · 49m



Amy Kimball @amyekimball · 1h



Imogen Whittam @imogenwhittam · 17h

Every conference should have classical music interludes!



Jonathan Zwart @brideyrevisited · 2h

#radsurveys15 continues, now that the music has stopped.



Every conference should have this standard of cakes !

ASTRON

ASTRON @ASTRON_LOFAR · 1h

We are going to miss these... at #RadSurveys15



#radsurveys15 - twitterverse



Sam Lindsay @SamNLindsay · Oct 20

Reason to miss being an astronomer: I could have been in Bologna this week for **#radsurveys15** (they are legit totally rad btw)...

Quotations

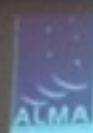
“There’s nothing so useless as a radio source”

- attributed to Jim Condon

“We don’t need the SKA. Resolution kills.” - Jim Condon.

“1% populations are extremely valuable for defining physical frameworks. Surveys should make efforts to find them” - G. Helou.

Robert Laing:



Single-object dinosaurs can coexist with younger, faster survey mammals*



* at least until the extinction event.

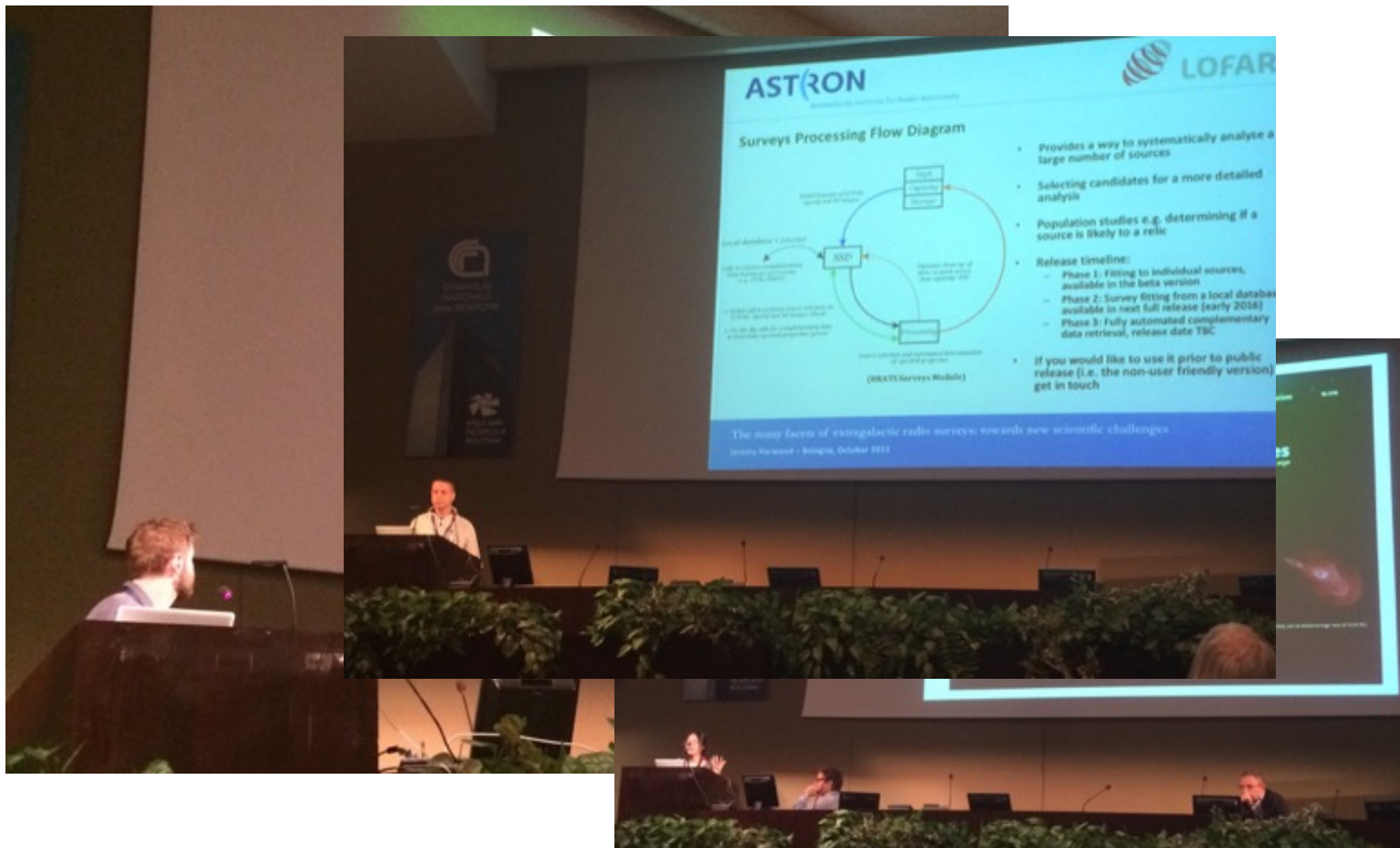
Bologna, October 2015

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Radio Galaxy Zoo & BRATS

Kyle Willet and Minnie Mao, Jeremy Harwood



Quotations

“There’s nothing so useless as a radio source”

- attributed to Jim Condon

“We don’t need the SKA. Resolution kills.” - Jim Condon.

“1% populations are extremely valuable for defining physical frameworks. Surveys should make efforts to find them” - G. Helou.

“The SKA will be 100x faster than the WSRT in HI - HALOGAS in 1 hour!” - Tom Oosterloo.

Good advice ?

“Radio astronomers should worry more about the fidelity of their images and less about dynamic range...”

- Preshanth Jagannatha

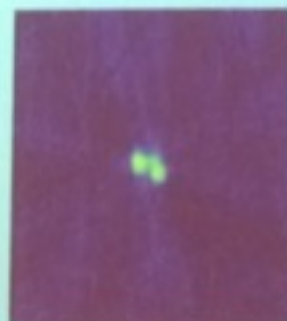
“Quantity needs quality” - Jim Condon

“We should stop detecting galaxies!” - Mario Santos.

“Don’t do a Large-Scale-Survey at this frequency with this telescope!” - Andrew O’Brien.

Bent-lobe sources in ATLAS-SPT

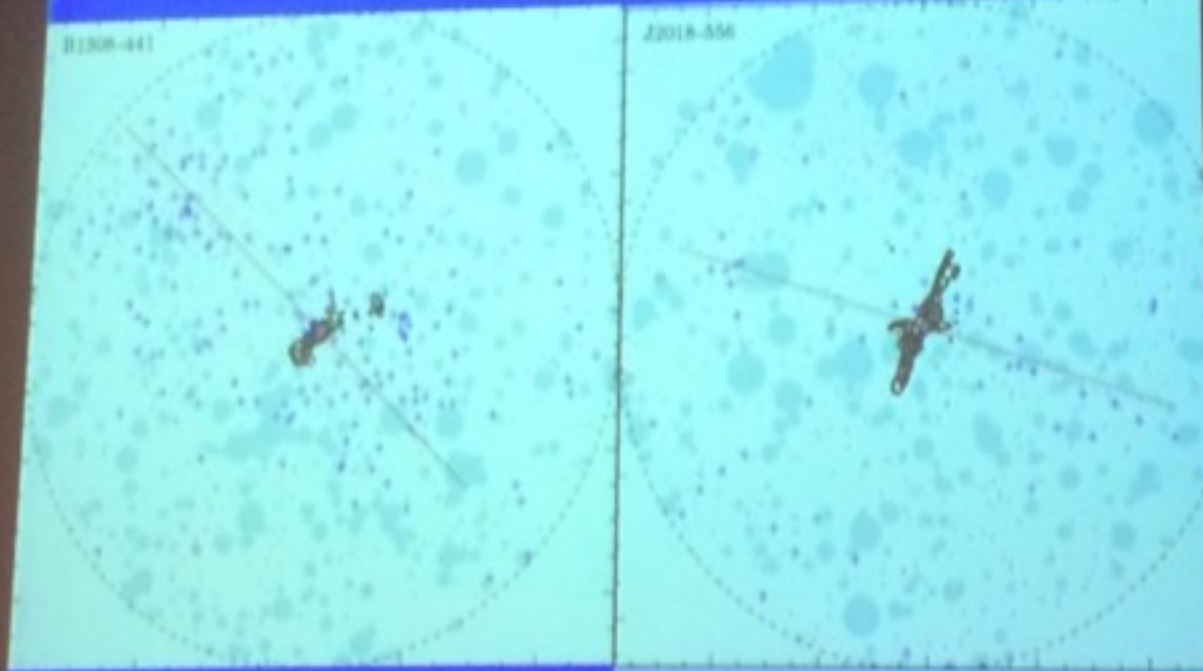
□ Detected 75 candidates



This week's most intriguing result?

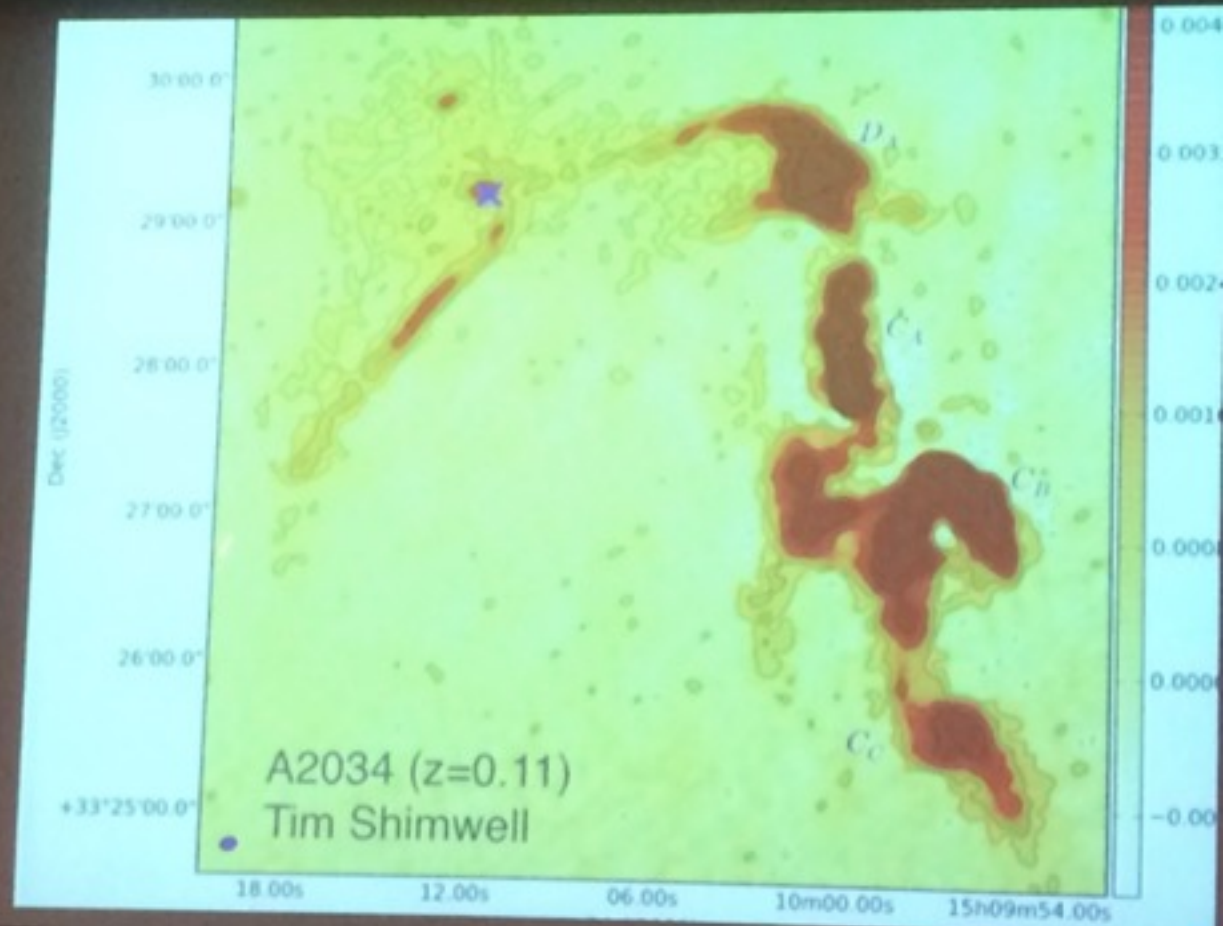
**- Lakshmi Saripalli
"Sitting on a gold mine".**

GRGs and large-scale galaxy distribution

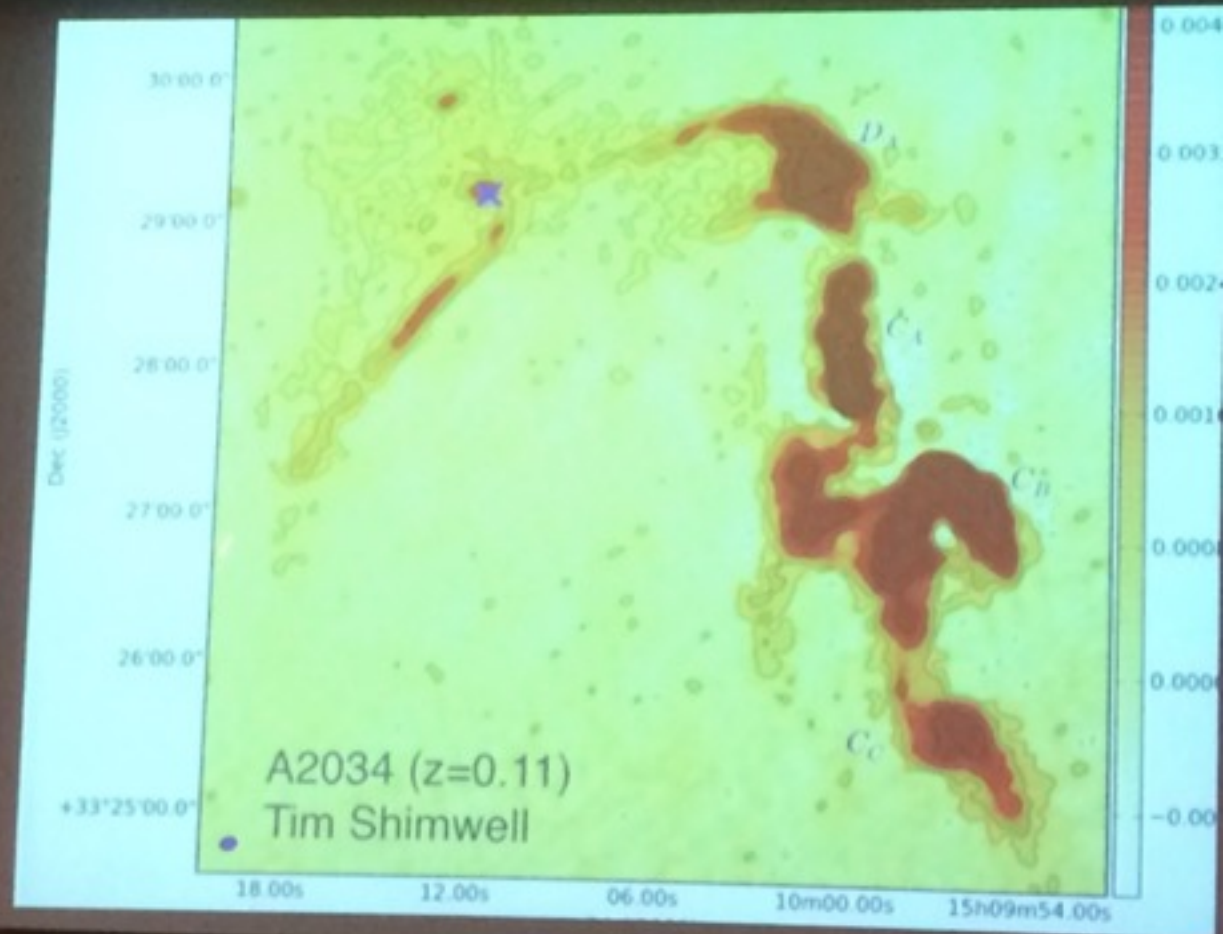


Good news!

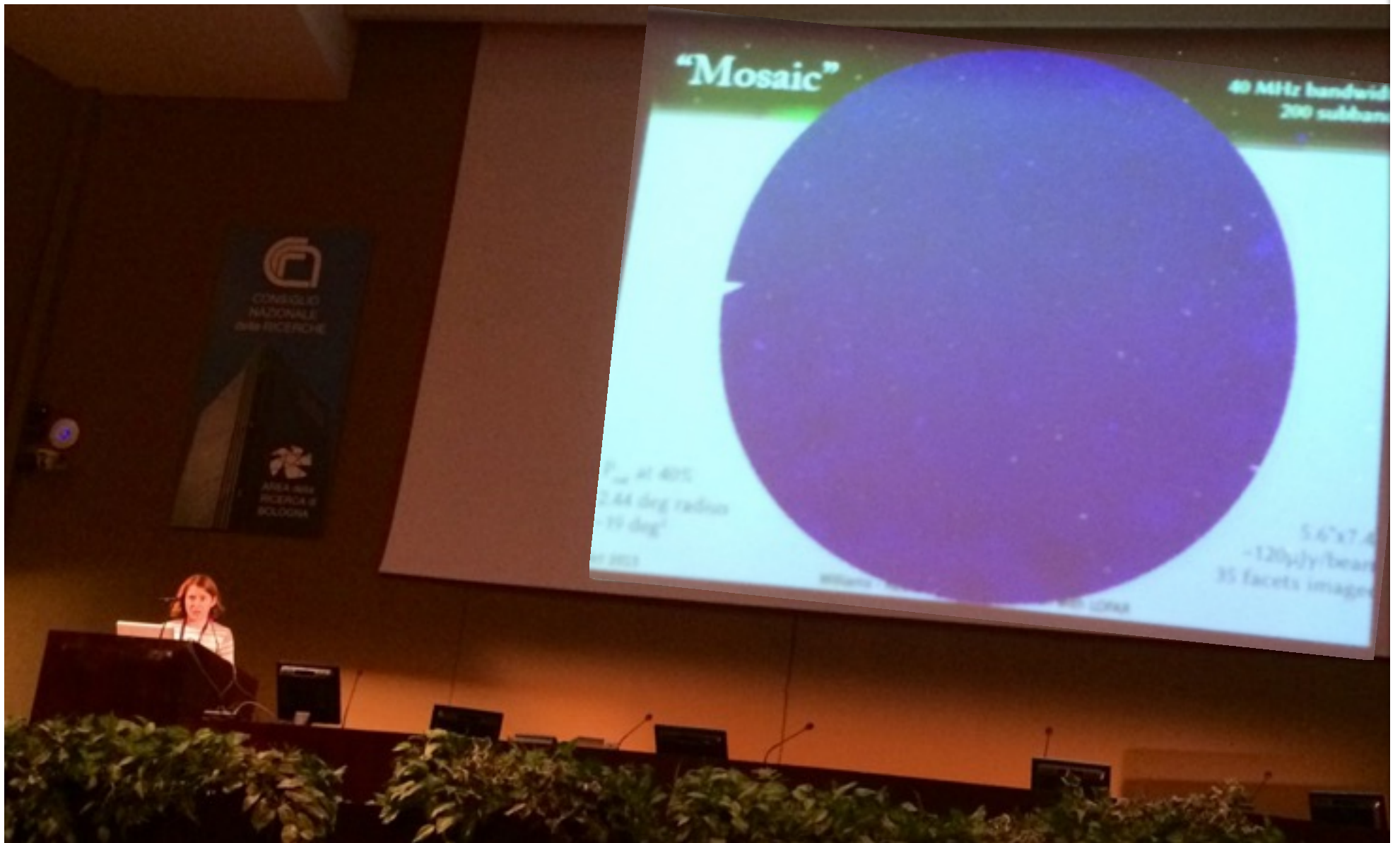
LOFAR is doing great!



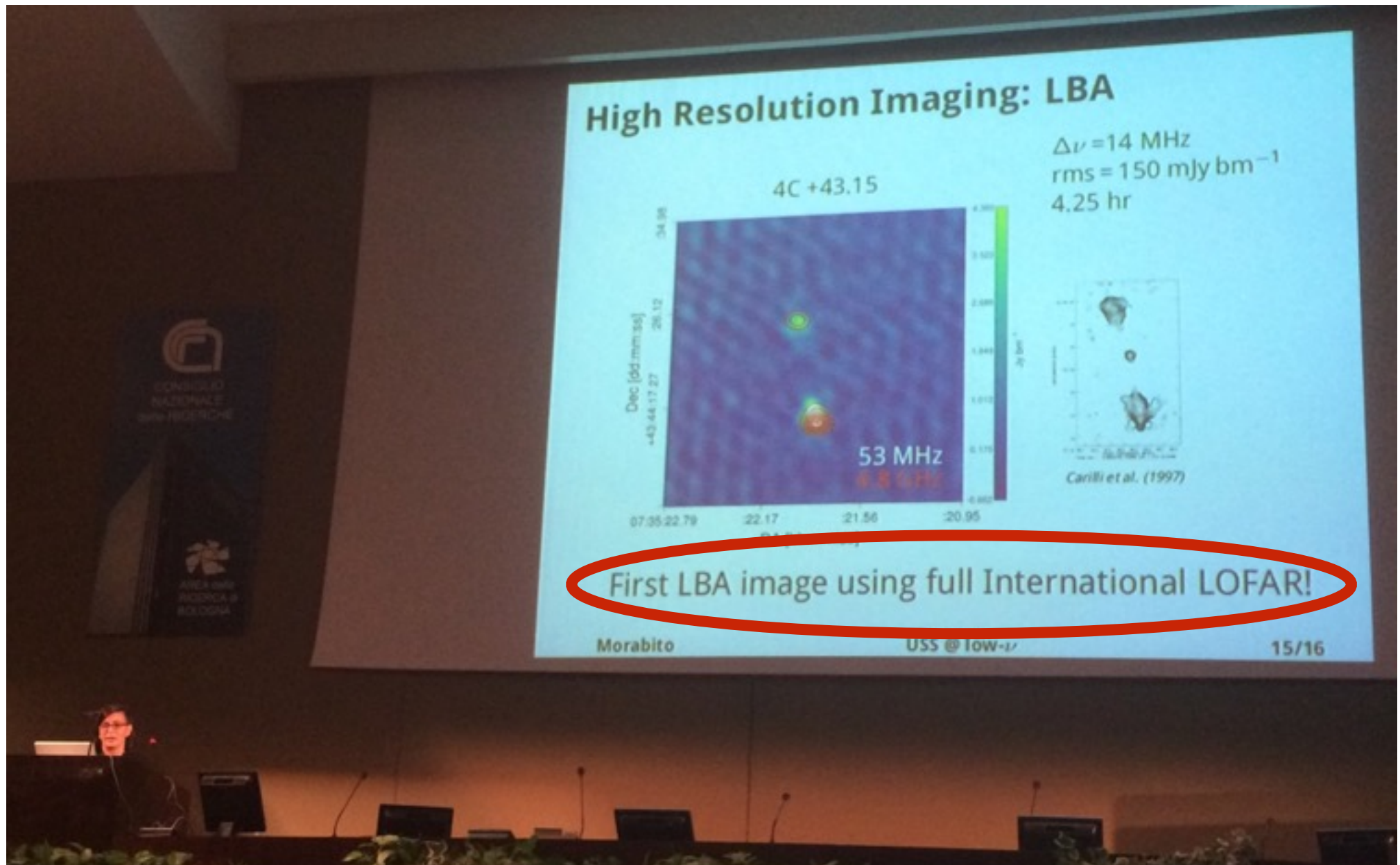
“LOFAR
is doing
great!”



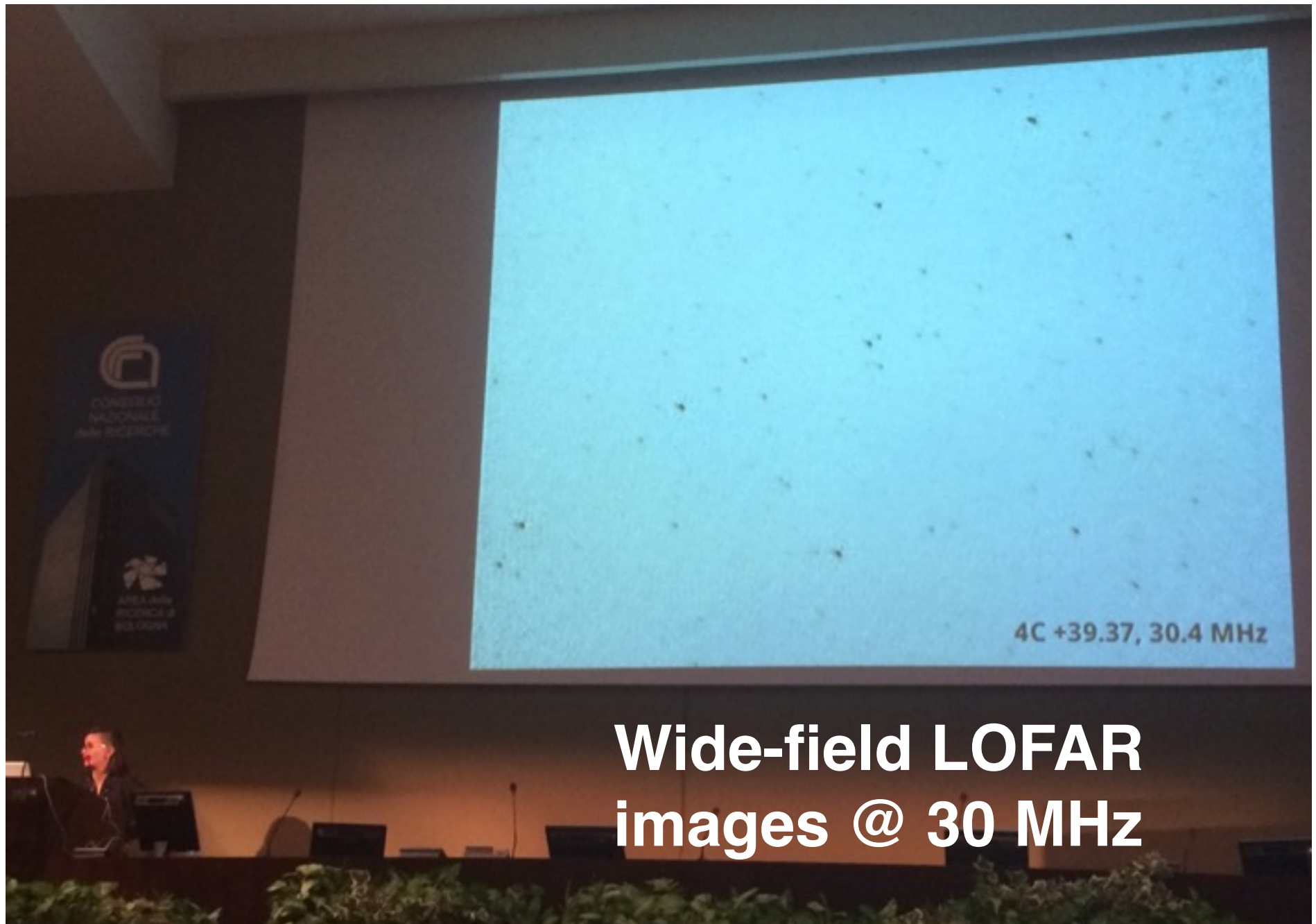
Wendy Williams



Leah Morabito



Leah Morabito



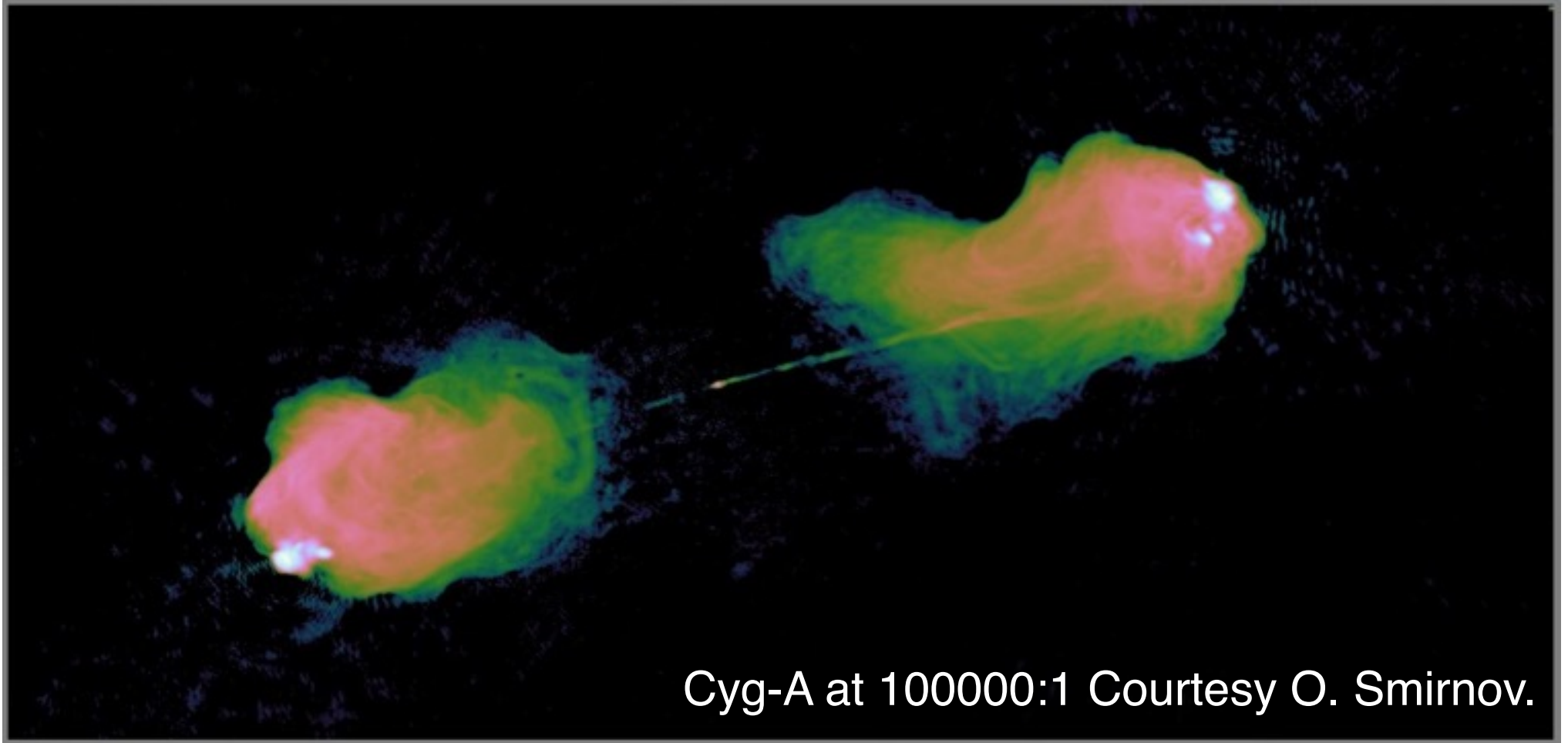
Don't underestimate the calibration difficulties of getting SKA1-low down to 20 microJy.

- Reinout van Weeren

RX J0603.3+4214 ($z=0.2$)
LOFAR 150 MHz
Chandra

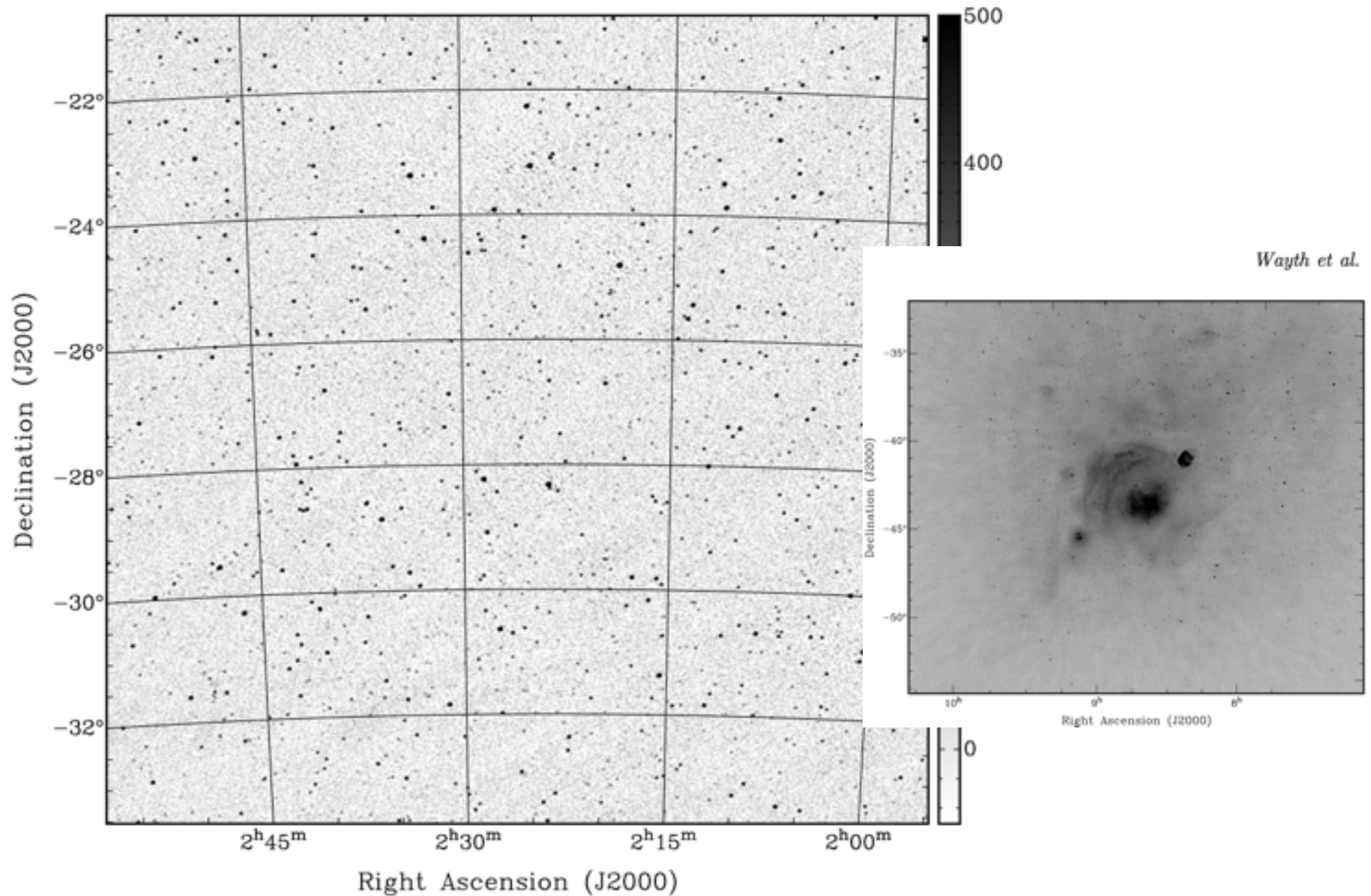
1 Mpc

LOFAR 3G calibration now being applied to JVLA data:



Cyg-A at 100000:1 Courtesy O. Smirnov.

MWA and GLEAM (Carole Jackson, Tom Franzen)



VLBI - Ivan Aguido, Yuri Kovalev

VLBI is great!

VLBI: The Near Future

EVN



VLBA



AVN Concept



LBA



Image credit: AVN

- Very Long Baseline Interferometry at the SKA-1 times:
 - SKA1-MID (phased array) + AVN + EVN
 - High angular resolution up to ~ 0.5 milli-arcseconds at μ -Jy levels (thermal noise)
 - Astrometric precisions of \sim few μ -arcseconds

Paragi et al. (AASKA14)

at Astrophys. Soc. Meeting on VLBI, 2014, Bologna, Italy. Ivan Aguido, IAA-CSIC, 23-10-2014



VLBI - Ivan Aguido, Yuri Kovalev

Radioastron:
challenging
our ideas
about AGN
physics...

AGN survey results: statistics

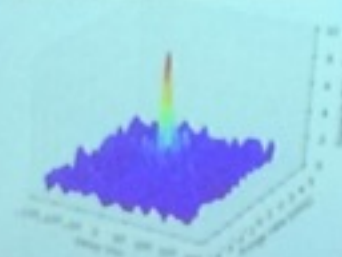
Sample: ~250 strong AGN

Correlated and post-processed to date: 1600 experiments, about 220 targets. Significant detections are found for 130 AGNs in 580 experiments at 18 and/or 6 and/or 1.3 cm up to 350,000 km.

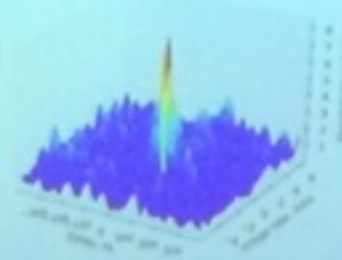
The highest resolution: 0235+164 & OJ287 at 1.3 cm, 15 ED, about 14 μ s.

Summary: typical Tb at least one order of magnitude higher than what was previously known.

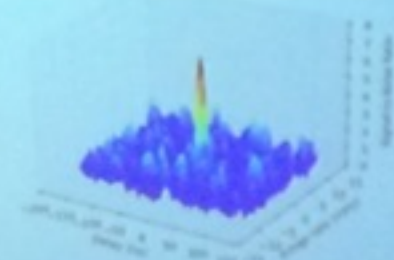
0235+164, 1.3 cm, RadioAstron GBT (15 Earth diameters)



OJ287, 1.3 cm, 15 ED, 28 Nov 2012, 8h 15m 00s, 20 mas



0235+164, 1.3 cm, RadioAstron GBT (15 Earth diameters)



Acronyms - pushing the limits... :

Ruta Kale - MaDCoWS: Massive Distant Clusters of the WISE Survey



 Ilse van Bemmelen and 24 others follow



Ray Norris @RayPNorris · 2m

#radsurveys15 : @RutaKale names sources from MADCOWS surveys as MOO J0133-1057 :)

Acronyms - Prina Patel was pushing the limits... :



Prizes

Contrived acronyms - pushing the limits of decency... :

And the winner is: *Ray Norris - WTF!*



Kyle Willett @kwwillett · 1d

WTF = Widefield ouTlier Finder. @RayPNorris pushing the limits of acronym etiquette. #radsurveys15




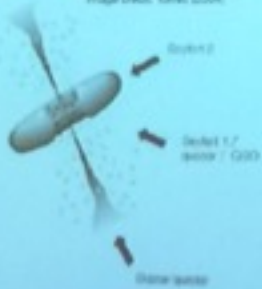
Inspiring Talks #1

AGN evolution - Vernesa Smolcic et al.

AGN in the radio regime:
low-excitation (LE) vs. high excitation (HE)

High excitation - cold mode - radiative mode	Low excitation - hot mode - jet mode
<ul style="list-style-type: none">Strong emission lines in optical spectrumX-ray, MIR, optical AGN (Unified model for AGN)	<ul style="list-style-type: none">Optical spectrum devoid of strong emission linesIdentified as AGN in the radio window<ul style="list-style-type: none">Usually LINER, absorption line AGN & FR I type$L_{\text{radio}} < 10^{28}$ W/Hz

Image credit: Teresi (2004)



Fornax A

Radio excess seen in LERGs - Nikola Baran, Claudia Mancuso et al.

Consiglio Nazionale delle Ricerche
AREA VIVA RICERCA E INNOVAZIONE

Composition of sub mJy radio sources

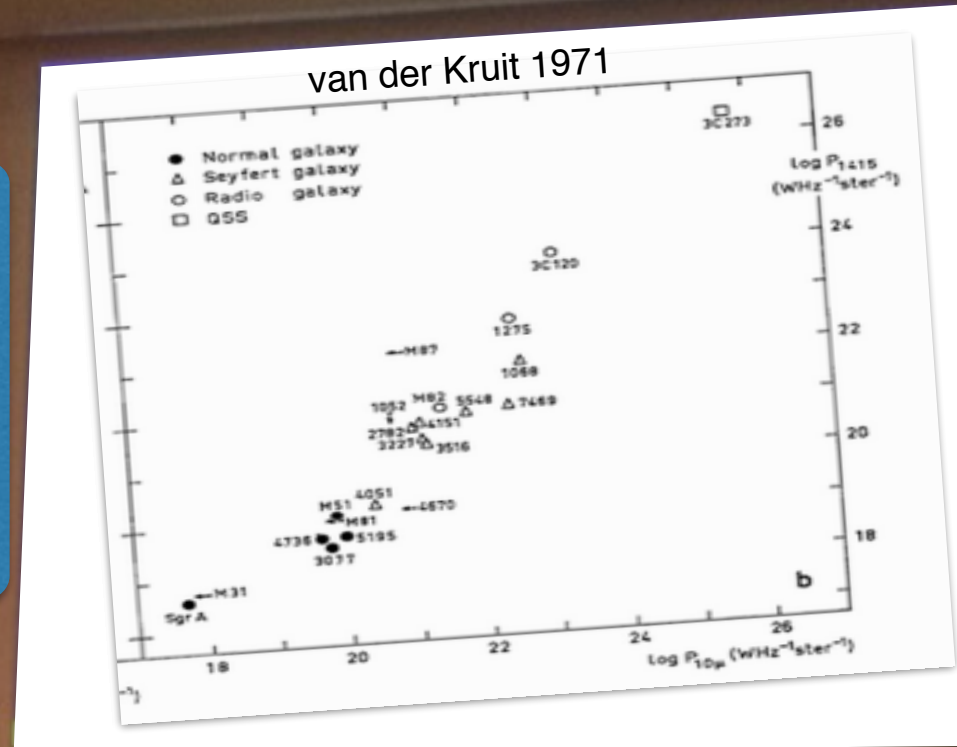
Consistent with
Padovani et al. 2015
Bonzini et al. 2013
Smolčić et al. 2008

S_{230} / mJy	Star-forming fraction	Low-excitation radio AGN fraction
100	0.40	0.75
150	0.40	0.45
200	0.58	0.18
300	0.58	0.22
400	0.85	0.22
500	0.85	0.22
600	0.85	0.22
700	0.85	0.22
800	0.85	0.22
900	0.85	0.22
1000	0.85	0.22

Best historical interjection:

Fatemeh Tabatabaei

“Don’t forget the FIR-radio correlation started life as the mid-IR-radio correlation!”



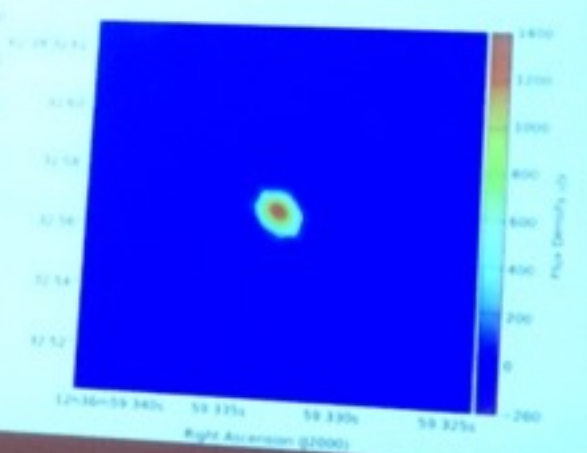
LERGs and deep, wide-field high resolution (VLBI) surveys e.g. Jack Radcliffe, Daria Guidetta et al.

“Wide-field VLBI is the here and now.” - Jack Radcliffe.

- Noise profile more uniform \Rightarrow reduction in phase errors
- This can be used on any future VLBI observation!

Phase referencing
SNR = 43.2

Multi-field self calibration
SNR = 102 (242% increase!!)

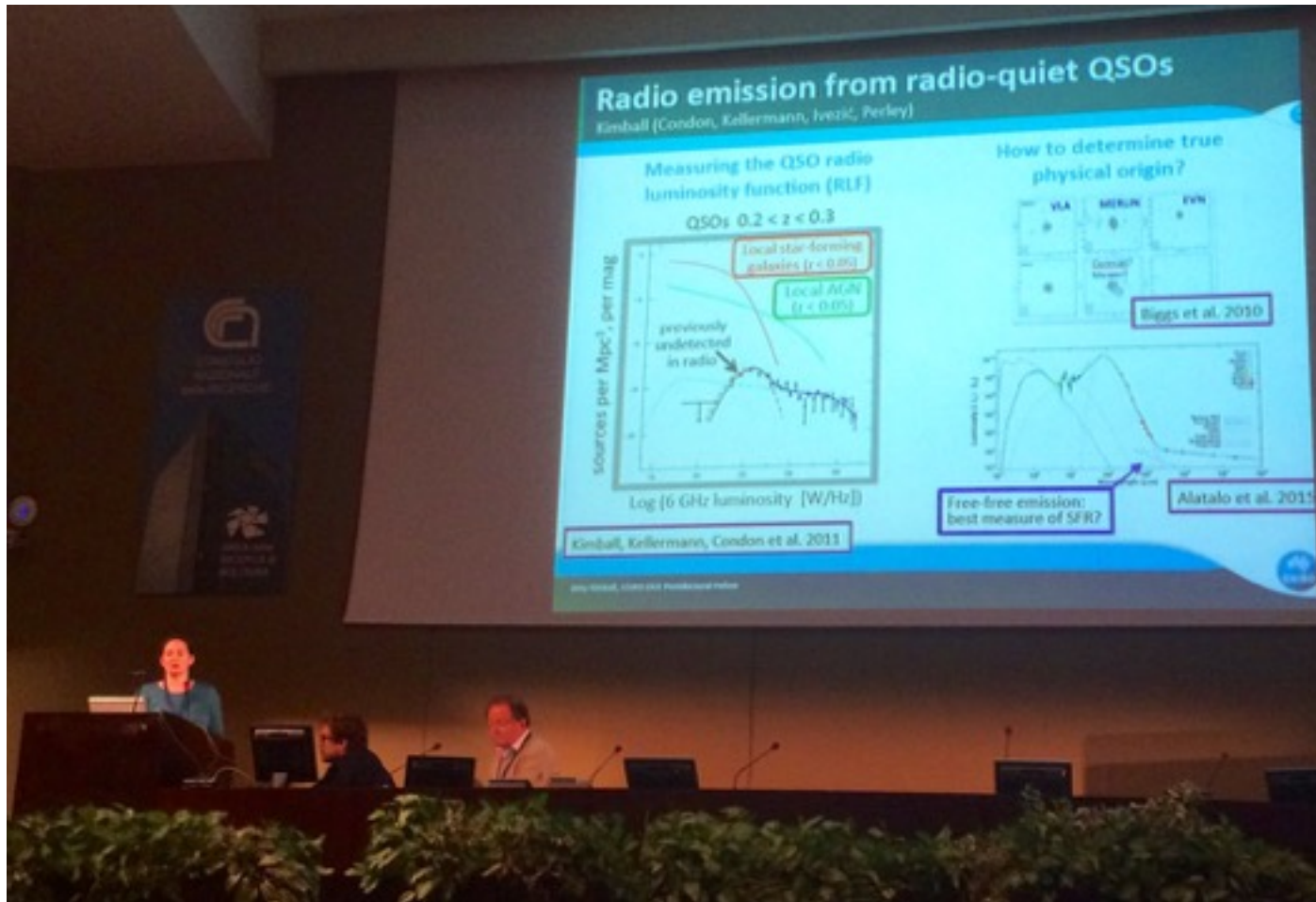


Poster sessions were great!



Best Poster title:

And the winner is: *Amy Kimball!*



 Tania Burchell and 9 others follow



Kyle Willett @kwwillett · 4h

. @amykimball Poster #1: Radio emission from radio-quiet QSOs. She says the title is totally not an oxymoron. #radsurveys15

Inspiring Talks #2

“J.P.” Macquart’s Transient Cheese Shop...

“Transients to suit everybody’s taste....”

Scientific Motivation

- Transients probe
 - high brightness temperature emission
 - extreme states of matter
 - physics of strong gravitational fields
 - physics of accretion
 - extreme energy densities
- Impulsive transients are subject to propagation effects that probe
 - the IGM
 - the spacetime metric

Sensitivity and Dwell time

Extragalactic

- Merging Black Holes
- Supernovae
- Magnetar Giant Flares
- Evaporating Black Holes
- Super-giant Pulsars
- Gamma-ray Bursts
- "Blissars"

Galactic

- ETI
- Pulsars
- RRATs
- Magnetars
- Micro-quasars

Terrestrial

- Permissible RFI
- Atmospheric effects
- We are here

Kyle Willett @kwwillett · Oct 20
Macquart: Fast radio bursts have an odd dependence on Galactic latitude due to scintillation effects.
ui.adsabs.harvard.edu/#abs/2015MNRAS... #radsurveys15

Hunting for missing baryons via FRB DMs

“There will be some dispersion in the Dispersion...”

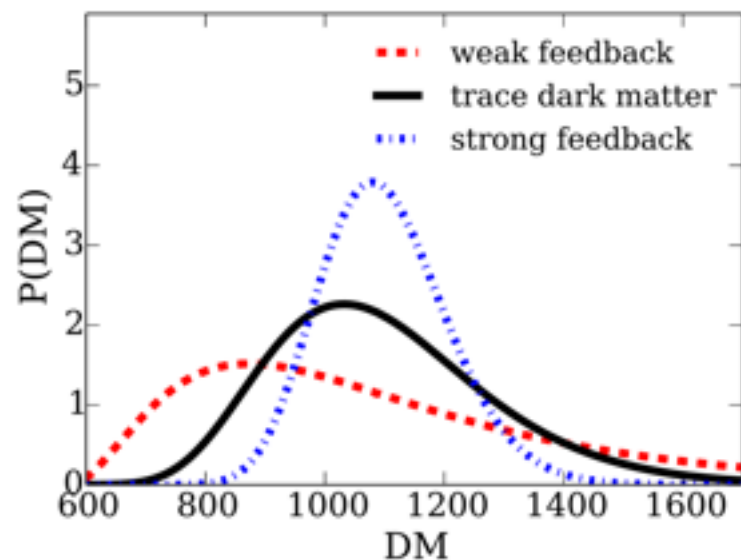


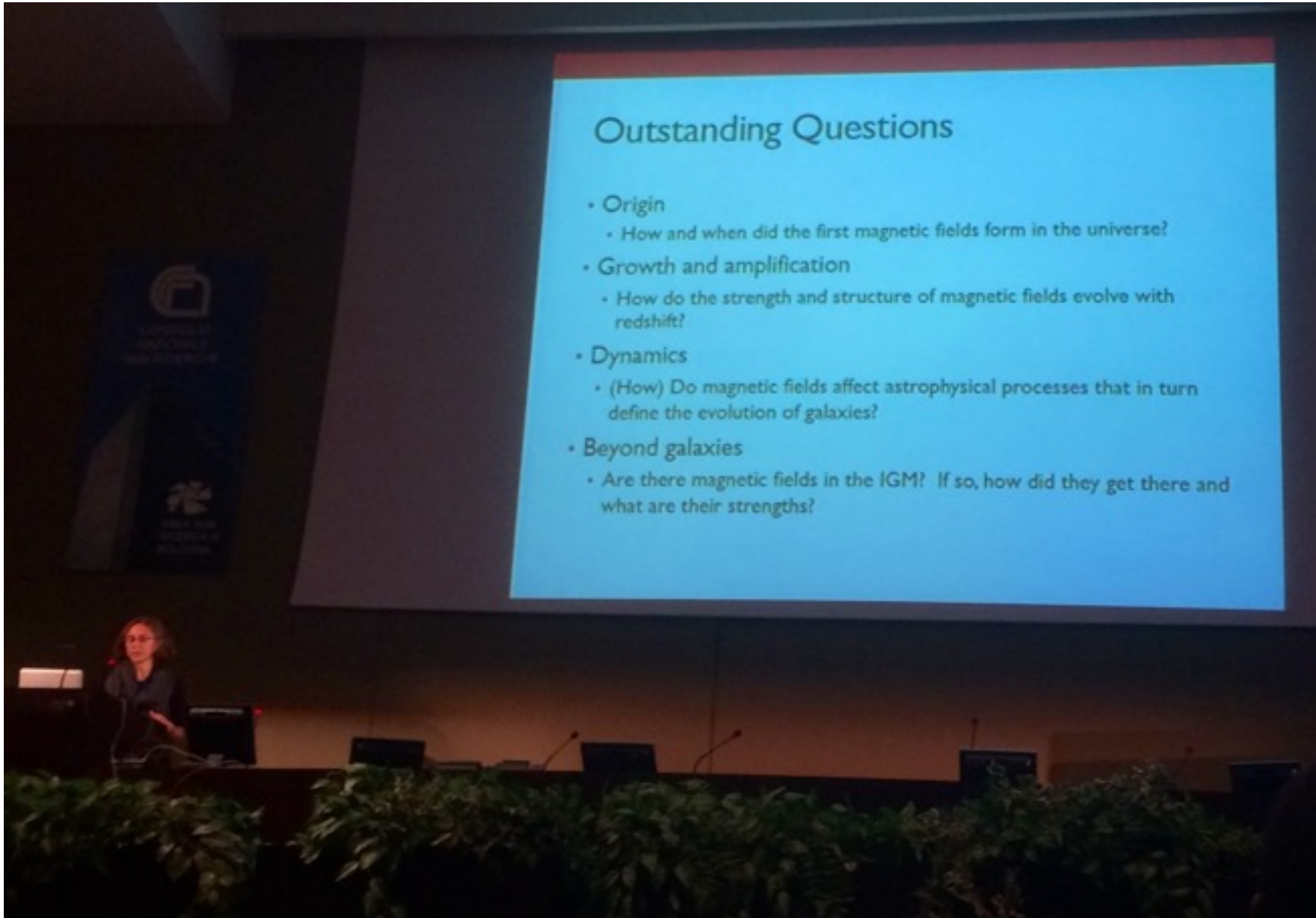
Figure 1: Possible probability distributions of FRB dispersion measures for bursts located at $z = 1$. The distribution depends on how the baryons are distributed near the halos of galaxy clusters along the line of sight. The more diffuse the gas, the more concentrated is the probability density around its central value. Here, strong feedback corresponds to a scenario in which the baryonic extent of each galaxy cluster halo extends to 2 virial radii, while the weak feedback corresponds to one in which the halo extends to only half the cluster virial radius. (See McQuinn (2014) for more details.)

Magnetism comes of age ?

“Anna Williams, George Heald, Federika Govoni et al. :

Outstanding Questions

- Origin
 - How and when did the first magnetic fields form in the universe?
- Growth and amplification
 - How do the strength and structure of magnetic fields evolve with redshift?
- Dynamics
 - (How) Do magnetic fields affect astrophysical processes that in turn define the evolution of galaxies?
- Beyond galaxies
 - Are there magnetic fields in the IGM? If so, how did they get there and what are their strengths?




Magnetism comes of age ?

“Anna Williams, George Heald, Federika Govoni et al. :

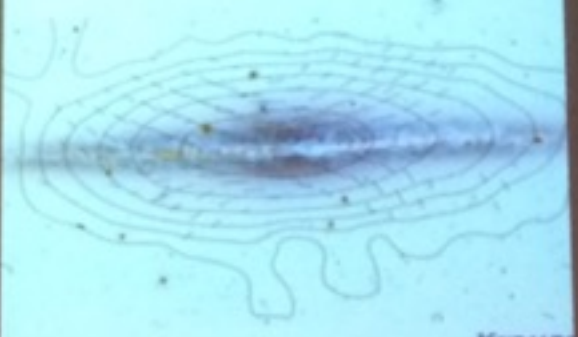
ASTRON

Magnetic fields in galaxies

- Broadly speaking: magnetic fields follow the optical spiral pattern, and show an X-shaped morphology in the halo



Fletcher & Beck



Krause

$|B| \sim \text{few } \mu\text{G (ordered)},$
 $\sim \text{few-10s } \mu\text{G (random)}$

George Heald / Extragalactic Radio Surveys meeting / 20-30-2015

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CONSIGLIO NAZIONALE DELLE RICERCHE
AREA DI RICERCA IN SCIENZE

Magnetism comes of age ?

“Anna Williams, George Heald, Federika Govoni, et al. :

SKA Cosmic Magnetism All-Sky Survey
Johnston-Hollitt et al. (2015)

Polarization Survey
Stokes I, Q, U

INSTRUMENT	SKA1-Mid
FREQUENCY	Band2 (950-1760 MHz)
SENSITIVITY	4 μ Jy/beam
RESOLUTION	2"
FIELD OF VIEW	All-Sky 30,000 deg ²

Williams et al. 2014
100 μ G

Govoni et al. 2015
40 μ G

SKA 1
7 μ G

?

Inspiring Talk #3

“Magnetogenesis...” - Franco Vazza

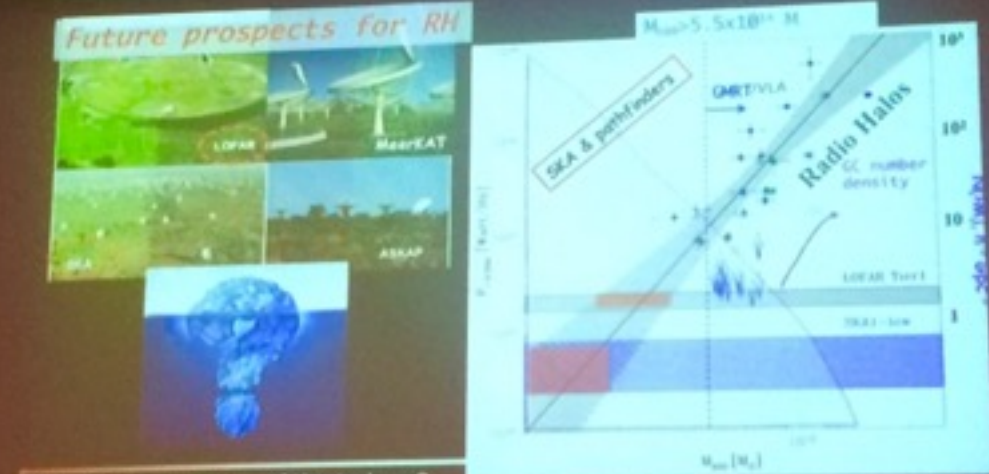
**Needs
SKA1-low.**



Clusters & Next-generation radio telescopes

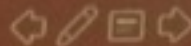
“**Rossella Cassano *et al.***”

Science
case for
SKA1-low
beyond EoR
and Pulsars.



Are we seeing the tip of the iceberg?
How many RH await discovery?

LOFAR and SKA1-LOW will explore low massive clusters ($M_{cl} \sim 10^{14} M_{\odot}$) that are $\sim 100+$ times more numerous than clusters observable by present facilities.



Remnant radio lobes

- Leith Goddfery, Marisa Brienza

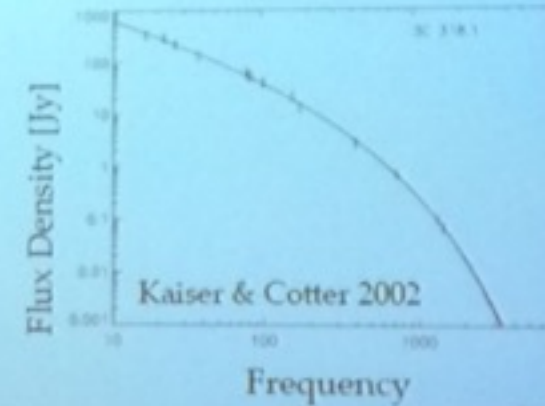
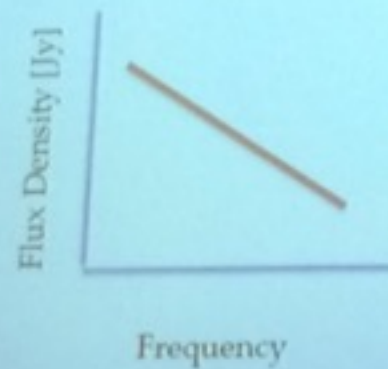
Waiting for
Deep LOFAR
surveys and
again SKA1-
low



Herc A: NRAO/NASA



B0924+30: M. Murgia



Prizes

Best SKA Engineering Change Proposal (ECP)



Prizes

Best SKA Engineering Change Proposal (ECP)

And the winner is: *Mario Santos!*

“I’m going to make the SKA into the most expensive voltmeter in the world”.

Conclusions...

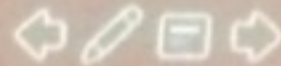
1. The combination of several probes available with radio telescopes will provide unprecedented constraints on cosmological parameters and a handle on systematics
2. Large continuum survey will probe the isotropy of the Universe and the cosmic dipole (as well as “standard” cosmology)
3. HI intensity mapping in particular opens up a new possibility for SKA1 (as a total power array)
4. Competitive constraints on DE and GR modified theories with HI IM at $z < 0.8$
5. But real strength is in probing very large scales: cross-correlate with Euclid/LSST at $z < 2$ to probe the nature of primordial fluctuations and deviations from General Relativity

Thanks to my collaborators... It has been (and still is)
great fun!

THANK YOU FOR YOUR ATTENTION

“It has been (and
still is) great fun!”

- Tiziana Venturi.



CONSE
MAZION
w RICE



Future

Italian Radio Astronomy - 51 years after the N-cross...



Future

Italian Radio Astronomy - 51 years after the N-cross...



INAF ORA

&

Radio Astronomy in general

- the best is yet to come!