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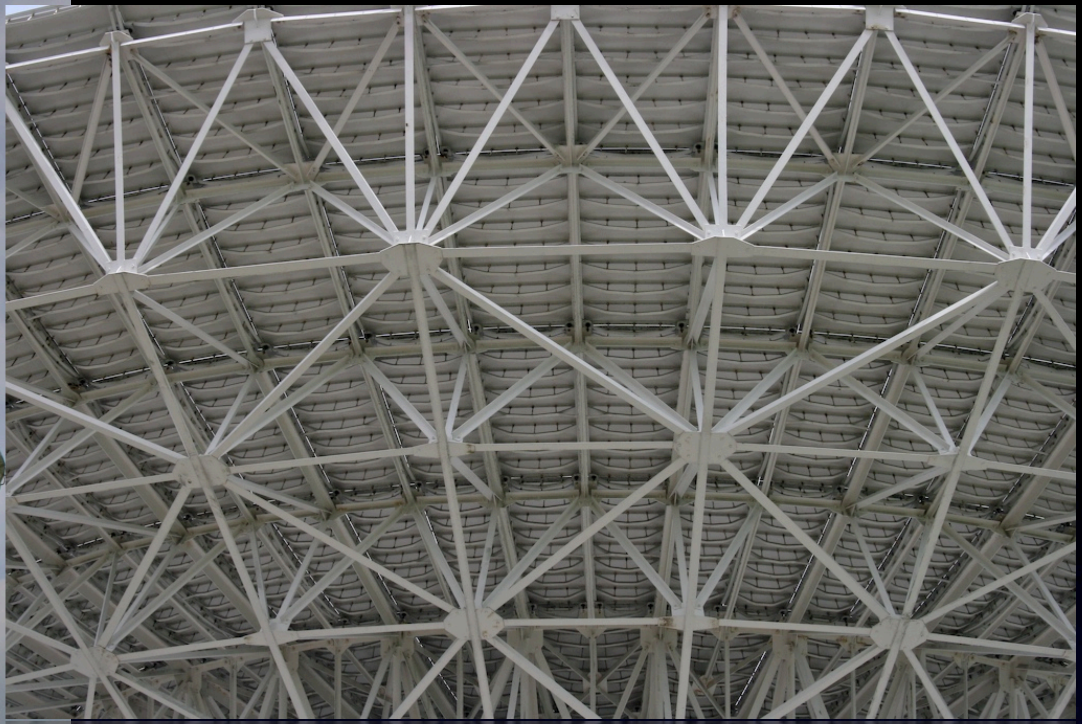
The University of Manchester

OCRA-F

Mike Peel

OCRA Collaboration: University of Manchester, Torun Centre for Astrophysics & University of Bristol

Torun 32m



Torun 32m

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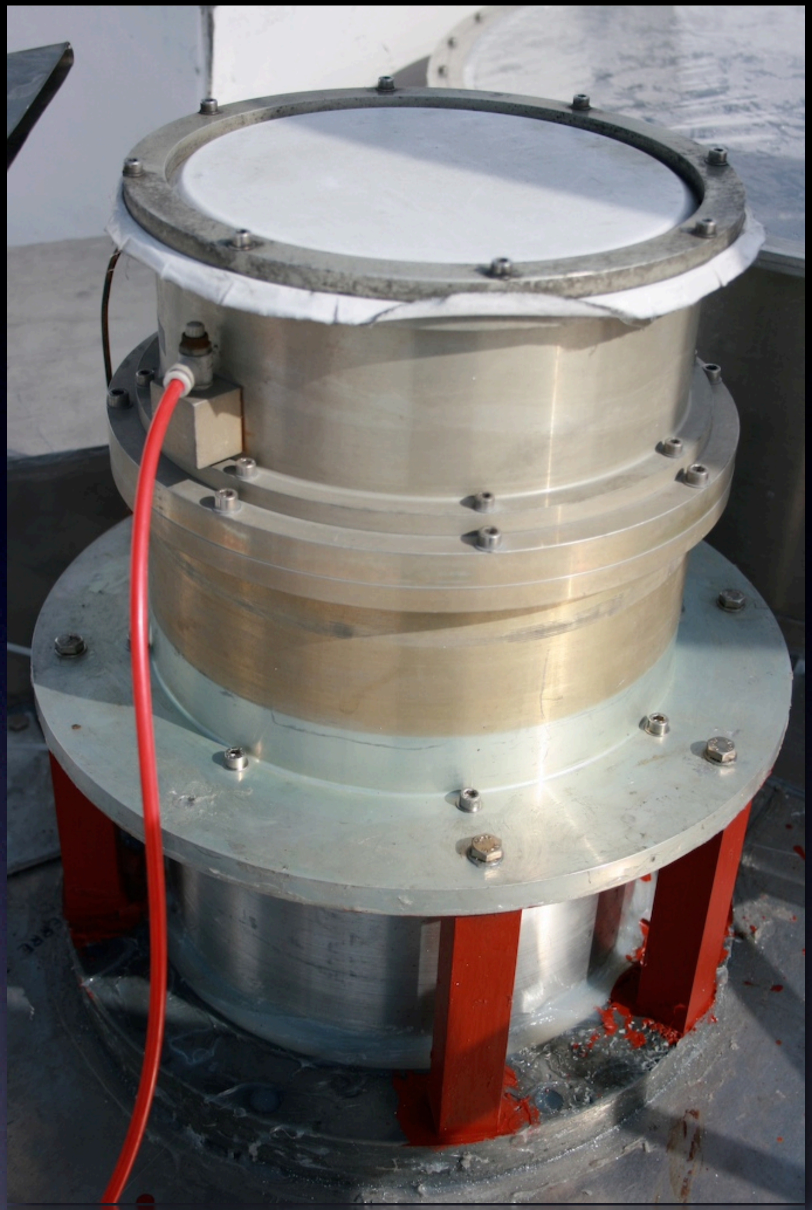
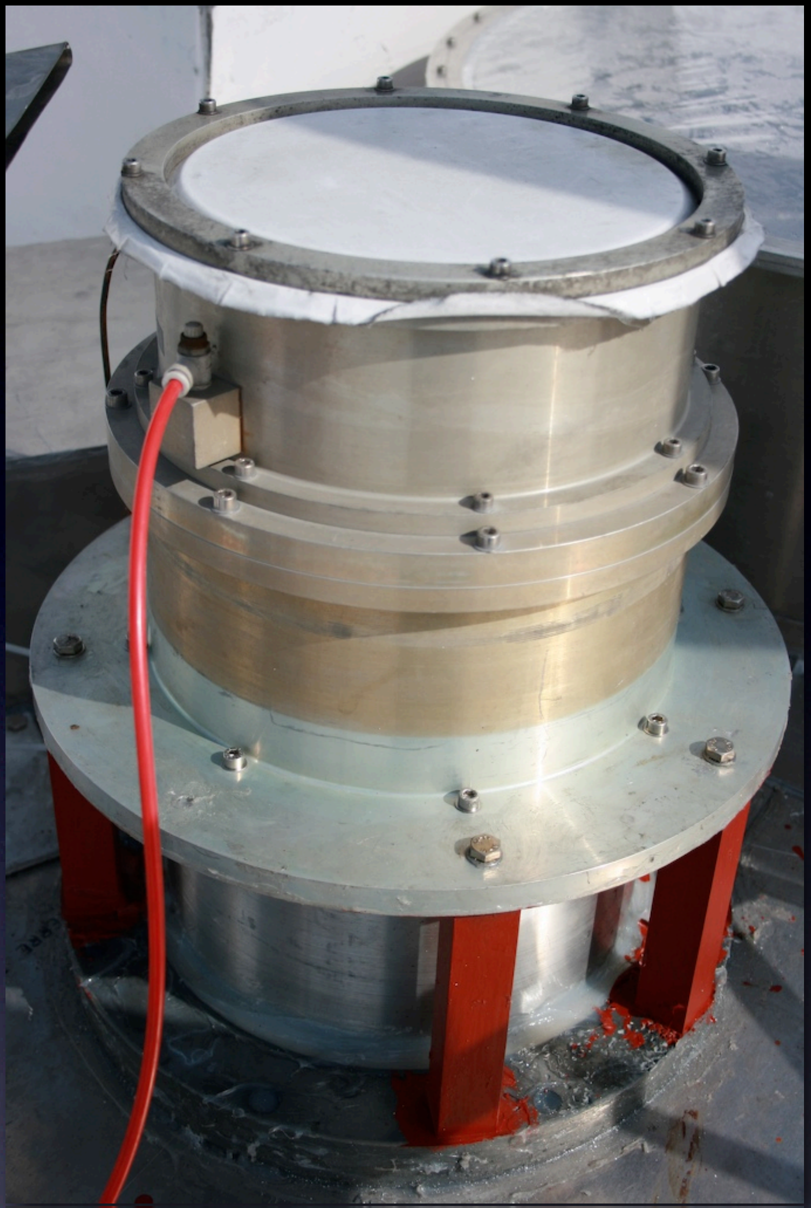


OCRA-p



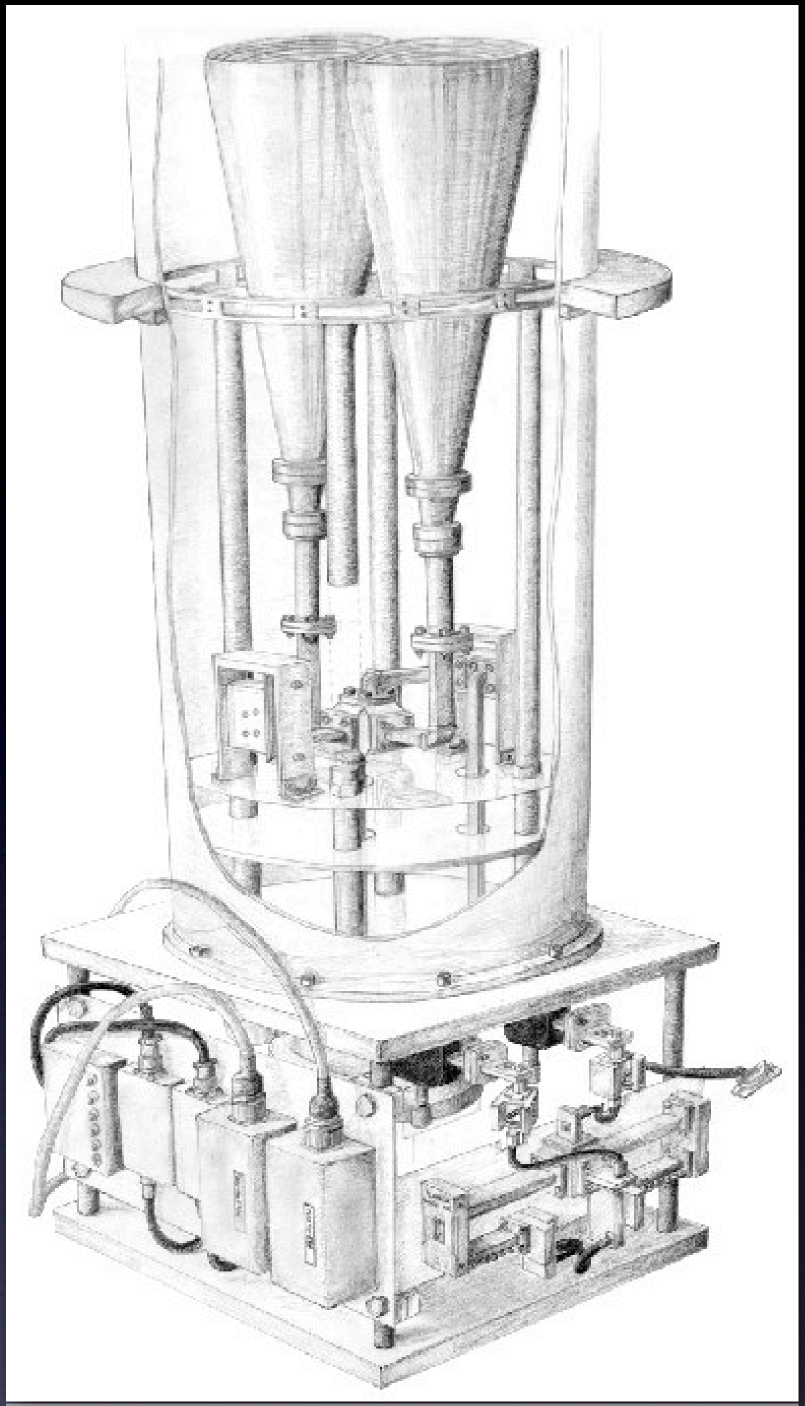
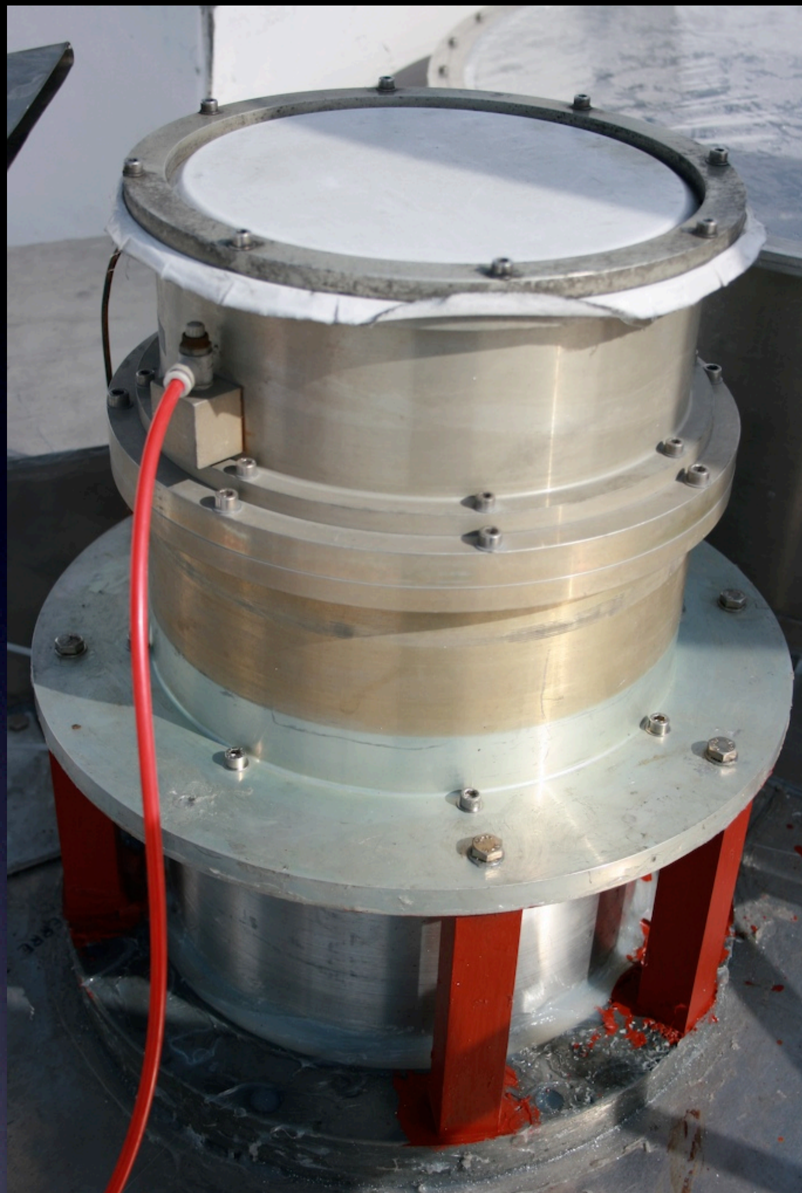
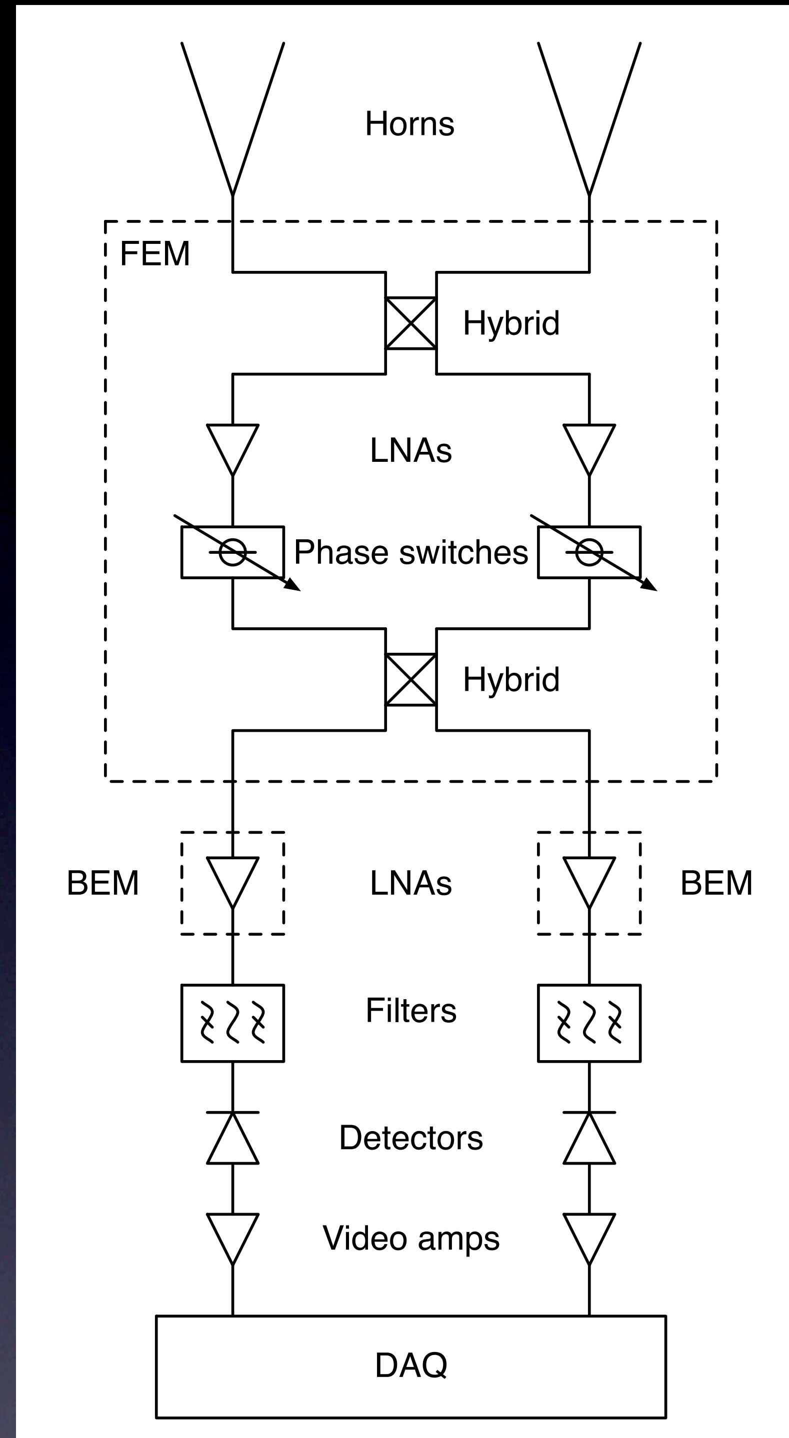


Image credit: S. Lowe

OCRA-p





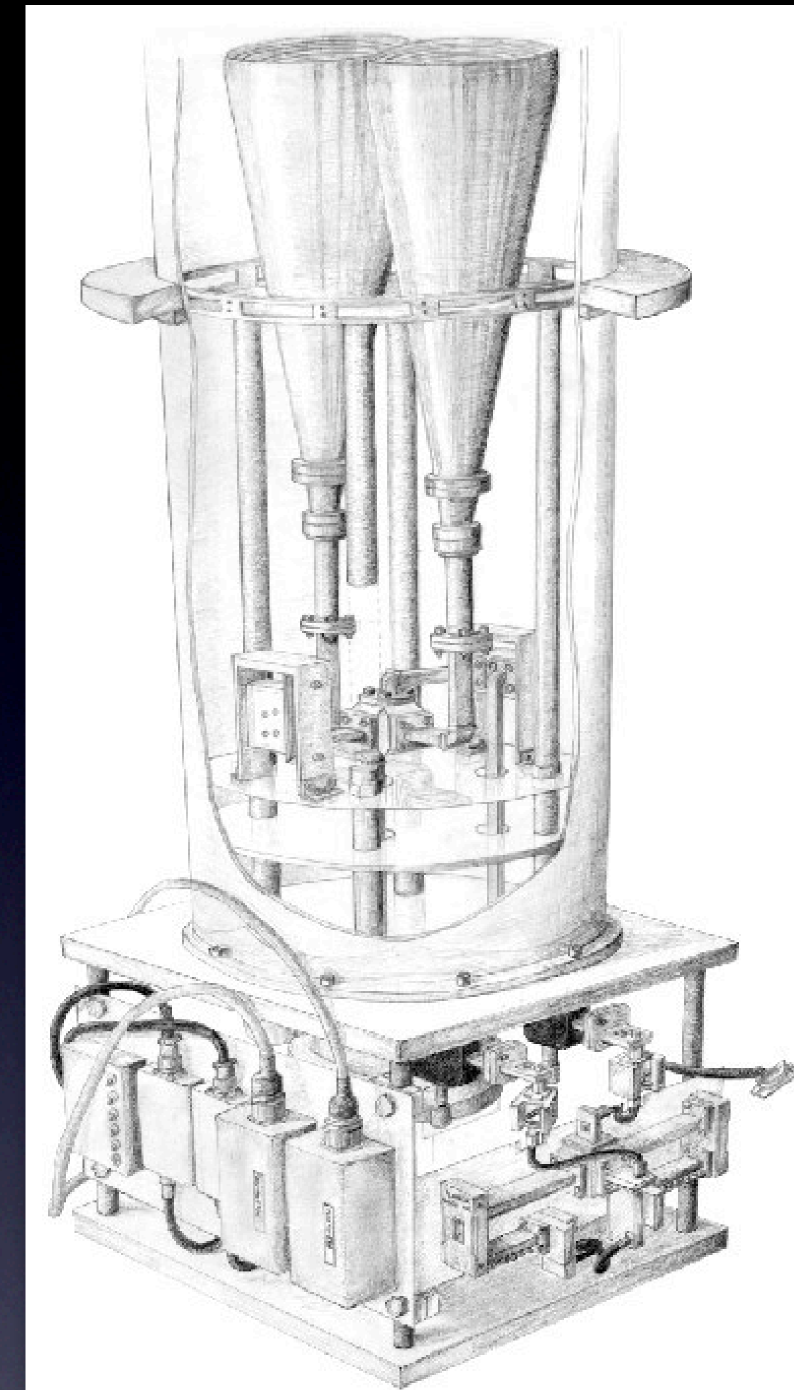
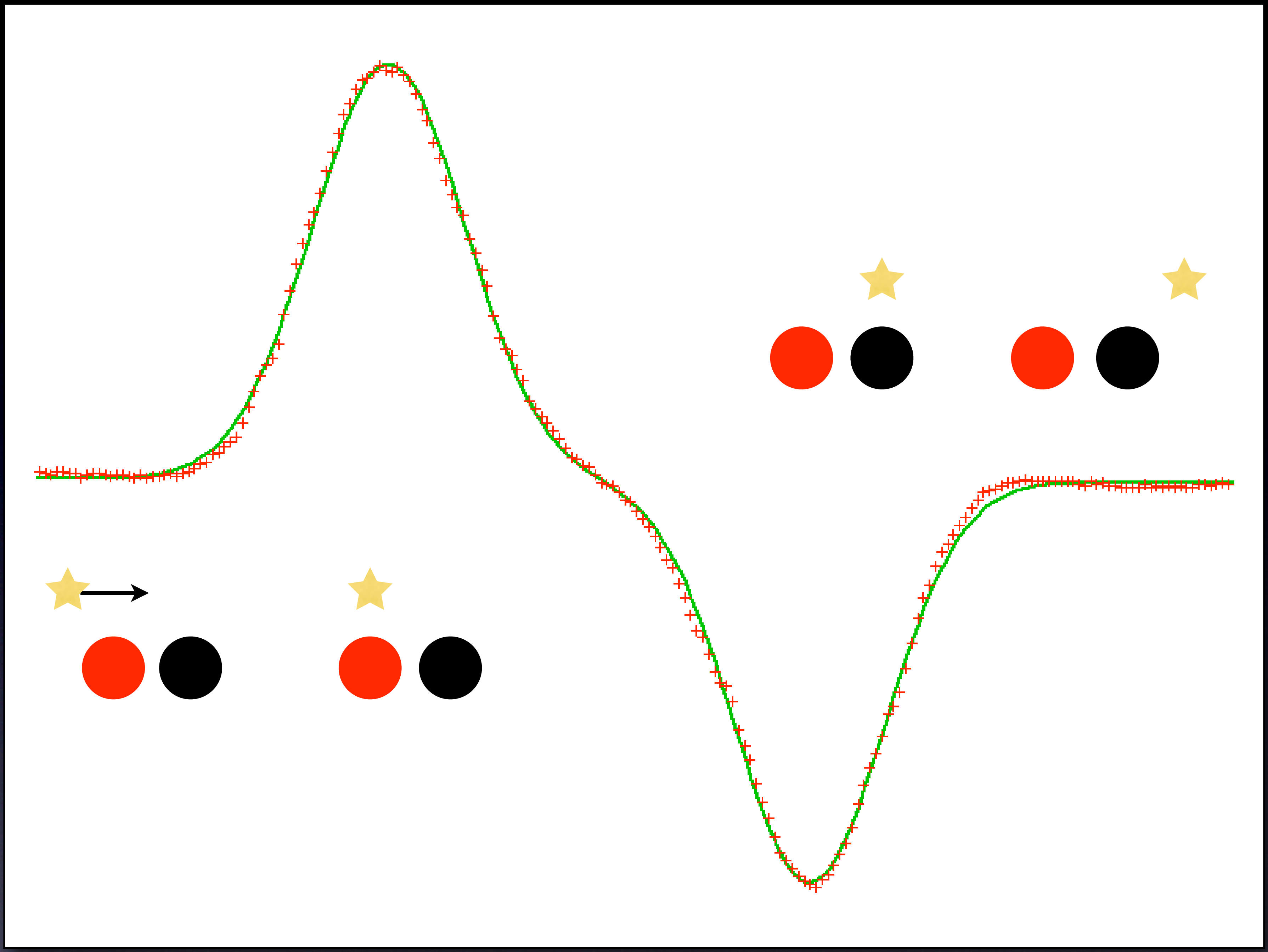


Image credit: S. Lowe

OCRA-p



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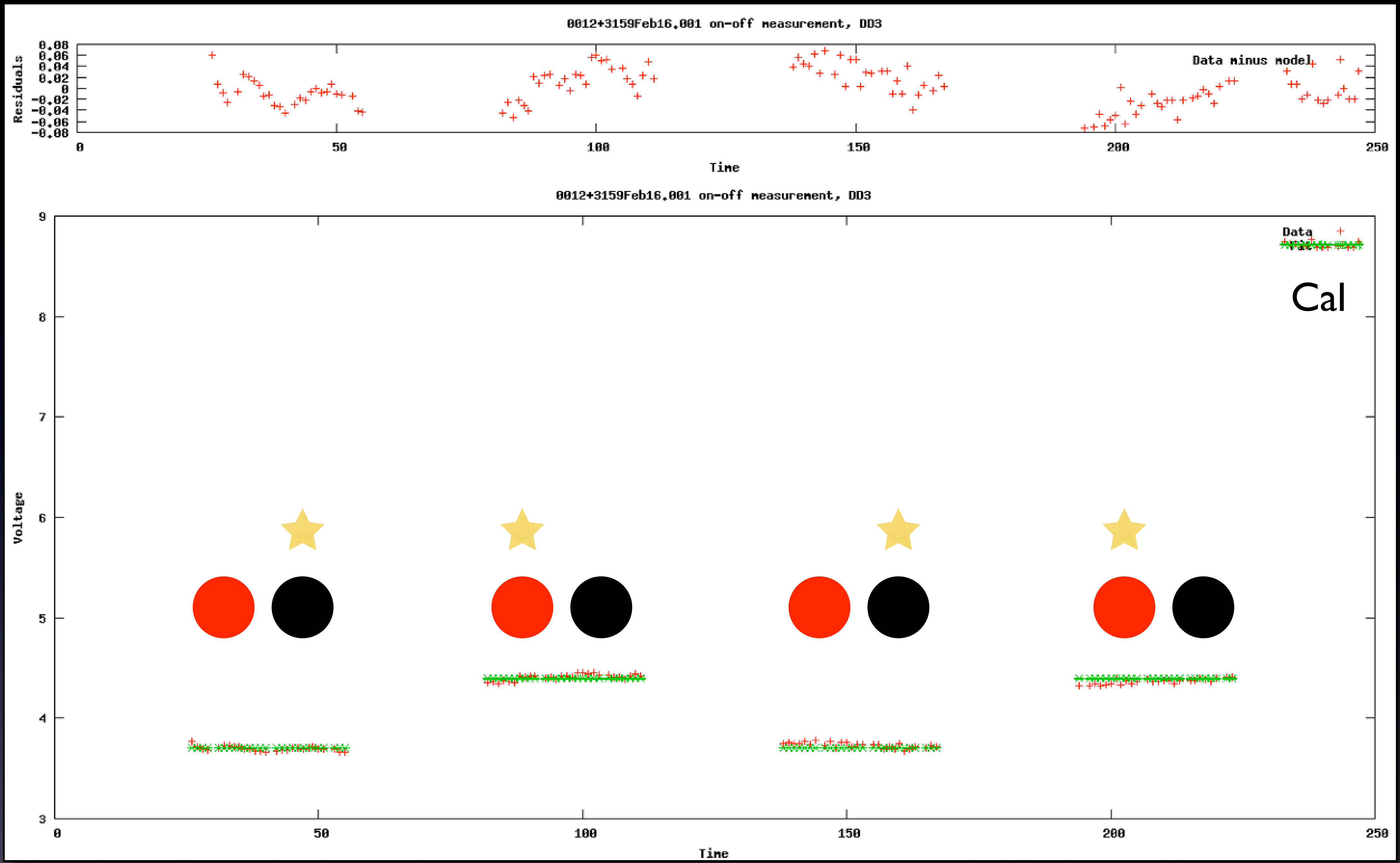
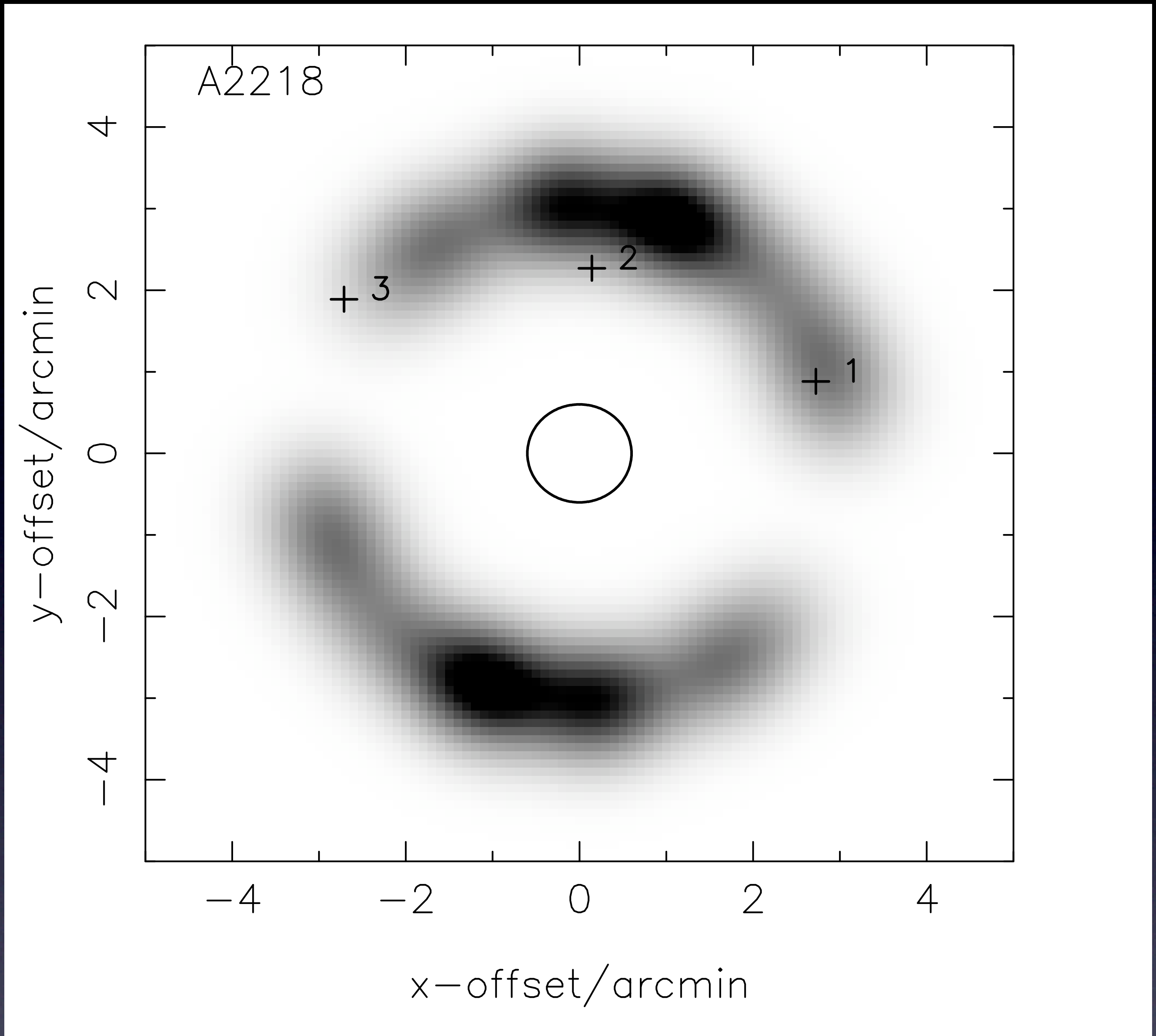


0012+3159Feb16.001 on-off measurement, DD3
Residuals
Data minus model
Time
0012+3159Feb16.001 on-off measurement, DD3
Voltage
Data
Cal
Time

On-Offs



Long integrations

Mon. Not. R. Astron. Soc. **378,** 673–680 (2007) doi:10.1111/j.1365-2966.2007.11808.x

Preliminary Sunyaev–Zel'dovich observations of galaxy clusters with OCRA-p

Katy Lancaster,[1★] Mark Birkinshaw,[1] Marcin P. Gawroński,[3] Ian Browne,[2] Roman Feiler,[3] Andrzej Kus,[3] Stuart Lowe,[2] Eugeniusz Pazderski[3] and Peter Wilkinson[2]

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ABSTRACT

We present 30-GHz Sunyaev–Zel'dovich (SZ) observations of a sample of four galaxy clusters with a prototype of the One Centimetre Receiver Array (OCRA-p) which is mounted on the Torun 32-m telescope. The clusters (Cl 0016+16, MS 0451.6–0305, MS 1054.4–0321 and Abell 2218) are popular SZ targets and serve as commissioning observations. All four are detected with clear significance (4–6σ) and values for the central temperature decrement are in good agreement with measurements reported in the literature. We believe that systematic effects are successfully suppressed by our observing strategy. The relatively short integration times required to obtain these results demonstrate the power of OCRA-p and its successors for future SZ studies.

Key words: galaxies: clusters: individual: Cl 0016+16 – galaxies: clusters: individual: MS 0451.6–0305 – galaxies: clusters: individual: MS 1054.4–0321 – galaxies: clusters: individual: A2218 – cosmic microwave background – cosmology: observations.

Science with OCRA-p

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Preliminary Sunyaev–Zel'dovich observations of galaxy clusters with OCRA-p

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Accepted 2007 March 29. Received

30 GHz flux density measurements of the Caltech-Jodrell flat-spectrum sources with OCRA-p *(Research Note)*

S. R. Lowe[1], M. P. Gawroński[2], P. N. Wilkinson[1], A. J. Kus[2], I. W. A. Browne[1], E. Pazderski[2], R. Feiler[2], and D. Kettle[1]

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Received June 7, 2007; accepted ???

ABSTRACT

Aims. To measure the 30-GHz flux densities of the 293 sources in the Caltech-Jodrell Bank flat-spectrum (CJF) sample. The measurements are part of an ongoing programme to measure the spectral energy distributions of flat spectrum radio sources and to correlate them with the milliarcsecond structures from VLBI and other measured astrophysical properties.
Methods. The 30-GHz data were obtained with a twin-beam differencing radiometer system mounted on the Toruń 32-m telescope. The system has an angular resolution of 1.2′.
Results. Together with radio spectral data obtained from the literature, the 30-GHz data have enabled us to identify 42 of the CJF sources as Giga-hertz Peaked Spectrum (GPS) sources. Seventeen percent of the sources have rising spectra ($\alpha > 0$) between 5 and 30 GHz.

Key words. Astronomical data bases: miscellaneous – Radio continuum: galaxies

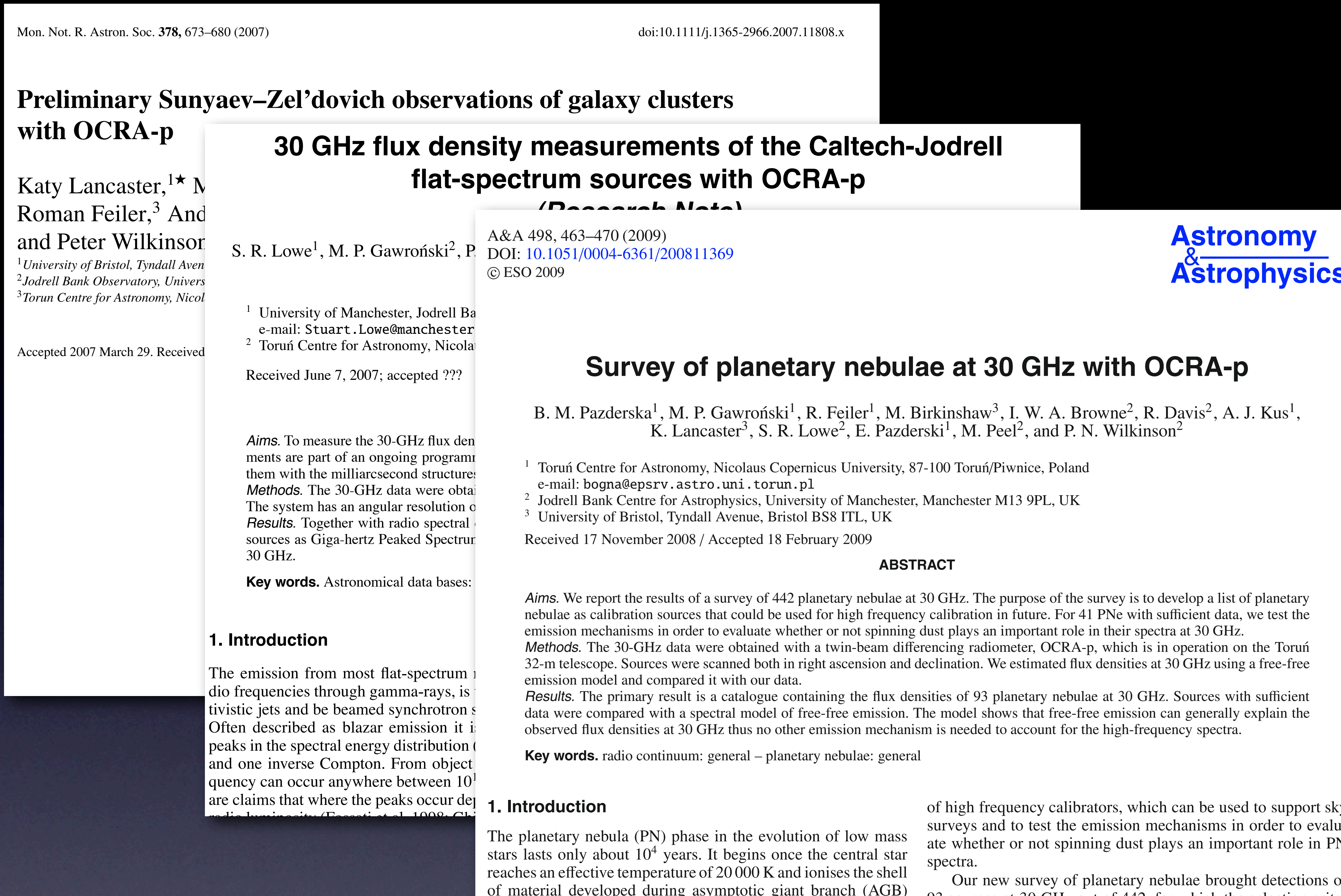
1. Introduction

The emission from most flat-spectrum radio sources, from radio frequencies through gamma-rays, is thought to arise in relativistic jets and be beamed synchrotron self-Compton emission. Often described as blazar emission it is characterized by two peaks in the spectral energy distribution (SED), one synchrotron and one inverse Compton. From object to object the peak frequency can occur anywhere between 10^{10} Hz to 10^{15} Hz. There are claims that where the peaks occur depends systematically on

1. $S_{4.85\ GHz} \geq 350\ mJy$
2. $\alpha_{1.4\ GHz}^{4.85\ GHz} \geq -0.5$[1]
3. $\delta(1950) \geq 35°$
4. $|b| \geq 10°$

In addition to the structural information obtained in the CJ VLBI surveys, extensive follow-up observations have been made with the VLBA (Britzen et al. in prep) to study the statistics of superluminal motions; redshift information is available for > 90%

Science with OCRA-p


Mon. Not. R. Astron. Soc. **378,** 673–680 (2007) doi:10.1111/j.1365-2966.2007.11808.x

Preliminary Sunyaev–Zel'dovich observations of galaxy clusters with OCRA-p

30 GHz flux density measurements of the Caltech-Jodrell flat-spectrum sources with OCRA-p

A&A 498, 463–470 (2009)
DOI: 10.1051/0004-6361/200811369
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Astronomy & Astrophysics

Survey of planetary nebulae at 30 GHz with OCRA-p

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Received 17 November 2008 / Accepted 18 February 2009

ABSTRACT

Aims. We report the results of a survey of 442 planetary nebulae at 30 GHz. The purpose of the survey is to develop a list of planetary nebulae as calibration sources that could be used for high frequency calibration in future. For 41 PNe with sufficient data, we test the emission mechanisms in order to evaluate whether or not spinning dust plays an important role in their spectra at 30 GHz.
Methods. The 30-GHz data were obtained with a twin-beam differencing radiometer, OCRA-p, which is in operation on the Toruń 32-m telescope. Sources were scanned both in right ascension and declination. We estimated flux densities at 30 GHz using a free-free emission model and compared it with our data.
Results. The primary result is a catalogue containing the flux densities of 93 planetary nebulae at 30 GHz. Sources with sufficient data were compared with a spectral model of free-free emission. The model shows that free-free emission can generally explain the observed flux densities at 30 GHz thus no other emission mechanism is needed to account for the high-frequency spectra.

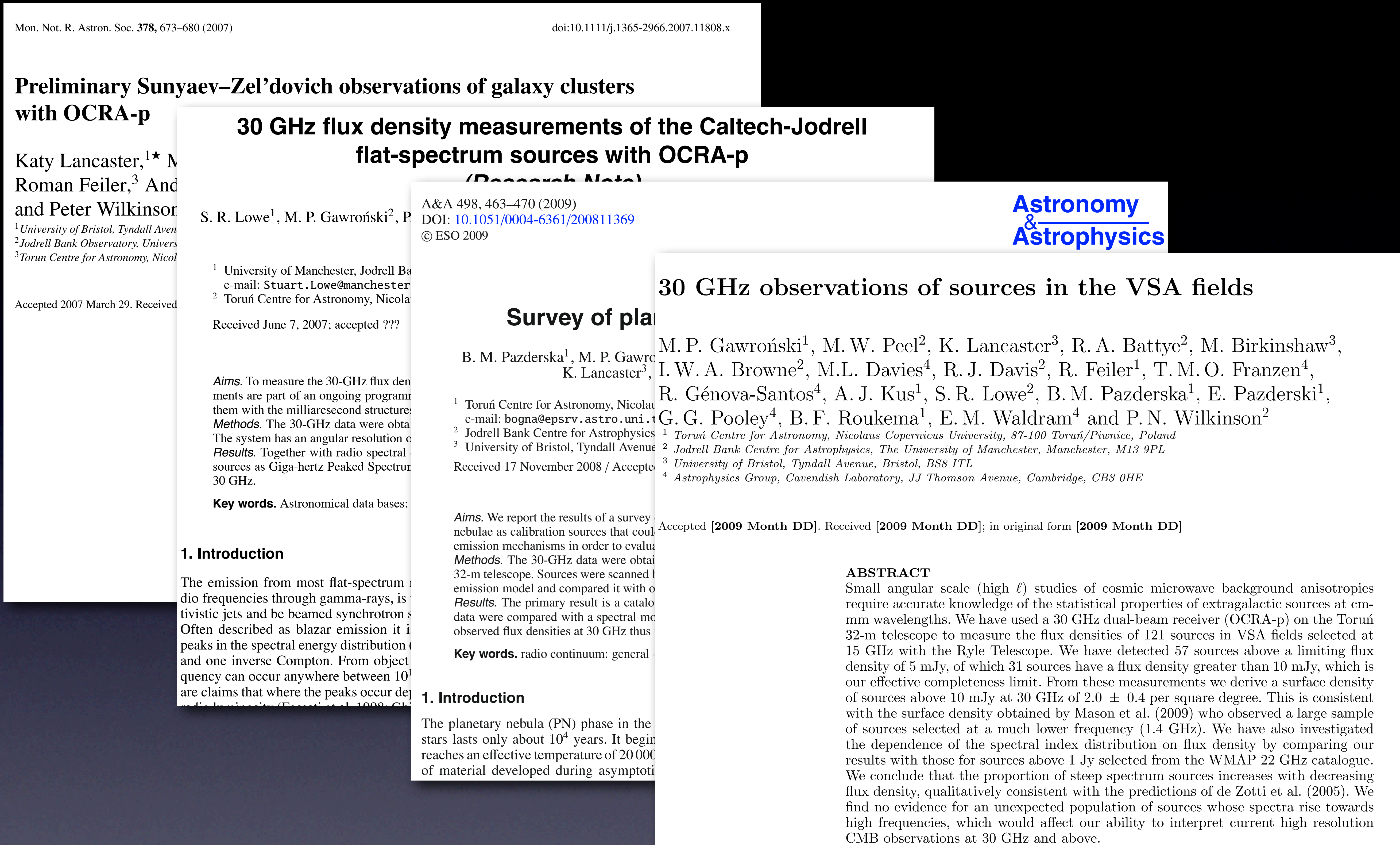
Key words. radio continuum: general – planetary nebulae: general

1. Introduction

The planetary nebula (PN) phase in the evolution of low mass stars lasts only about 10^4 years. It begins once the central star reaches an effective temperature of 20 000 K and ionises the shell of material developed during asymptotic giant branch (AGB) ... of high frequency calibrators, which can be used to support sky surveys and to test the emission mechanisms in order to evaluate whether or not spinning dust plays an important role in PN spectra.

Our new survey of planetary nebulae brought detections of 93 sources at 30 GHz out of 442, for which the selection crite-

Science with OCRA-p



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Preliminary Sunyaev–Zel'dovich observations of galaxy clusters with OCRA-p

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Accepted 2007 March 29. Received

30 GHz flux density measurements of the Caltech-Jodrell flat-spectrum sources with OCRA-p

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e-mail: Stuart.Lowe@manchester
[2] Toruń Centre for Astronomy, Nicola

Received June 7, 2007; accepted ???

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Methods. The 30-GHz data were obtai
The system has an angular resolution o
Results. Together with radio spectral
sources as Giga-hertz Peaked Spectrum
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Key words. Astronomical data bases:

1. Introduction

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Astronomy & Astrophysics

Survey of pla

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K. Lancaster[3],

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[2] Jodrell Bank Centre for Astrophysics
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Key words. radio continuum: general –

1. Introduction

The planetary nebula (PN) phase in the
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30 GHz observations of sources in the VSA fields

M. P. Gawroński[1], M. W. Peel[2], K. Lancaster[3], R. A. Battye[2], M. Birkinshaw[3], I. W. A. Browne[2], M.L. Davies[4], R. J. Davis[2], R. Feiler[1], T. M. O. Franzen[4], R. Génova-Santos[4], A. J. Kus[1], S. R. Lowe[2], B. M. Pazderska[1], E. Pazderski[1], G. G. Pooley[4], B. F. Roukema[1], E. M. Waldram[4] and P. N. Wilkinson[2]
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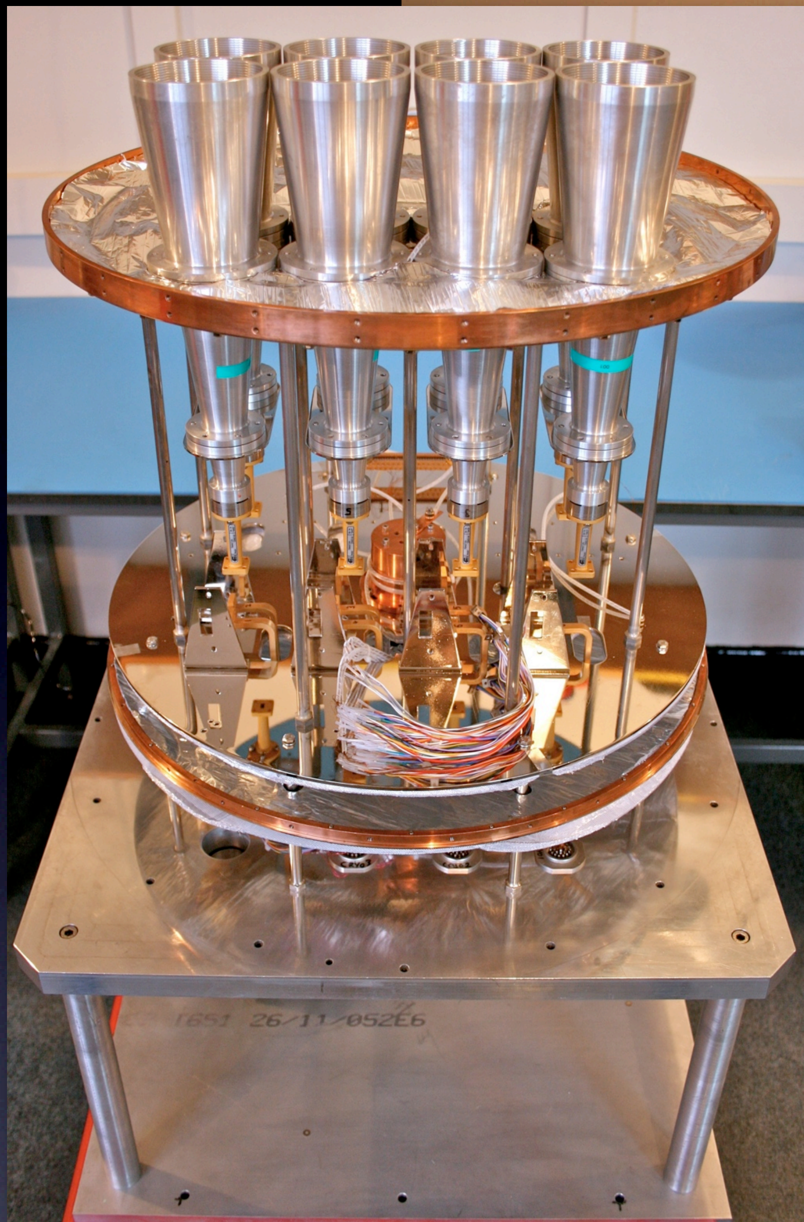
ABSTRACT
Small angular scale (high ℓ) studies of cosmic microwave background anisotropies require accurate knowledge of the statistical properties of extragalactic sources at cm-mm wavelengths. We have used a 30 GHz dual-beam receiver (OCRA-p) on the Toruń 32-m telescope to measure the flux densities of 121 sources in VSA fields selected at 15 GHz with the Ryle Telescope. We have detected 57 sources above a limiting flux density of 5 mJy, of which 31 sources have a flux density greater than 10 mJy, which is our effective completeness limit. From these measurements we derive a surface density of sources above 10 mJy at 30 GHz of 2.0 $\pm$ 0.4 per square degree. This is consistent with the surface density obtained by Mason et al. (2009) who observed a large sample of sources selected at a much lower frequency (1.4 GHz). We have also investigated the dependence of the spectral index distribution on flux density by comparing our results with those for sources above 1 Jy selected from the WMAP 22 GHz catalogue. We conclude that the proportion of steep spectrum sources increases with decreasing flux density, qualitatively consistent with the predictions of de Zotti et al. (2005). We find no evidence for an unexpected population of sources whose spectra rise towards high frequencies, which would affect our ability to interpret current high resolution CMB observations at 30 GHz and above.

Science with OCRA-p

OCRA-F



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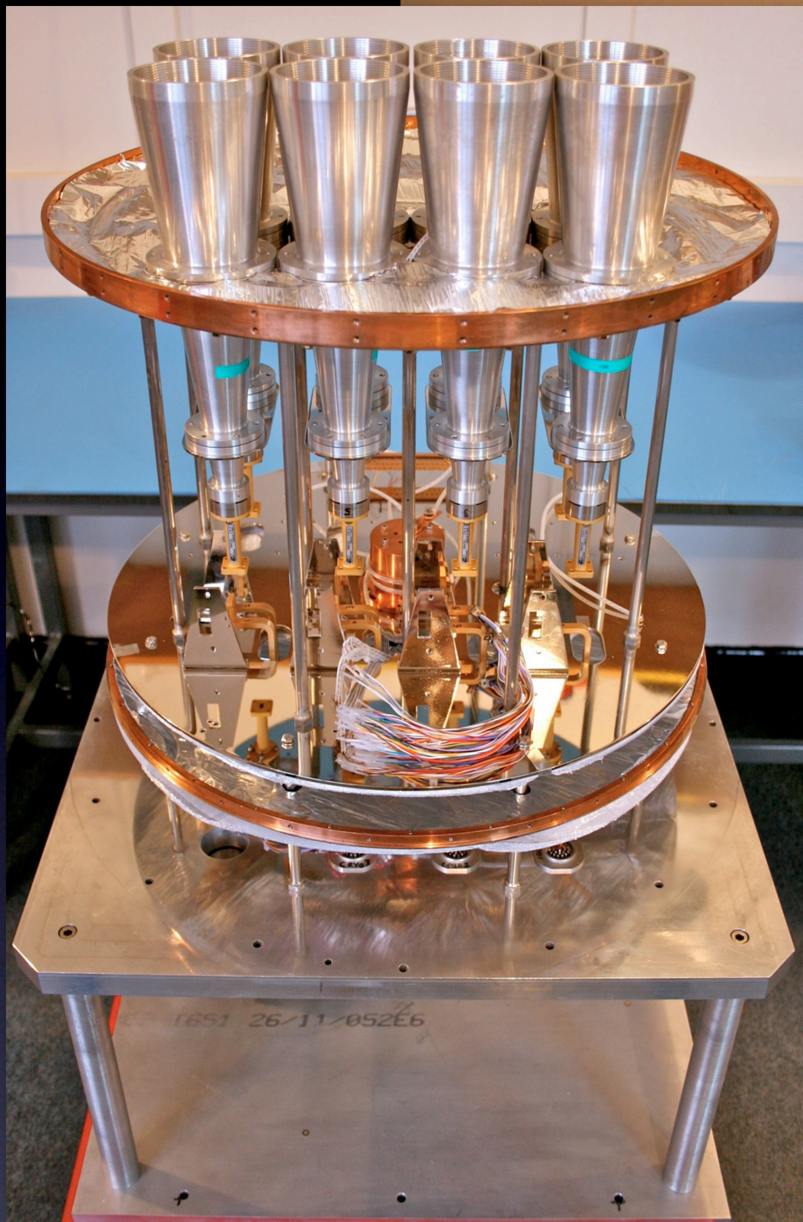

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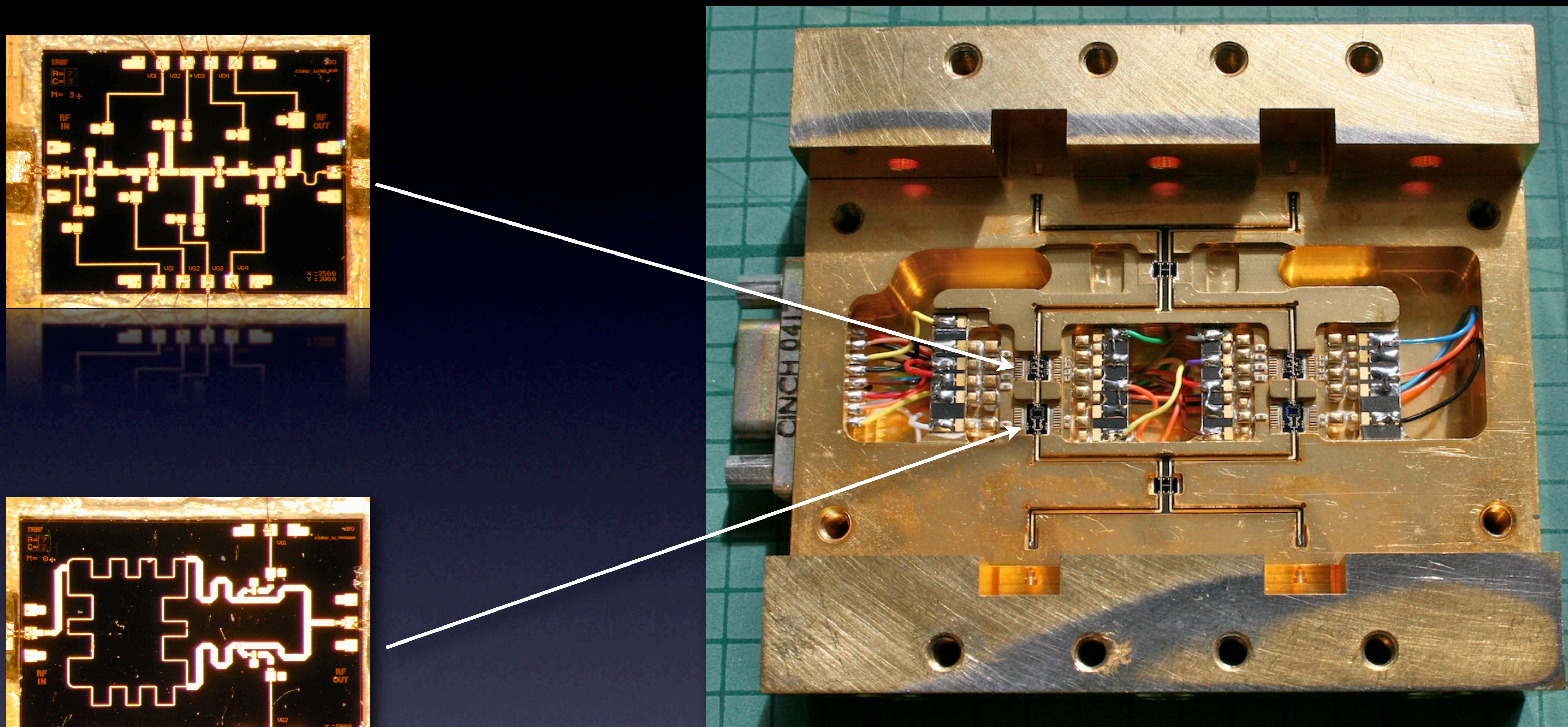
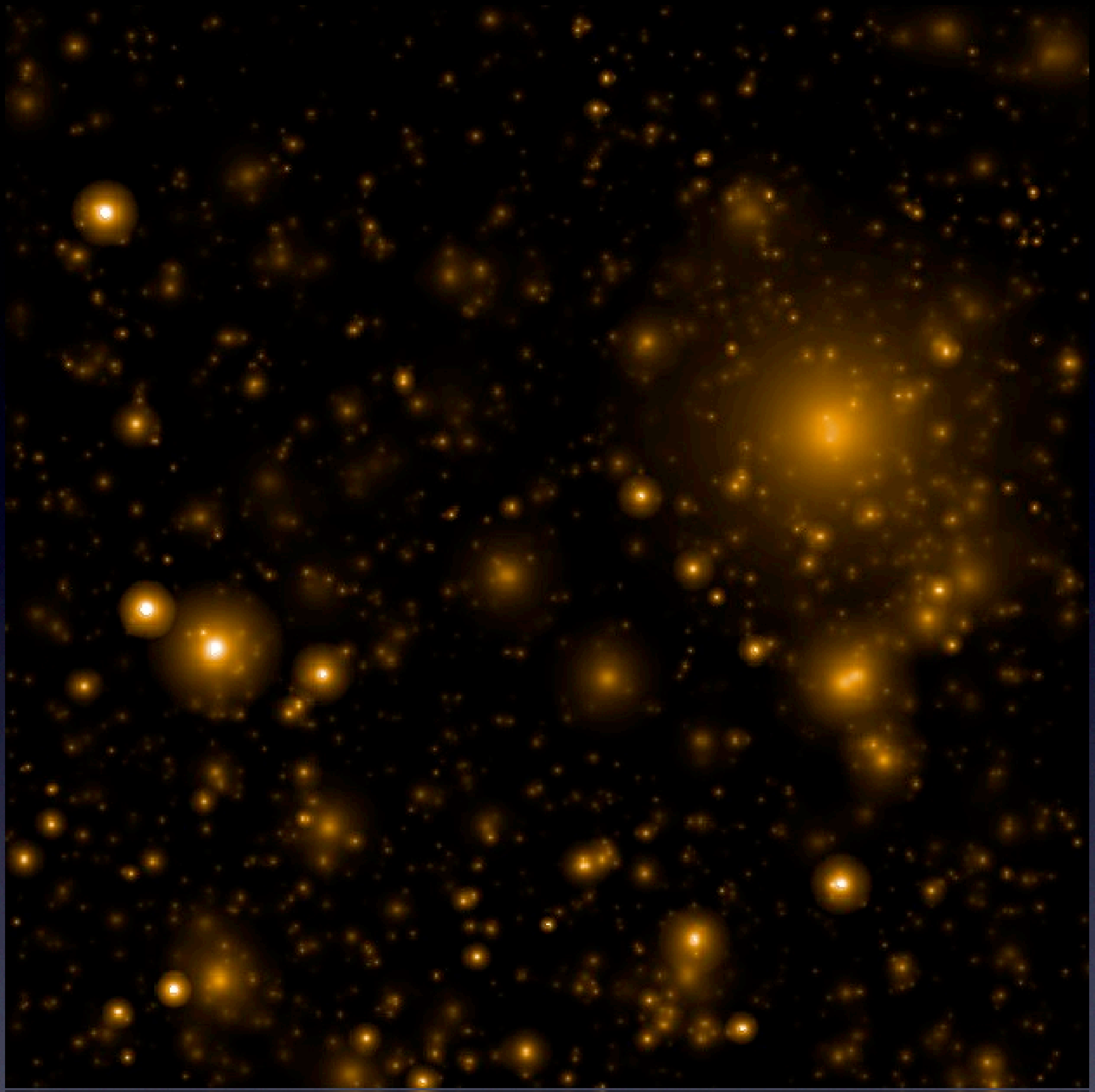


MMICs

Kettle et al. (2005,2007)



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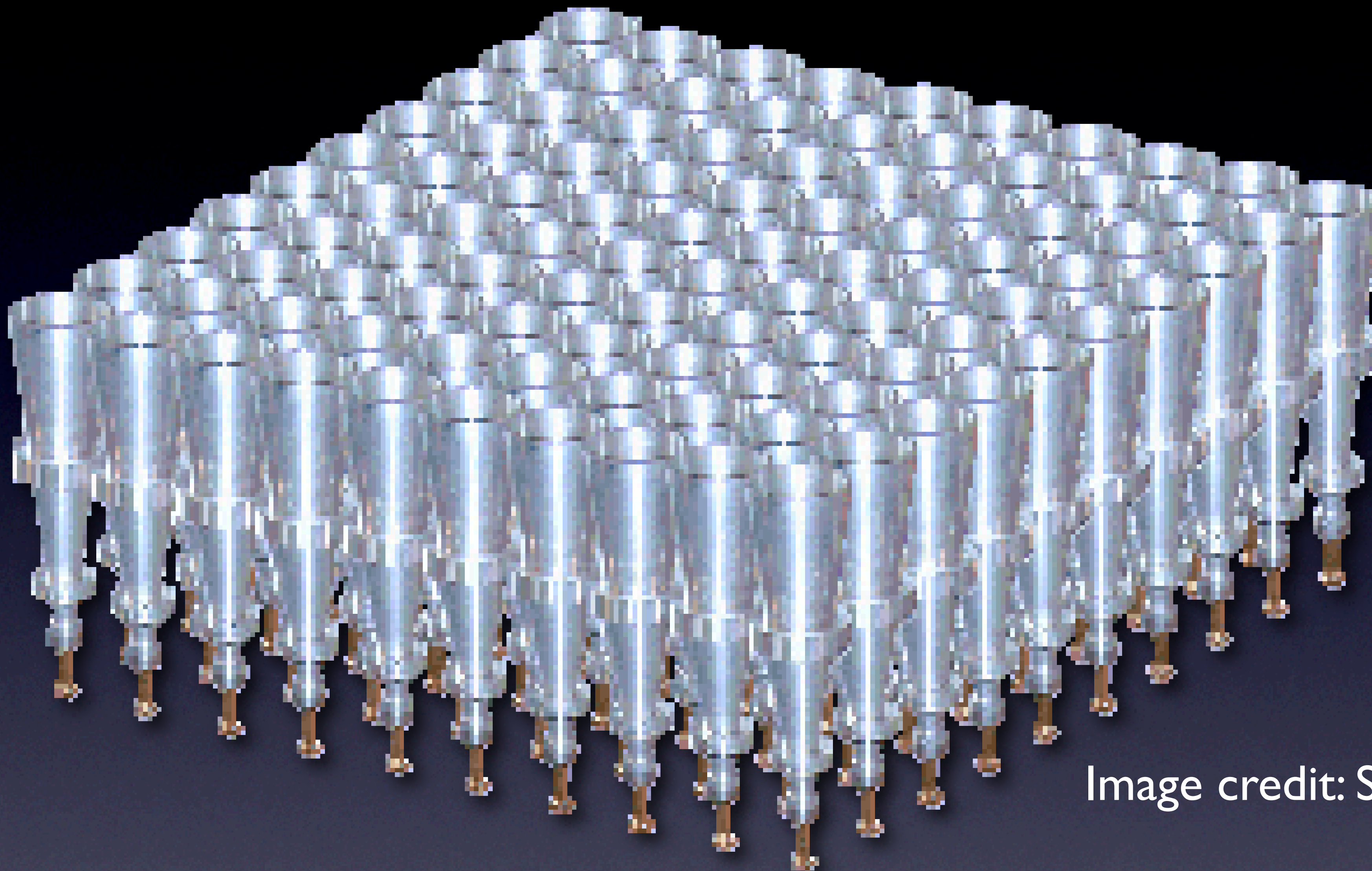

Image credit: S. Lowe

100 beams

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