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OCRA: The One Centimetre Receiver Array

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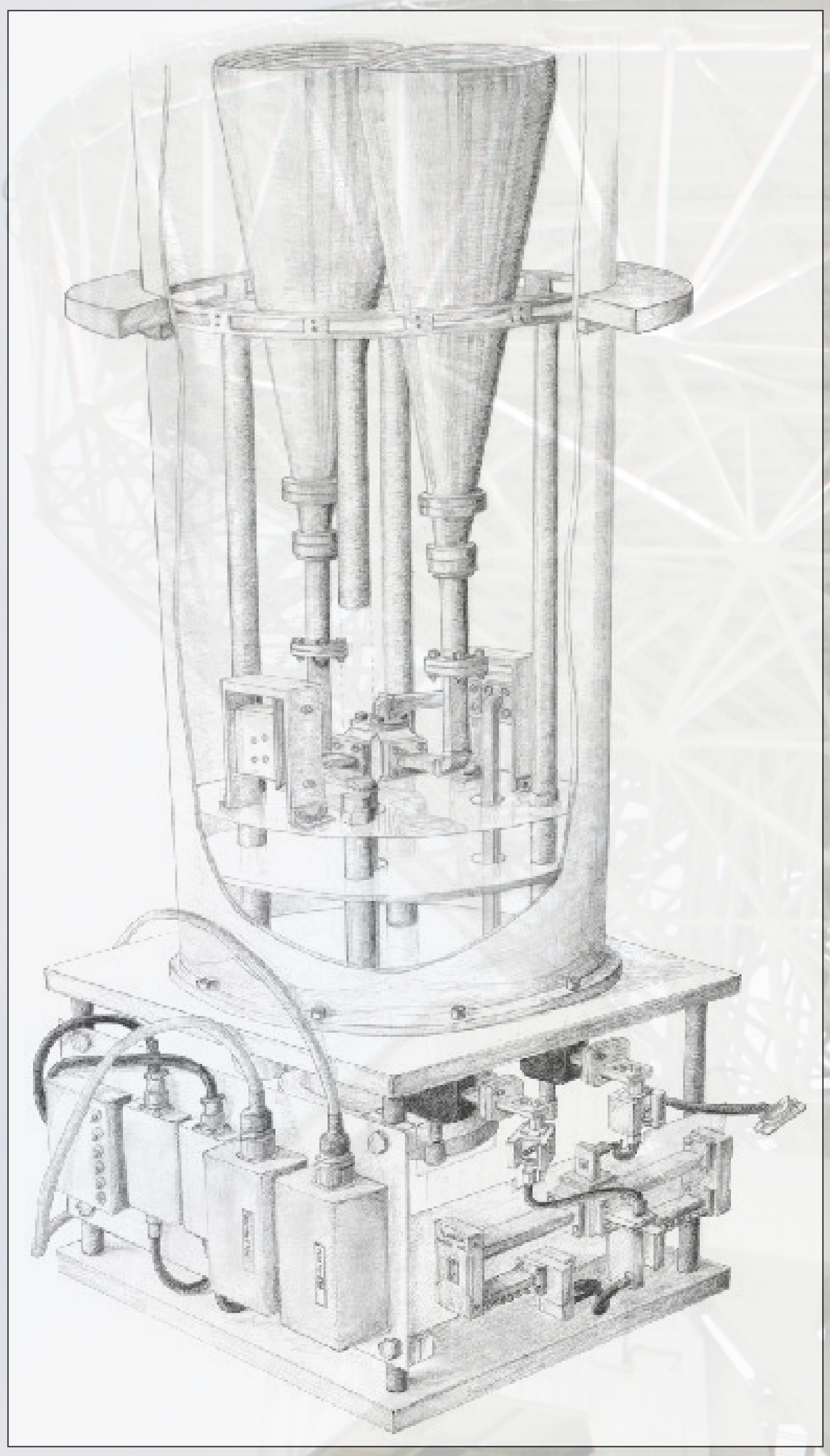
The One Centimetre Receiver Array (OCRA) program is focused on developing multi-pixel arrays of continuum receivers at microwave frequencies. It currently has two receivers, OCRA-p and OCRA-F, both of which operate at a wavelength of 1 cm (30 GHz). OCRA-p is a 2-beam prototype currently located on the Toruń 32m telescope in Poland, and OCRA-F is an 8-beam receiver array due to start observing at the start of 2009 from the same location. The ultimate goal of the program is to construct a 100-beam receiver array.

OCRA-p



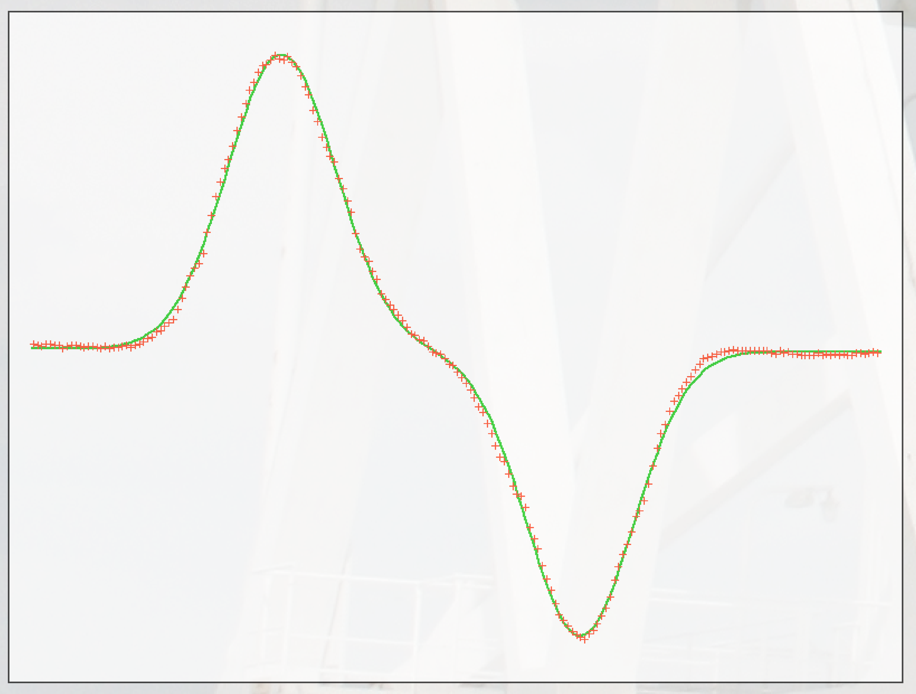
OCRA-p. Image credit: S. Lowe

The OCRA prototype is a two-beam pseudo-correlator receiver based upon the Planck LFI receiver chain, and is similar to the WMAP 23 GHz receiver.

The two beams are combined together using a hybrid, then combinations of the signals passed through two Low Noise Amplifiers (LNAs) and a pair of phase switches. The signals are then separated by another hybrid, futher amplified and square-law detected. The detected signals are subtracted from each other to get the difference in signal between the two beams. This reduces the effect of 1/f noise from the LNAs and the atmosphere.

Beams:	2
Resolution:	72 arcseconds
Frequency range:	27-33 GHz
System temperature:	40 K (all contributions)
Nominal noise:	7 mJy $s^{-0.5}$

OCRA-p has been used to observe radio point sources (the CJF sample; Lowe et al. 2007, and the Very Small Array fields; Gawronski et al. 2008), the Sunyaev-Zel'dovich (SZ) effect from clusters of galaxies (Lancaster et al. 2007) and planetary nebulae (Pazderska et al. 2008).



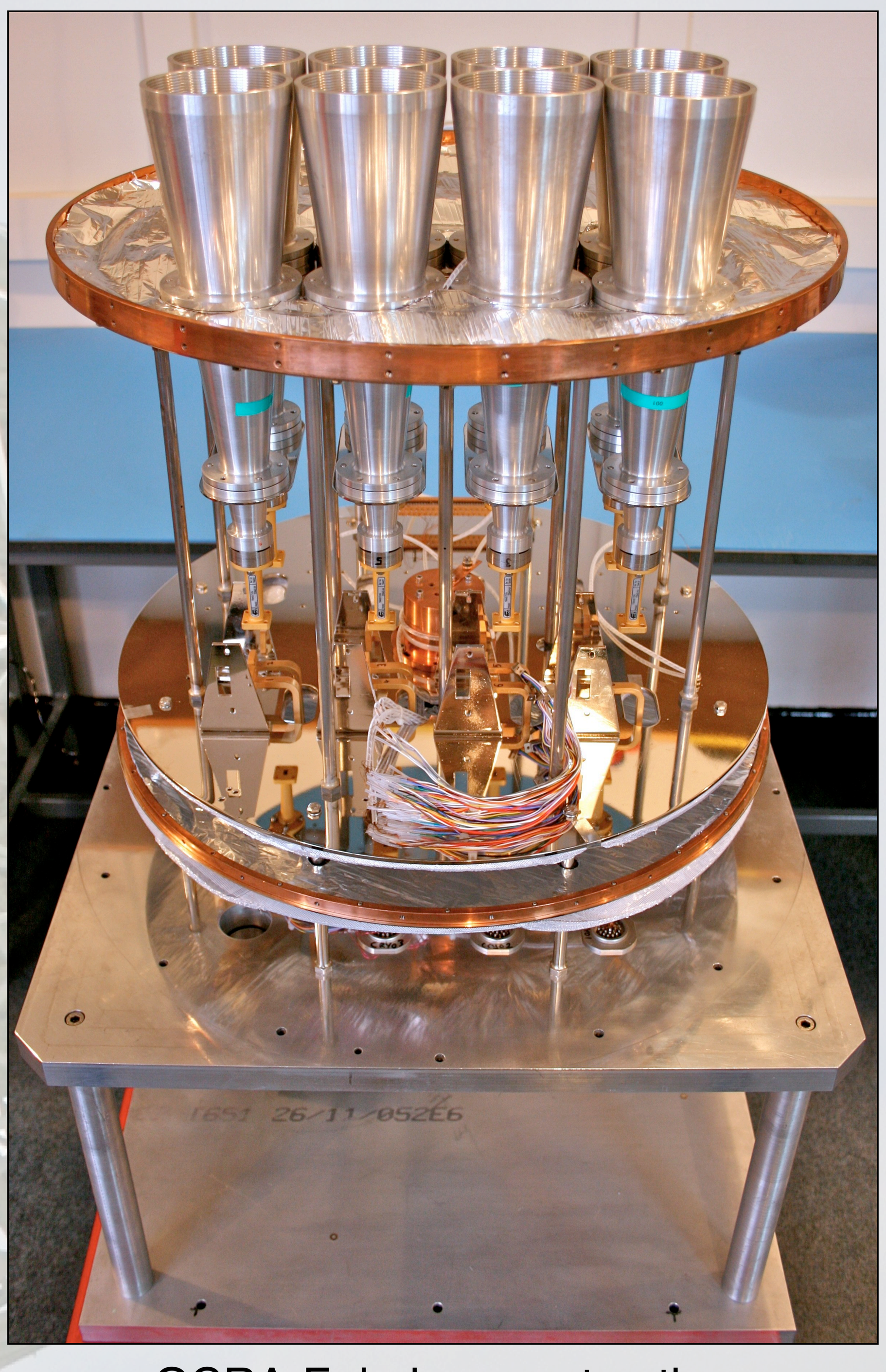
An example azimuth scan of NGC 7027

On the left is an example OCRA-p cross-scan of NGC 7027, a planetary nebula that is also a strong radio source. The red points are the one second data and the green line is a double gaussian fit, representing the 'positive' and 'negative' beams.

OCRA-F

OCRA FARADAY currently has 8 beams, with the space for expansion to 16 beams; these are arranged in pairs. The receiver builds upon OCRA-p, following the same receiver chain pattern but using Monolithic Microwave Integrated Circuits (MMICs) in place of traditional components (see Kettle & Roddis 2007).

OCRA-F is currently being assembled and is expected to begin observing at the start of 2009, with an upgrade to 16 beams around 2010. OCRA-F will be used to do small scale blind surveys for point sources and the SZ effect, and will also be able to create maps of extended emission.

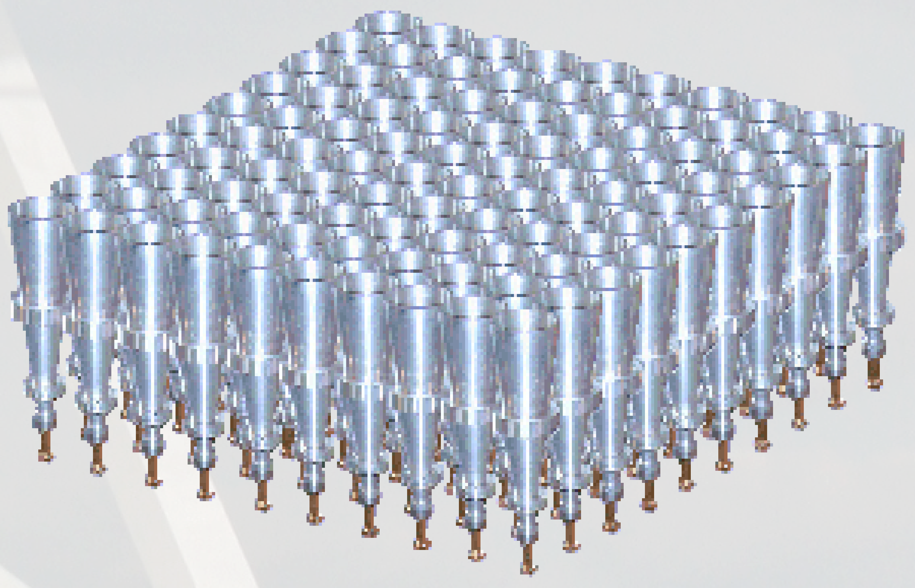


OCRA-F during construction

Beams:	8; later 16
Resolution:	72 arcseconds
Frequency range:	26-36 GHz
System temperature:	50K (all contributions)
Nominal Noise (per pair):	7 mJy $s^{-0.5}$

OCRA-C

The goal of the OCRA program is to construct a 100 beam array, which can then be used for large scale blind surveys of point sources and the SZ effect (Browne et al. 2000). The receiver technology required for such an instrument will be studied in the EC Framework 7 APRICOT (All Purpose Radio Imaging Cameras On Telescopes) project within RadioNet. The aim is to combine spectroscopic and continuum measurements in one receiver.



An impression of a 100-beam OCRA horn array. Image credit: S. Lowe

The OCRA collaboration consists of R. Battye, I. Browne, R. Davis, S. Lowe, M. Peel and P. Wilkinson at the Jodrell Bank Centre for Astrophysics; R. Feiler, M. Gawronski, A. Kus, B. Pazderska and E. Pazderski at the Toruń Centre for Astrophysics, and A. Azareedh, M. Birkinshaw and K. Lancaster at the University of Bristol. It also involves the engineering staff at Jodrell Bank Observatory, including C. Baines, E. Blackhurst, J. Edgley, D. Kettle, J. Kitching, D. Lawson, J. Marshall and N. Roddis.

Browne, I. et al. (2000), Proc. SPIE **4015**, 299
Gawronski, M. et al. (2008), in prep.
Kettle, D. & Roddis, N. (2007), IEEE TMTT **12**, 2700
Lancaster, K. et al. (2007), MNRAS **378**, 673
Lowe, S. et al. (2007), A&A **474**, 1093
Pazderska, B. et al. (2008), in prep.

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