



Synthesis Imaging in Radio Astronomy

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The US National Radio Astronomy Observatory (NRAO) operates the world's most powerful synthesis radio telescope, the Very Large Array (VLA), located on the high plains of New Mexico. This instrument utilises the principle of 'aperture synthesis' originally developed in the UK and Australia in the 1950s and 60s. The idea is that a number of well-separated radio telescopes are linked together as interferometers. From the sum total of the data they produce, over say 12 hours, a computer is able to reconstruct a radio image whose resolution is limited only by the largest separation in the array. The NRAO, via the VLA, has brought the original principle to a fine art and the 'radio-photographs' it produces now rival, and in some cases even exceed, optical quality.

Every three years since 1982 the NRAO staff have prepared a series of lectures for serious students of synthesis imaging and image processing who intend to use the VLA for professional astronomical research. This volume is a written record of the 1988 series. Many of the exciting developments in data processing which have made synthesis telescopes so powerful are outside the scope of current textbooks on astronomy or electrical engineering. The staff members therefore set out to remedy this defect in sufficient, one might even say exhaustive, detail to enable astronomers of all disciplines and levels of experience to exploit the VLA to the full.

The lectures covered the whole gamut of the subject starting from the basic principles of coherence in physical optics and moving on to the use of Fourier methods in all their elegance and seemingly endless versatility. The crucial later ideas relating to the recognition and correction errors in the data and in the images are beautifully expounded and, for dessert, we are offered a 'Hitch-

Hiker's Guide' to the use of the VLA in practice. There are 25 lectures in all. For the professional, and aspiring professional, user of radio synthesis arrays world-wide (for example the University of Manchester's MERLIN array) this book is a gold-mine of information. As such it will find a ready market in the research community. For the amateur the book may seem daunting in its scope and mathematical content and sadly lacking in examples of VLA images over which to marvel. Nevertheless all of us can be grateful that a major research tool has been well-served by its acolytes and that the fruits of their labours are being passed on to the next generation.

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Dr Peter Wilkinson is a lecturer in radio astronomy at the University of Manchester's Jodrell Bank Observatory. He has been interested in the theory of aperture synthesis for many years.