Title :

Synthesis-imaging in radio astronomy : Reconstructing spatial and spectral structure of an astronomical source

Author(s) :

Urvashi Rau
National Radio Astronomy Observatory, USA

Abstract :

A radio interferometer is an indirect imaging device that partially samples the spatial Fourier transform of a 2D brightness-distribution. Image reconstruction is typically done as an iterative non-linear optimization, with the sky brightness-distribution at a given observing frequency parameterized as a collection of 2D basis functions. In recent years, broad-band receivers have begun to be used on these instruments, primarily to increase their sensitivity by recording data simultaneously across a wide range of frequencies. This has resulted in the need to develop image-reconstruction algorithms that account for the effects of combining measurements from multiple observing frequencies (namely, the frequency-dependence of the spatial-frequency sampling-function and array-element responses, and the intrinsic spectral structure of the astronomical source). Wide-band imaging algorithms simultaneously model and reconstruct both the spatial and spectral structure of the sky brightness distribution, at the sensitivity level allowed by the full bandwidth of the receiver, and can operate in conjunction with methods that account for various direction-dependent instrumental effects.

This talk will contain a brief overview of some established image-reconstruction algorithms in radio interferometry, and will focus on recent developments in algorithms for wide-band image-reconstruction across wide fields-of-view. Some imaging results using data from the EVLA (Expanded Very Large Array) telescope will also be presented.