Statistical Definition Of Angular Resolution In Imaging And Image Deconvolution

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Outline

- Introduction
- Statistical Definition of Angular Resolution
- Imaging and Image Deconvolution
- Conclusions
Introduction: Rayleigh criterion

Airy Pattern

\[ \sin \theta = 1.220 \frac{\lambda}{D} \]
Introduction: Image Deconvolution

CLEAN, Kalman Filter, Maximum Entropy Method (MEM), Maximum a Posteriori (MAP), Direct Demodulation (DD) …
Introduction: Hard X-ray Modulation Telescope

The FWHM of the PSF of HXMT is about 1.1°. The final target of angular resolution is about 5′.

The count-rate map of HEAO1—A4 observation of the galactic center region (left) and the X-ray intensity image derived from this count-rate map with the direct demodulation method.
Statistical Definition of Angular Resolution
Statistical Definition of Angular Resolution

Correlation Coefficient Curve at Position 135

Position (unit: arcsecond)
Statistical Definition of Angular Resolution
Statistical Definition of Angular Resolution

A Point Spread Function

Original True Image

One Sample of Observed Data
Statistical Definition of Angular Resolution

Correlation Coefficient Curve at Position 135

Position (unit: arcsecond)
Statistical Definition of Angular Resolution
Statistical Definition of Angular Resolution
Statistical Definition of Angular Resolution

Definition:

The Angular Resolution at a Pixel is the FWHM of its Correlation Coefficient Curve.
Imaging and Image Deconvolution: CLEAN
Imaging and Image Deconvolution
Imaging and Image Deconvolution
Conclusions

- Angular resolution can be defined in statistic view.
- Angular resolution depends not only by telescope, but also by the quality of data as well as the structures of the sources.
- New definition of angular resolution can be used estimate the quality of images in deconvolution.