

USING ASTRO-WISE SYSTEM FOR THE LOW FREQUENCY ARRAY (LOFAR)

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RADIO INTERFEROMETRY – BASICS

- A Radio interferometer consists of N antennae of diameter D , each with field of view (λ/D) . Voltages of every $N(N-1)/2$ pairs of antennae are correlated to give as many complex **visibilities** every integration time.
- Each **visibility** is (the amplt and phase) of *one* component of the **fourier transform** of the image in the field of view. More the number of visibilities, better the coverage of fourier plane and better the image.
- The *resolution* is $\sim \lambda/B_{\max}$, B_{\max} is max distance between 2 antennae.
- Unmeasured fourier components leads to terrible sidelobes in array response function (aka **dirty beam** , aka actual psf).
- This response is deconvolved, giving a model of the sky, which is convolved again with a nice gaussian (aka **clean beam** , aka psf).
- This **psf can vary** across the sky, and not be diffraction limited, due to corruptions in the sky model due to data errors, instrument aberrations, ionospheric abberations, and need to be modelled.

LOFAR – BASICS

- Ambitious project, funded and to be built by 2008 in Netherlands (with few antennae in Germany). Will be providing best resolution and sensitivity at low frequencies ($\nu=200$ MHz, 120 MHz, 75 MHz, 30 MHz).
- 45 stations, each made of few 100 dipoles, correlated together.
- **FOV**= (0.2, 1.7, 2.9, 4.6, 12 deg); **resolution**= (0.4, 2, 5, 8, 20 arcsec).
- High source density (10^8 - 10^9 over 2π), confusion. Extended sources.
- Ionosphere distorts psf heavily. Partly calibratable.
- Get images at every frequency bin, for all four stokes parameters.
- Leiden involved in all-sky surveys at all freq.s, tbd in weeks to years.

MANAGING LOFAR SURVEY DATA

- Raw data product for Astro-Wise will be **calibrated images**
- Many images obtained over entire period to be coadded for each area
- Manage all these images, combine, reprocess, track history of sources (variability, *uv*-coverage, multiples)
- Make source lists for each image as they come in. Compare with previous ones, make master lists, compare with other catalogues
- Source properties to link to ionosphere conditions, psf variations
- Data rate = few10s Tb/day (line), storage=1 Tb (contm) and 1 Pb (line)
- Hence, we will explore using Astro-Wise to manage the LOFAR survey database, starting from **processed images**.
- Need to put in radio interferometry-specific concepts and functionalities into Astro-Wise
- Will develop LOFAR-specific source extraction program in Python which can be fit in.