

MPAGS Astrophysical Techniques

Interferometry 2025

Tim Pearce

Please email Tim (tim.pearce@warwick.ac.uk) your answers by the due date. There is no mark associated with the assignment, as the aim is that you engage with the topic.

1. What is the (1d) visibility of a star as a function of baseline (assume a uniform disk, without limb darkening). What is the significance of the first ‘null’? Practically, how might one measure the diameter of a star (e.g. with CHARA)?
2. What astrophysical source was being observed in the sparse aperture masking example from Cheetham+16, and what is the reasoning for this conclusion? (hint: think about the amplitudes of the dots in the FT of the image, these are *uv* space)
3. How does a synthesised image change if you remove the short baselines? Or the long baselines? How might one use this behaviour to explore an interferometric dataset?
4. What does the Fourier Transform of a large uniform source imply for planning observations of large diffuse structures with ALMA? What should the observing strategy be?
5. Use the ALMA OST to plan an observing strategy for a continuum observation of one of the OST source models (e.g. M51). Assume the default declination (-35°), a continuum observation with frequency of 350GHz, 7.5GHz bandwidth (the “recommended continuum setup”), Stokes I, and 3rd octile PWV. Use “ALMA” as the instrument, a single pointing, tick “yes” for deconvolution (CLEAN), and experiment to find the best resolution to extract the spatial information. How long should the integration be? Send your answer as a brief description of your approach to figuring this out, and a screenshot of the resulting simulated observation. You should be able to get something that looks quite similar to the input image.