

# ATI 2014

## Exercises on Interferometers

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1. The VLT interferometer has four telescopes, with the longest baseline between two of the 8.4 m telescopes being 144m. To compensate for optical path differences introduced by the different telescope positions, there is a beam delay room underneath the mountain where the optical beam from each telescope is sent to a movable mirror retroreflector and sent back to the beam combination optics.
  - (a) What is the declination of the celestial object with the fastest apparent angular velocity on the celestial sphere, ignoring proper motions? [1]
  - (b) What is the fastest speed that the retroreflector has to move when observing with the longest baseline? [2]
2. The ALMA telescope is observing a galaxy at a wavelength of 1mm, with the largest possible baseline of 16km and a shortest baseline of 150m. The larger dishes used are 12m in diameter.
  - (a) Give the field of view and highest angular resolution of the observations. [2]
  - (b) The lowest elevation for a celestial target is 20 degrees above the horizon. What is the largest time delay that the correlator has to introduce into the signals from the array to phase them? [2]
3. Seven of the 12m ALMA telescopes are placed in a line, with 36m from the center of one dish to the center of the next dish in line.
  - (a) What is the approximate height of the first sidelobe of the PSF compared to the central on-axis lobe in the line of the interferometers? Normalise the height of the central peak of the PSF to be 1. (Hint: You can do this with the practicum code from last week...) [3]
  - (b) What is the relative height of the first grating peak to the normalised central PSF peak? [1]