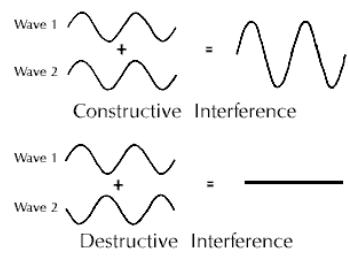


Interferometry

- When two waves (sound, light, seismic, ocean, etc.) come to the same place and time → **interference**
- The technique of **interferometry** uses interference phenomena for measurement purposes, either for small angles or for tiny distance increments.



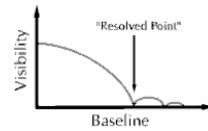
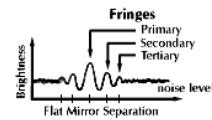
- An **interferometer** is a device to make such measurements.

This image shows a computer simulation interface for an interferometer setup. The central area features a virtual laboratory bench with various optical components: a lamp, mirrors, lenses, and a detector. A yellow hand cursor is pointing towards the lamp. On the left, there's a digital display showing 'Angle from Centerline to Lamp' with a value of '00' and a control slider for 'Rotation Angle' ranging from 0° to 90°. Below these are buttons for 'MIRROR 1 CONTROL' and 'MIRROR 2 CONTROL'. At the bottom center is a 'DELAY' control with a slider and a digital display showing '00'. To the right are buttons for 'PLOT' and 'CLEAR'. On the far right, there's a 'LIGHT SWITCH' with 'ON' and 'OFF' positions, and another digital display for 'Rotation Angle' with a value of '00' and a control slider for 'MIRROR 2 CONTROL' ranging from 0° to 90°.

<http://sim.jpl.nasa.gov/interferometry/Demo/simford7.htm>

Challenges of Interferometry

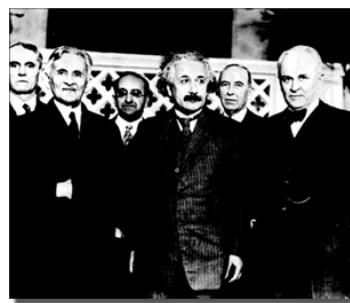
- Fringes on length scales of wavelengths
 - precise measurements (laser metrology)
 - sensitive to vibration, movement, thermal expansion
- Starlight not monochromatic
 - interference smeared out



http://www.space.com/scienceastronomy/astronomy/interferometry_101.html

Interferometry in Astronomy

- Michelson was the first American to be awarded the Nobel Prize in Physics in 1907. Michelson was also the first to apply interferometry to astronomy.



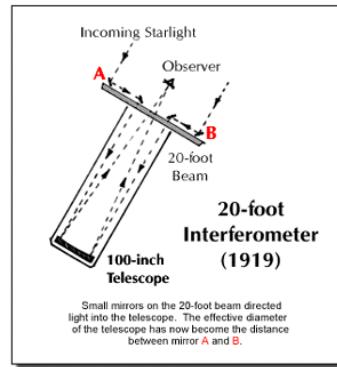
(From left) Albert Michelson, Albert Einstein,
Robert A. Millikan on the Caltech campus in Pasadena.

<http://sim.jpl.nasa.gov/interferometry/>

Michelson Stellar Interferometry

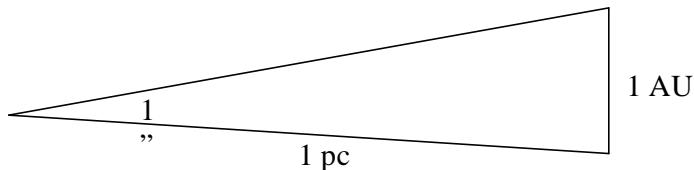


The 20-foot beam on top of the 100-inch
Hooker Telescope on Mt. Wilson in
Southern California.

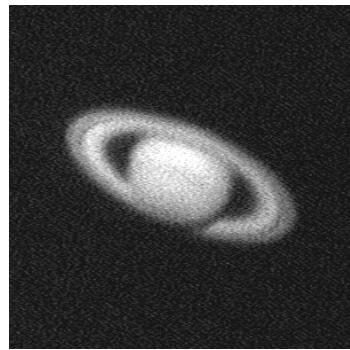


→ angular diameter
of Betelgeuse

AB=Effective diameter

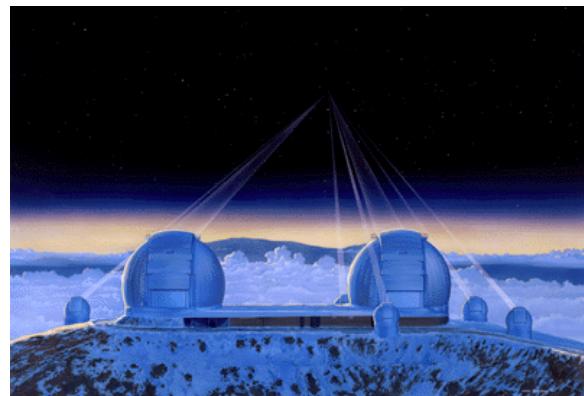


Q: $R \sim 7 \times 10^8$ m, so.....what is the
approximate angular size of a nearby star?



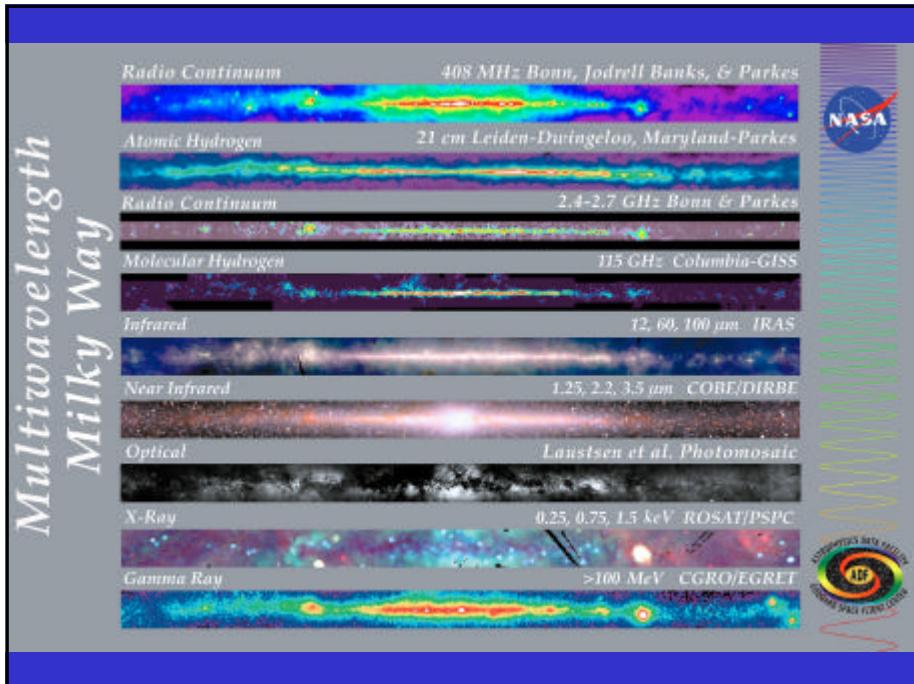
CHARA (Center for High Angular Resolution Astronomy) Array on Saturn 50 frames at 1/10
fps taken with S2 on Oct 2, 2000

<http://www.chara.gsu.edu/CHARA/>



Keck Telescopes as part of an interferometer

Multiwavelength Milky Way



可見光



紅外線



John Carpenter and Robert Hurt/MAS Project

只緣身在此山中 ... 從我們的所在看銀河系



Far Infrared View of the Milky Way
(IRAS 12, 25, 60, 100 microns)



Near Infrared View of the Milky Way
(COBE 1.2, 2.2, 3.4 microns)

銀河系包含大約4千億顆 (400 billion) 恒星。所有我們看到的星星都在銀河系內



由於星系塵埃的影響，我們看到的只是鄰近的星星