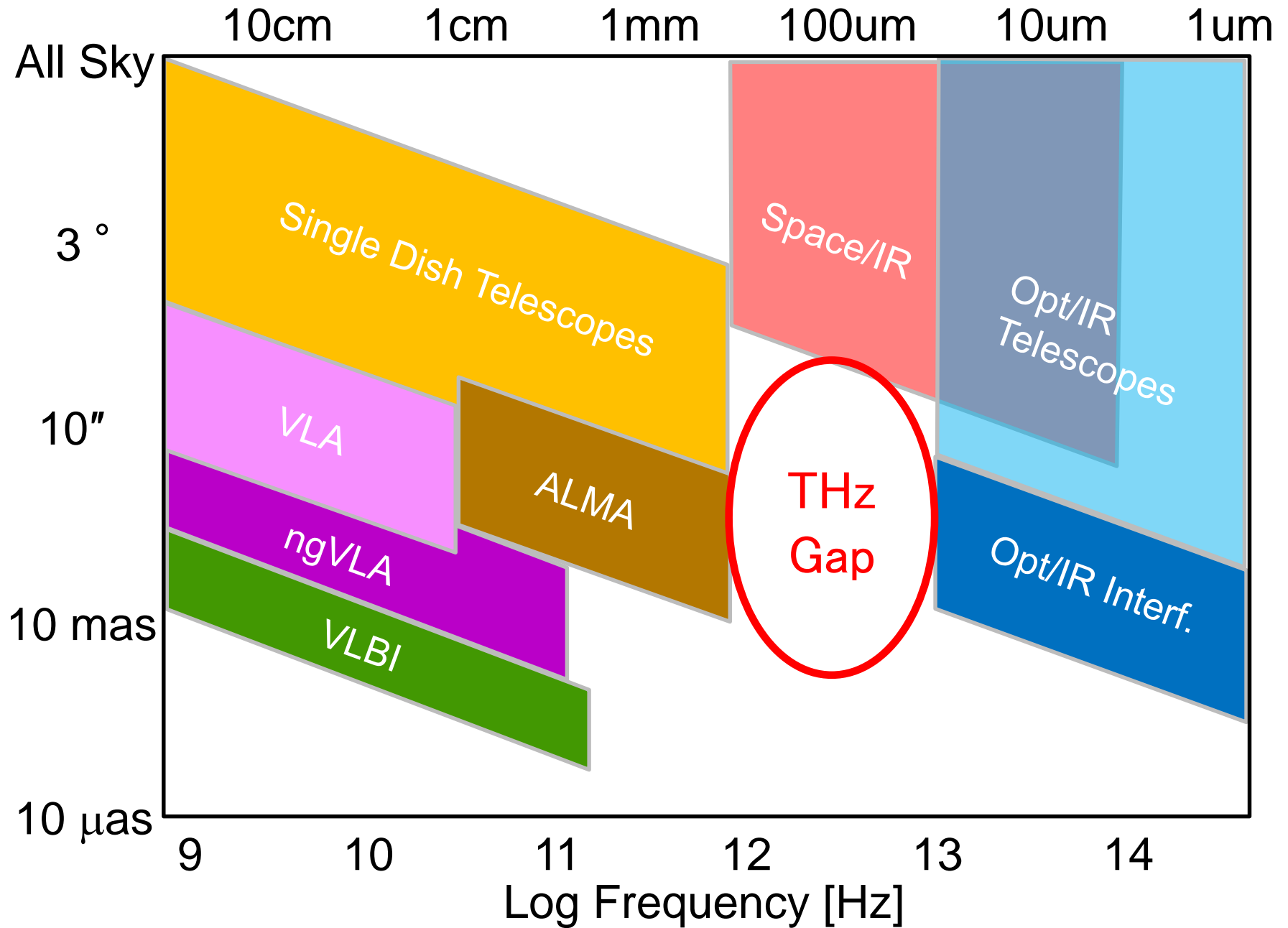


Space Infrared Intensity Interferometry スペース赤外線強度干渉計

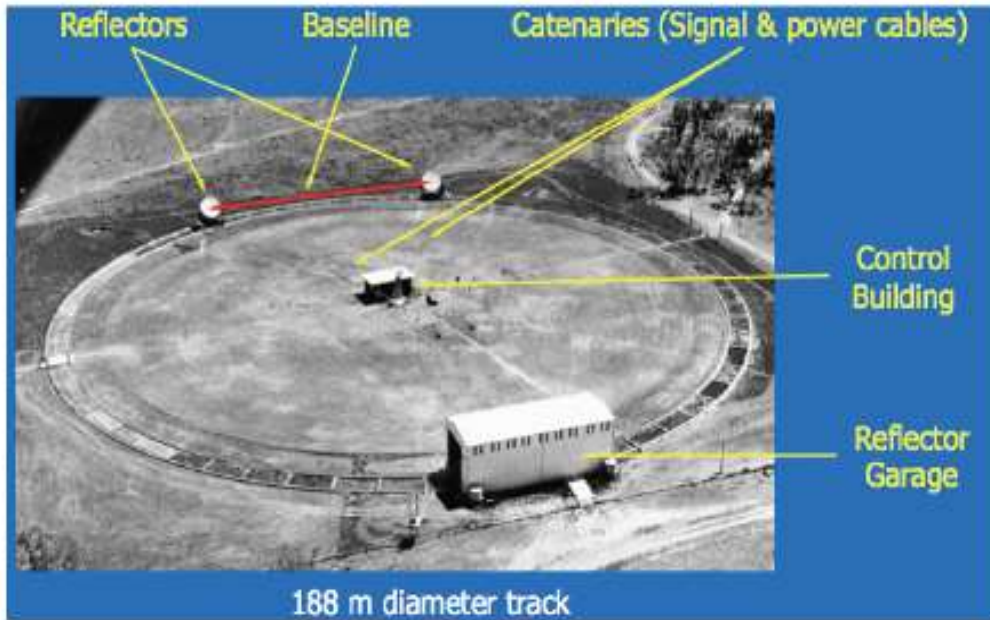
Hiroshi Matsuo (ATC/NAOJ)

松尾 宏(国立天文台・先端技術センター)

Angular Scale of Observation



Narrabri Stellar Intensity Interferometer

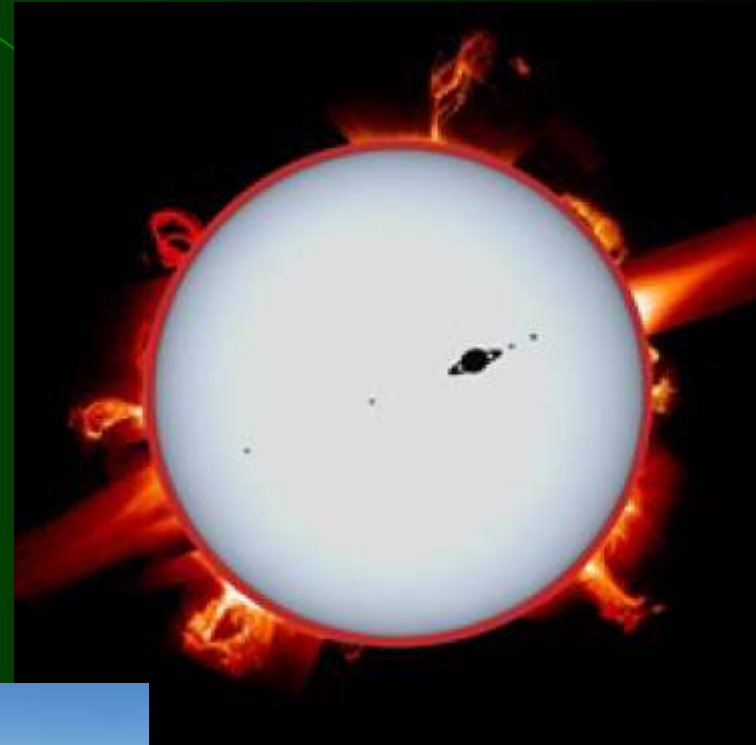


Narrabri Stellar Interferometer

Hanbury-Brown et al. (1974)
Diameter of 32 early-type stars were measured.

CTA as Intensity Interferometer

- Phase recovery
 - Cauchy-Riemann equation (amplitude and phase relation)
- Angular resolution
 - $30 \mu\text{as}$

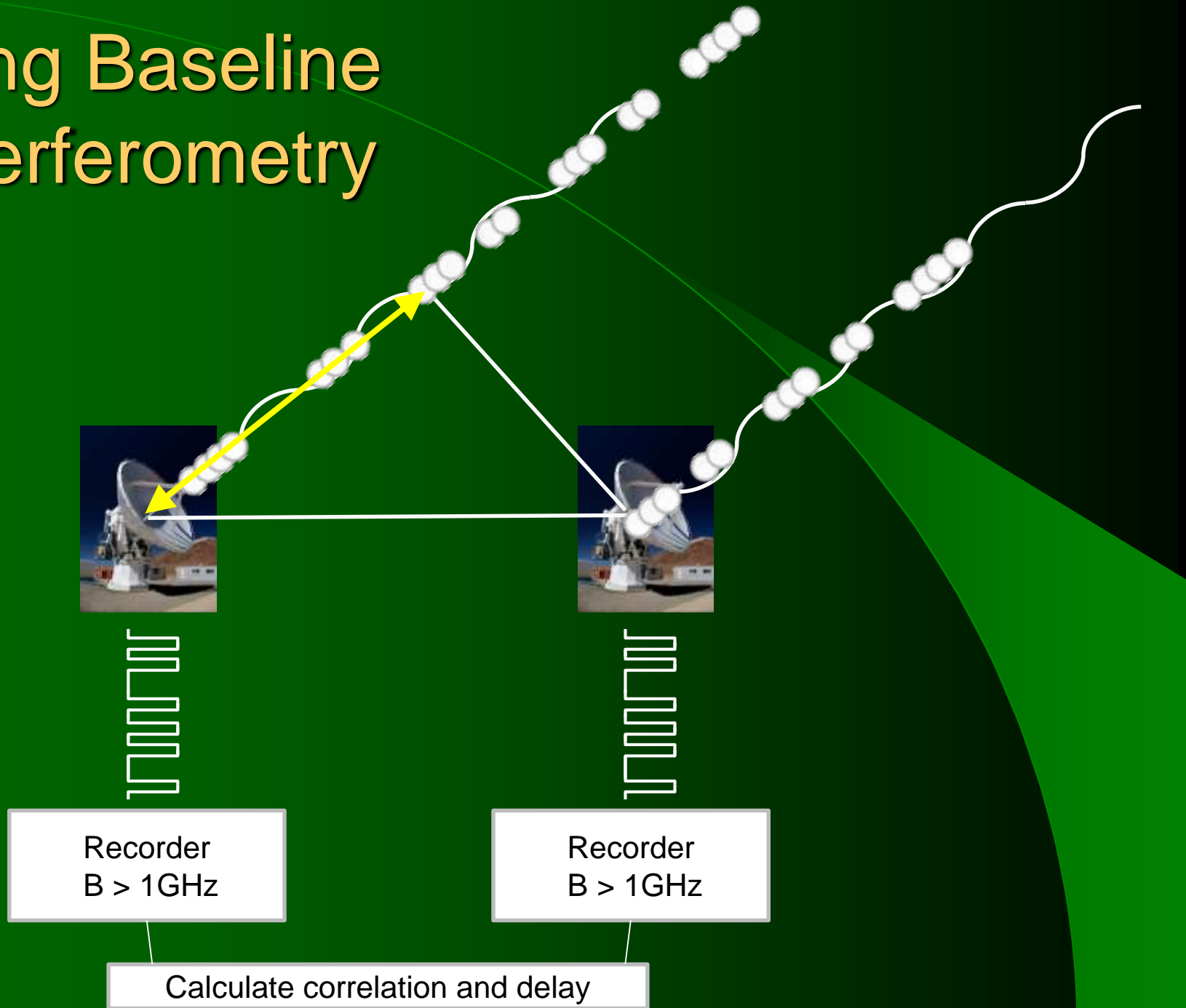


Cherenkov Telescope Array

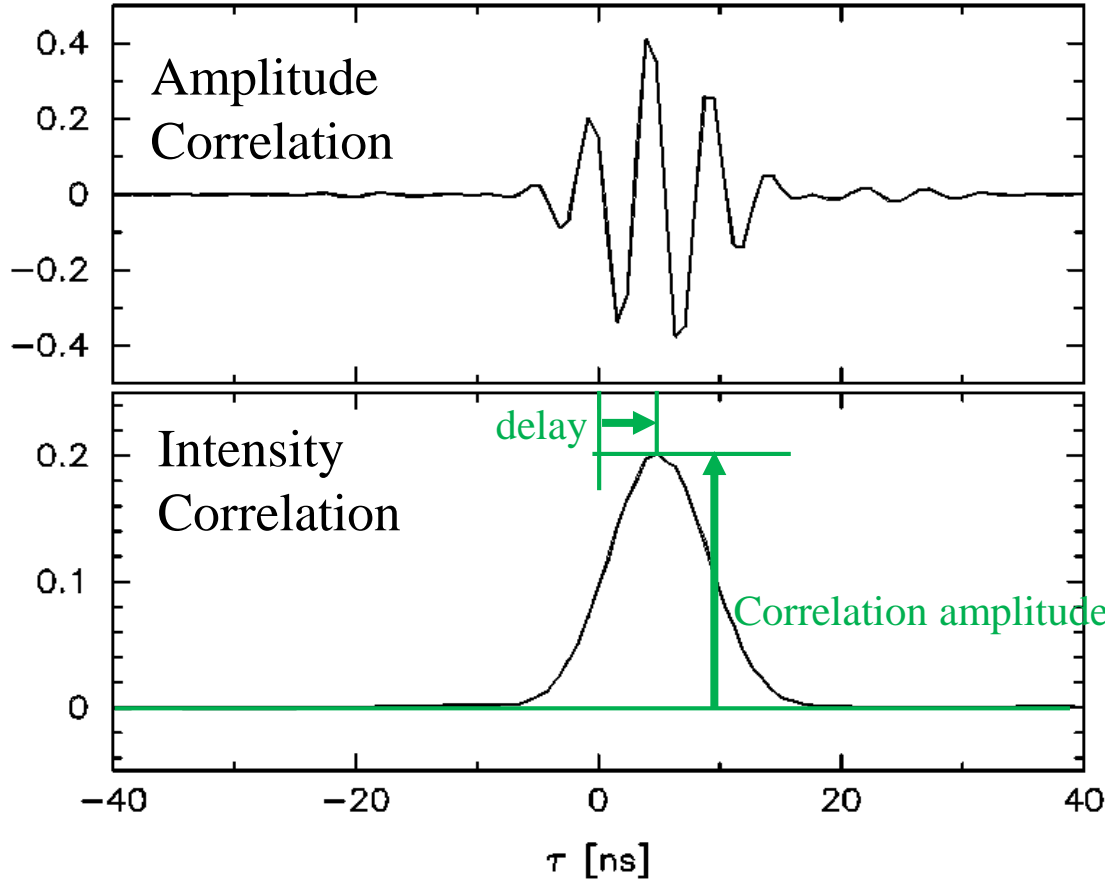


Dravins, SPIE 99070M (2016)

Long Baseline Interferometry



Nobeyema Radioheliograph at 17 GHz



Antenna Temperature T_A^* [K]

System Temperature T_{sys} [K]

Frequency ν [Hz]

Bandwidth $\Delta\nu$ [Hz]

$$\Delta t = \frac{T_{\text{sys}}}{T_A^*} \cdot \frac{1}{\sqrt{\Delta\nu \cdot \tau}} \cdot \frac{1}{\Delta\nu} \text{ [s]}$$

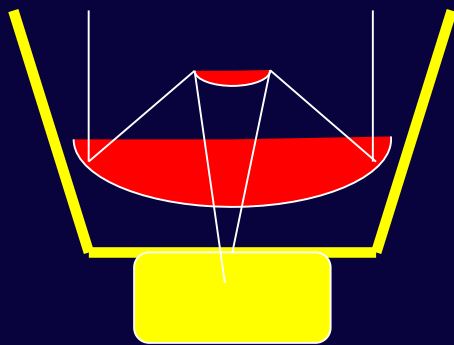
$$\Delta\varphi = 2\pi\nu\Delta t \text{ [rad]}$$

Intensity Interferometry

- Cross correlation of Intensity (E^2)
 - Missing phase information
- Stable against phase fluctuation
 - Coherence lengths \gg Wavelengths
- Photon counting detector can be used
 - High sensitivity, no receiver quantum limit
- High correlation efficiency in infrared
- Photon bunches enable delay measurements

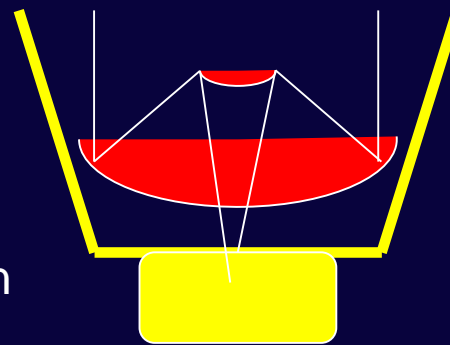
Technologies for Space FIR Interferometry

- Cryogenics - AKARI, SPICA, Astro-H
- VLBI technology - HALCA, Astro-G
- Superconducting detectors - SMILES



Photon Counters
Atomic clock
Recorder

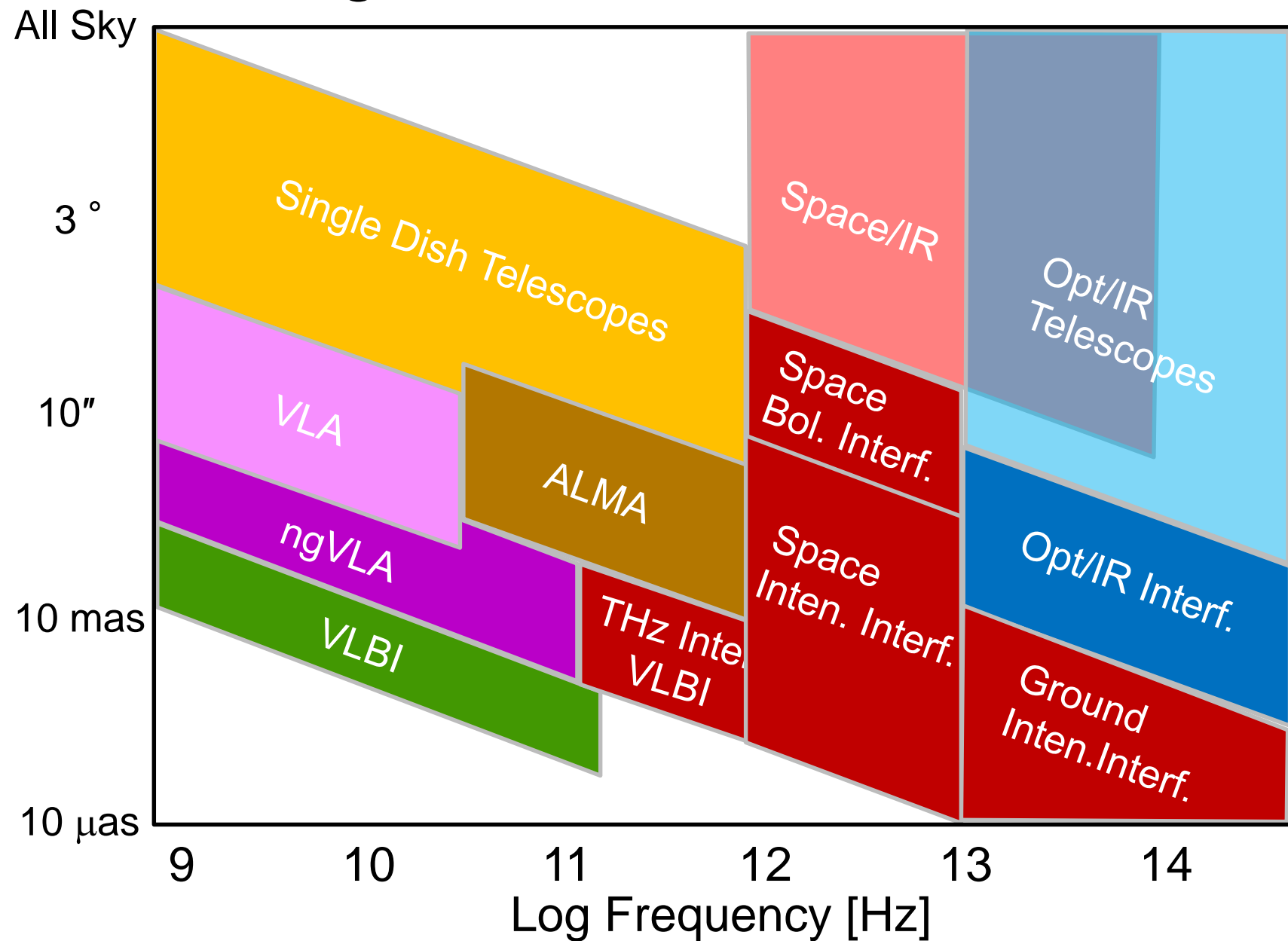
Formation
Flight



Photon Counters
Atomic clock
Recorder



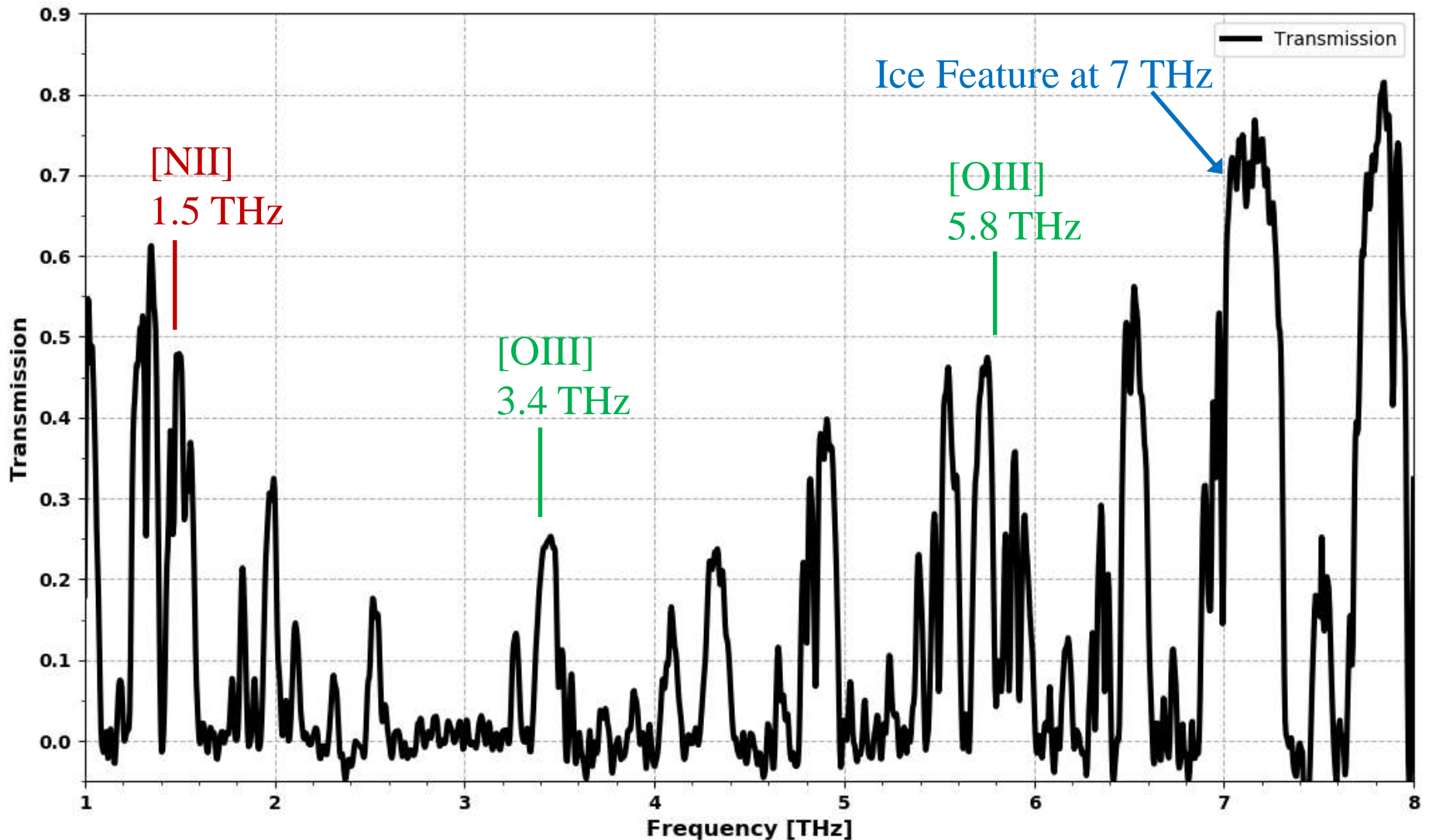
Angular Scale of Observation



Problems to be solved

- Time scale of the project
 - Ground-based demonstration
- Wavelengths of interests
 - Is delay calibration possible in infrared ?
- Fast photon counting technologies
 - Superconducting detectors
- Precision satellite orbit determination
 - Formation flights
- Fast data rates

The Most Transparent Atmosphere



August 9th 12–18h UTC, 2010