Modern Interferometric Arrays

Fundamentals of Radio Interferometry: Chapter 1, Section 11

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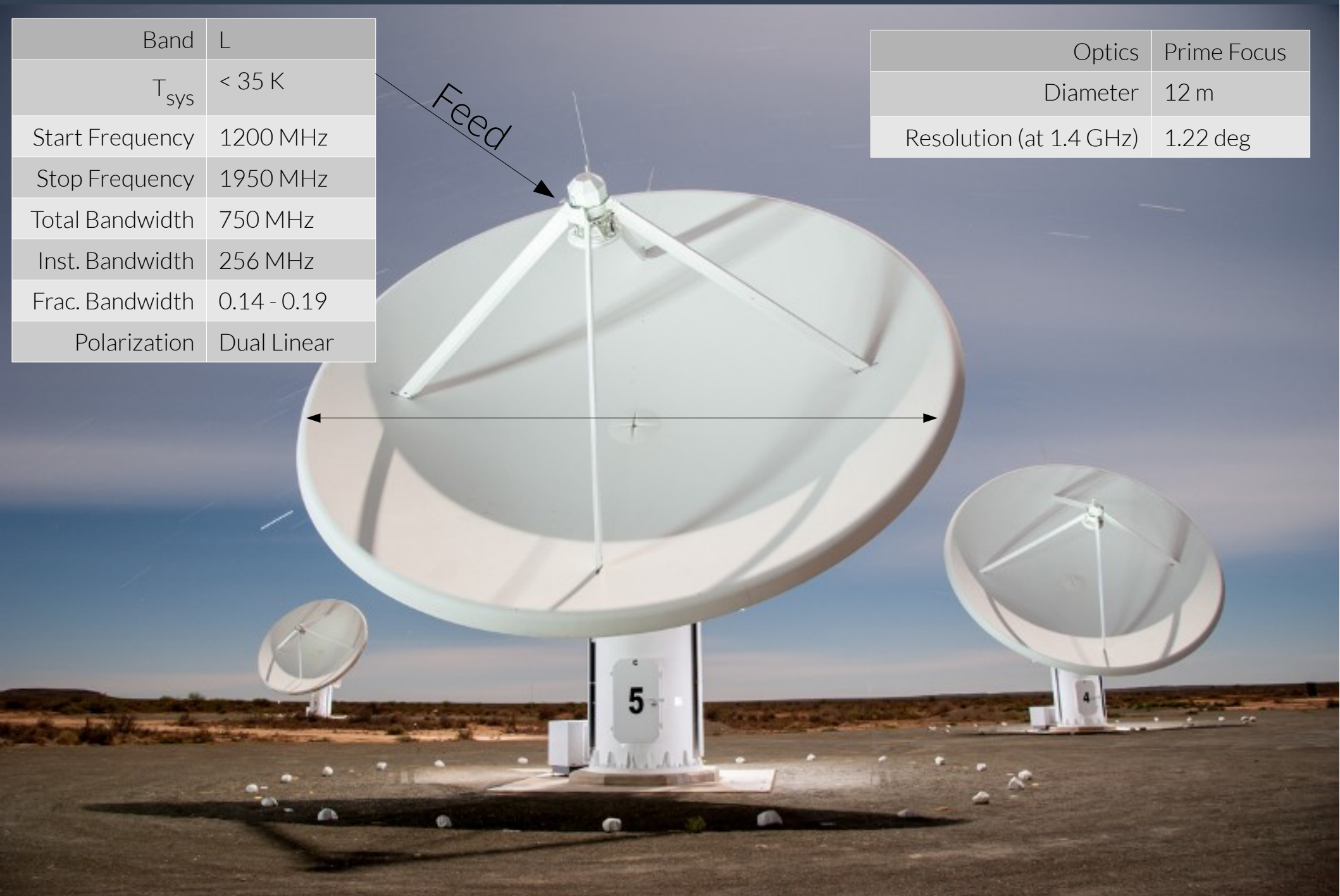
Karoo Array Telescope (KAT-7)

Band	L
T_{sys}	< 35 K
Start Frequency	1200 MHz
Stop Frequency	1950 MHz
Total Bandwidth	750 MHz
Inst. Bandwidth	256 MHz
Frac. Bandwidth	0.14 - 0.19
Polarization	Dual Linear

Optics	Prime Focus
Diameter	12 m
Resolution (at 1.4 GHz)	1.22 deg



Karoo Array Telescope (KAT-7)

Number of Elements	7
Min. Baseline	26 m
Min. Resolution (@ 1.4 GHz)	0.56 deg
Max. Baseline	185 m
Max. Resolution (@ 1.4 GHz)	4.7'

Bandwidth

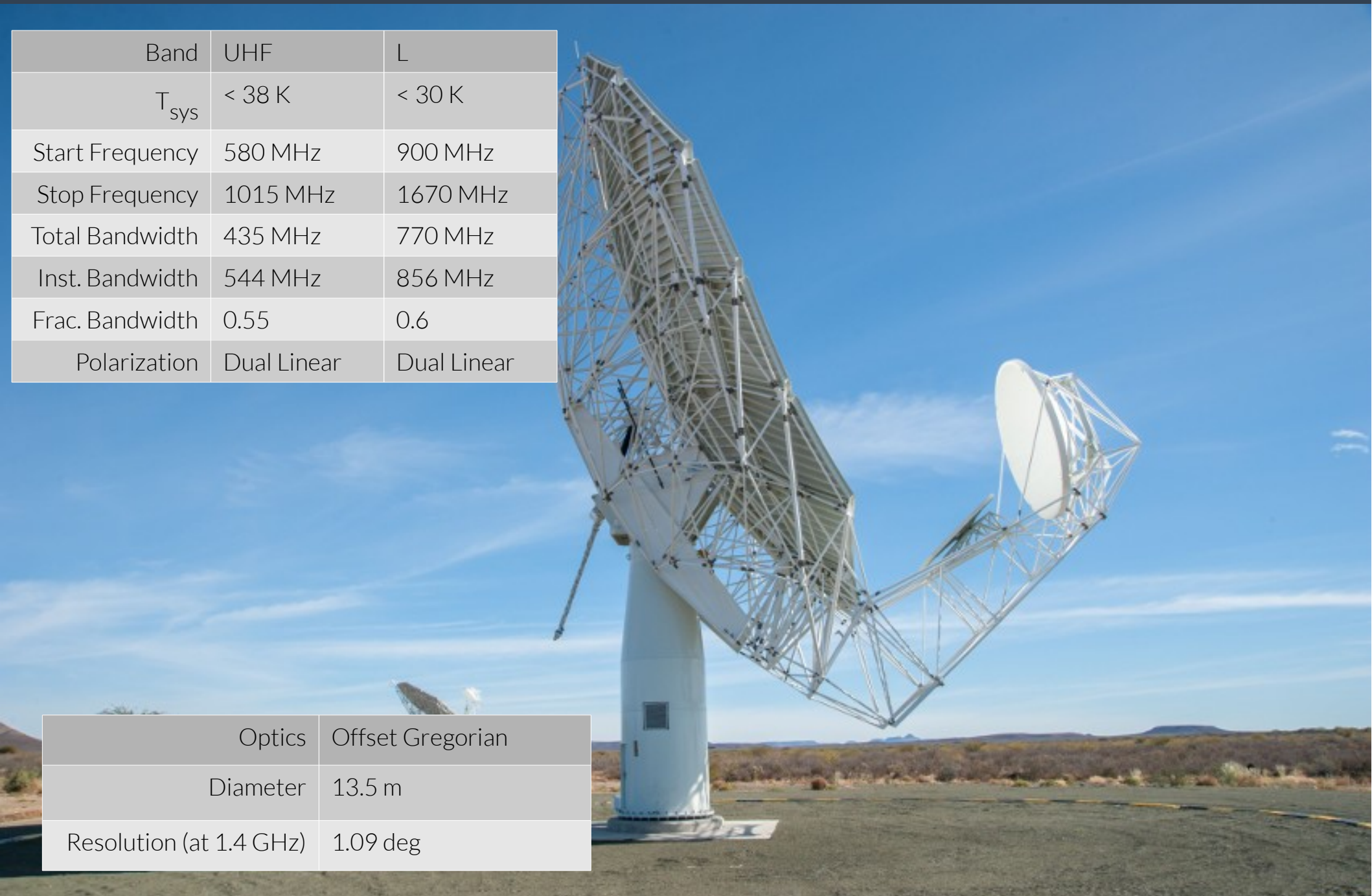
Total Bandwidth: bandwidth available based on the analogue filters of the feeds.

Instantaneous Bandwidth: bandwidth available based on the digital front-end.

Fractional Bandwidth: $$\nu_{\mathrm{frac}} = \frac{\nu_f - \nu_0}{\nu_c}, \quad \nu_c = \frac{\nu_f + \nu_0}{2}$$

MeerKAT

Band	UHF	L
T_{sys}	< 38 K	< 30 K
Start Frequency	580 MHz	900 MHz
Stop Frequency	1015 MHz	1670 MHz
Total Bandwidth	435 MHz	770 MHz
Inst. Bandwidth	544 MHz	856 MHz
Frac. Bandwidth	0.55	0.6
Polarization	Dual Linear	Dual Linear



Optics	Offset Gregorian
Diameter	13.5 m
Resolution (at 1.4 GHz)	1.09 deg

What do you call it?

Telescope or
Antenna or
Dish or
Element

MeerKAT

Number of Elements	64
Min. Baseline	29 m
Min. Resolution (@ 1.4 GHz)	0.51 deg
Max. Baseline	8 km
Max. Resolution (@ 1.4 GHz)	6.6”

Baseline and Visibilities

Measurements in an interferometric arrays are made with **pairs** of telescopes.

The measurement is called a *visibility* (also called a *cross-correlation*).

Number of baselines (unique pairs*)

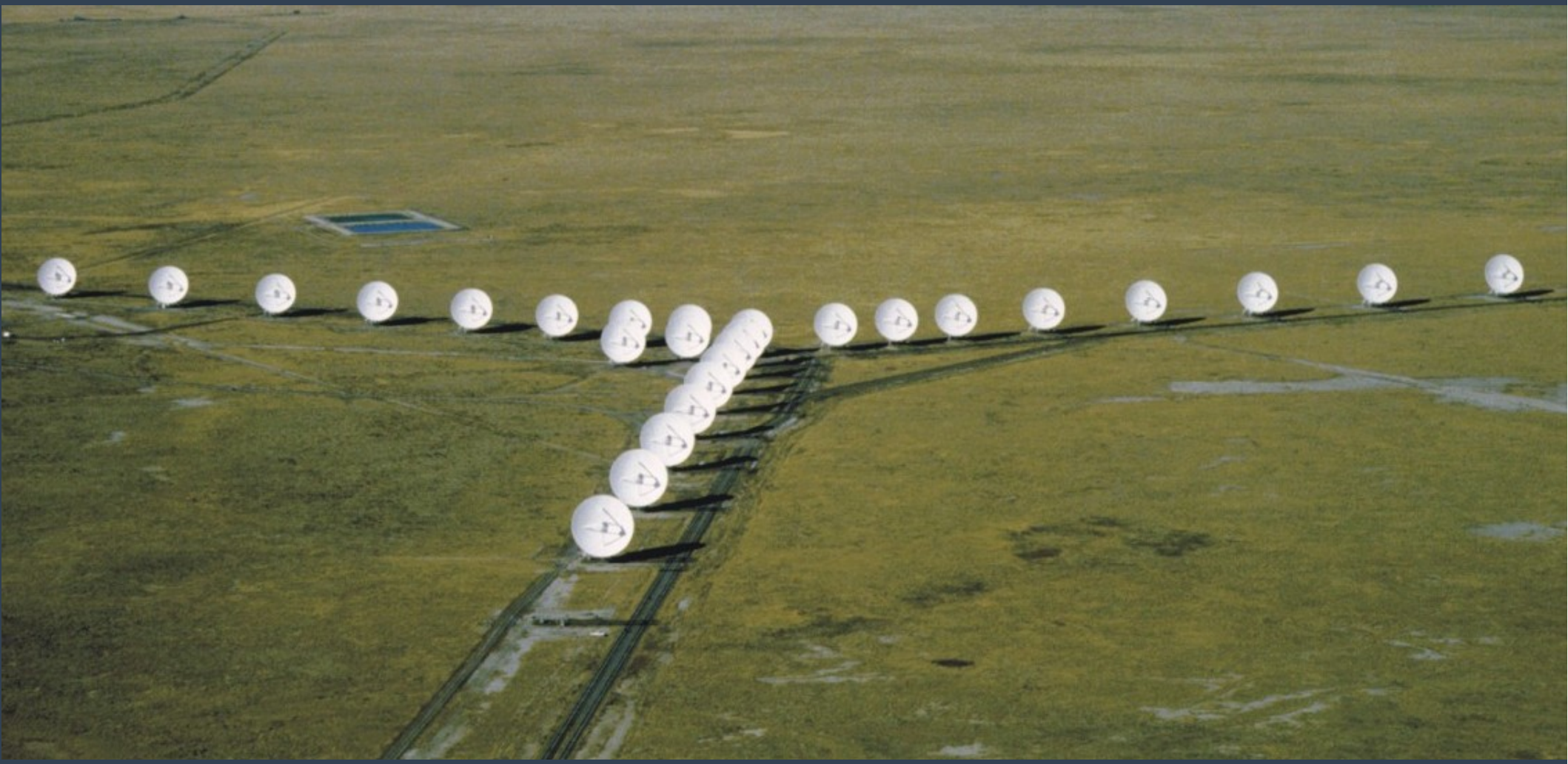
$$N_{\mathrm{BL}} = \frac{N_{\mathrm{ant}}(N_{\mathrm{ant}} - 1)}{2}$$

*This does not include the self measurement (or zero baseline), also called the *auto-correlation*.

The Karl G. Jansky Very Large Array (JVLA)

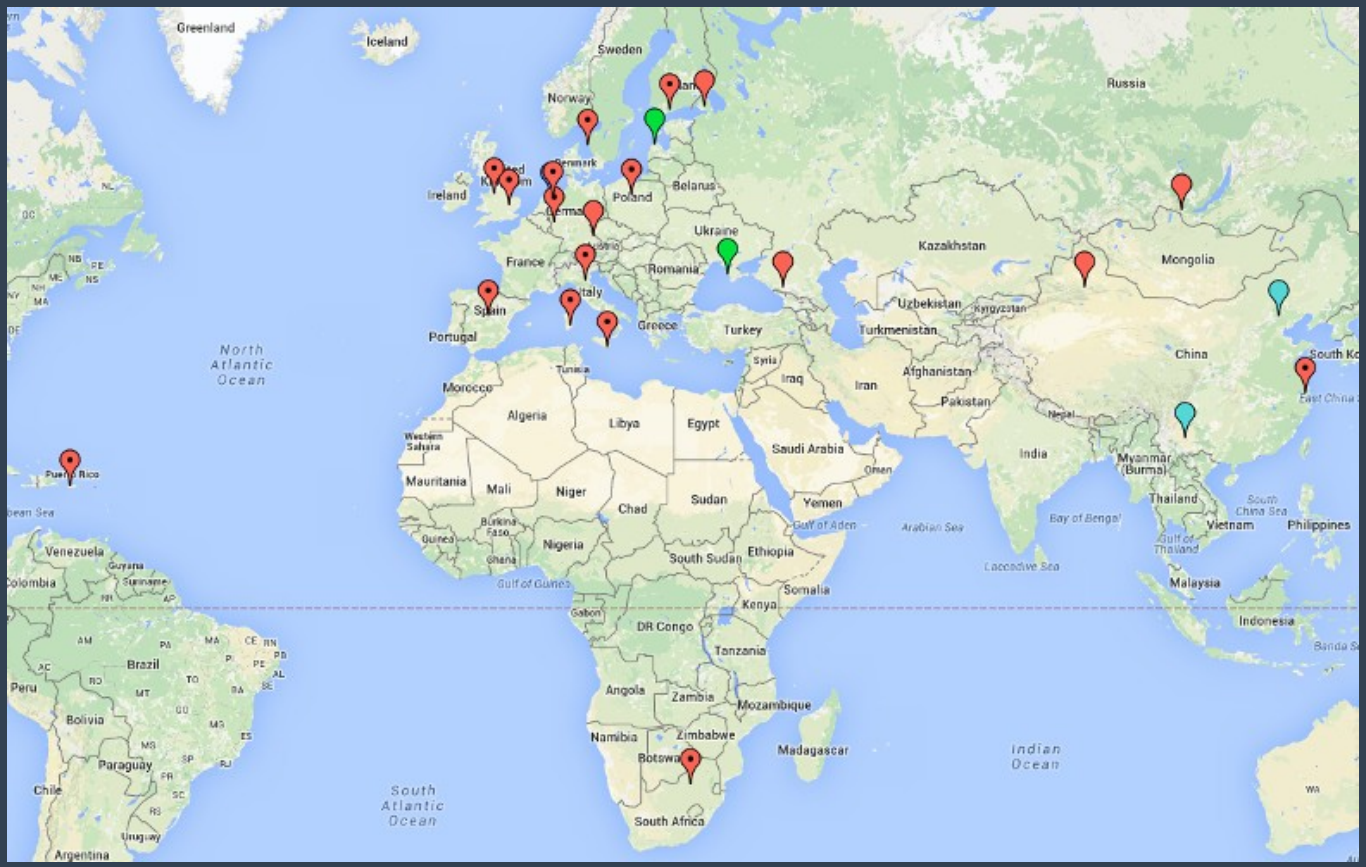
Optics	Cassegrain
Diameter	25 m
Resolution (at 1.4 GHz)	0.56 deg

The Karl G. Jansky Very Large Array (JVLA)



The Low Frequency Array (LOFAR)

Very-Long Baseline Interferometry (VLBI)



Many more...

See Chapter 1, Section 11 for more examples