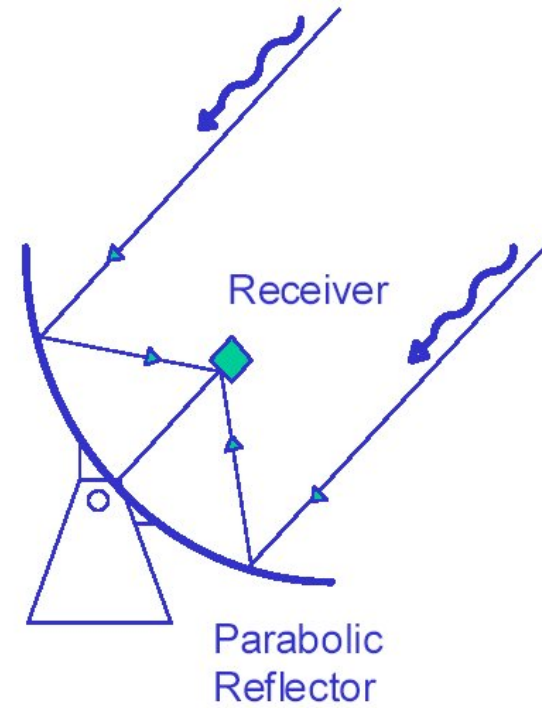
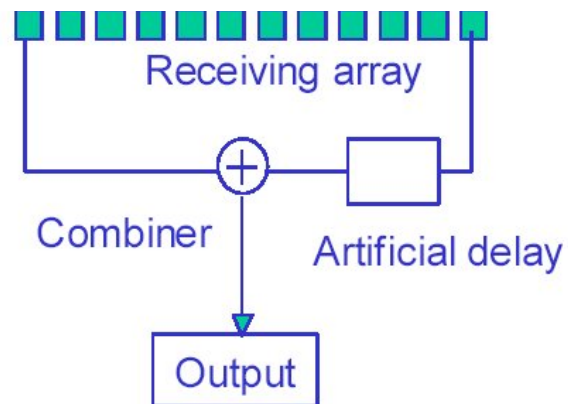


Aperture Arrays -Past, Present & Future!

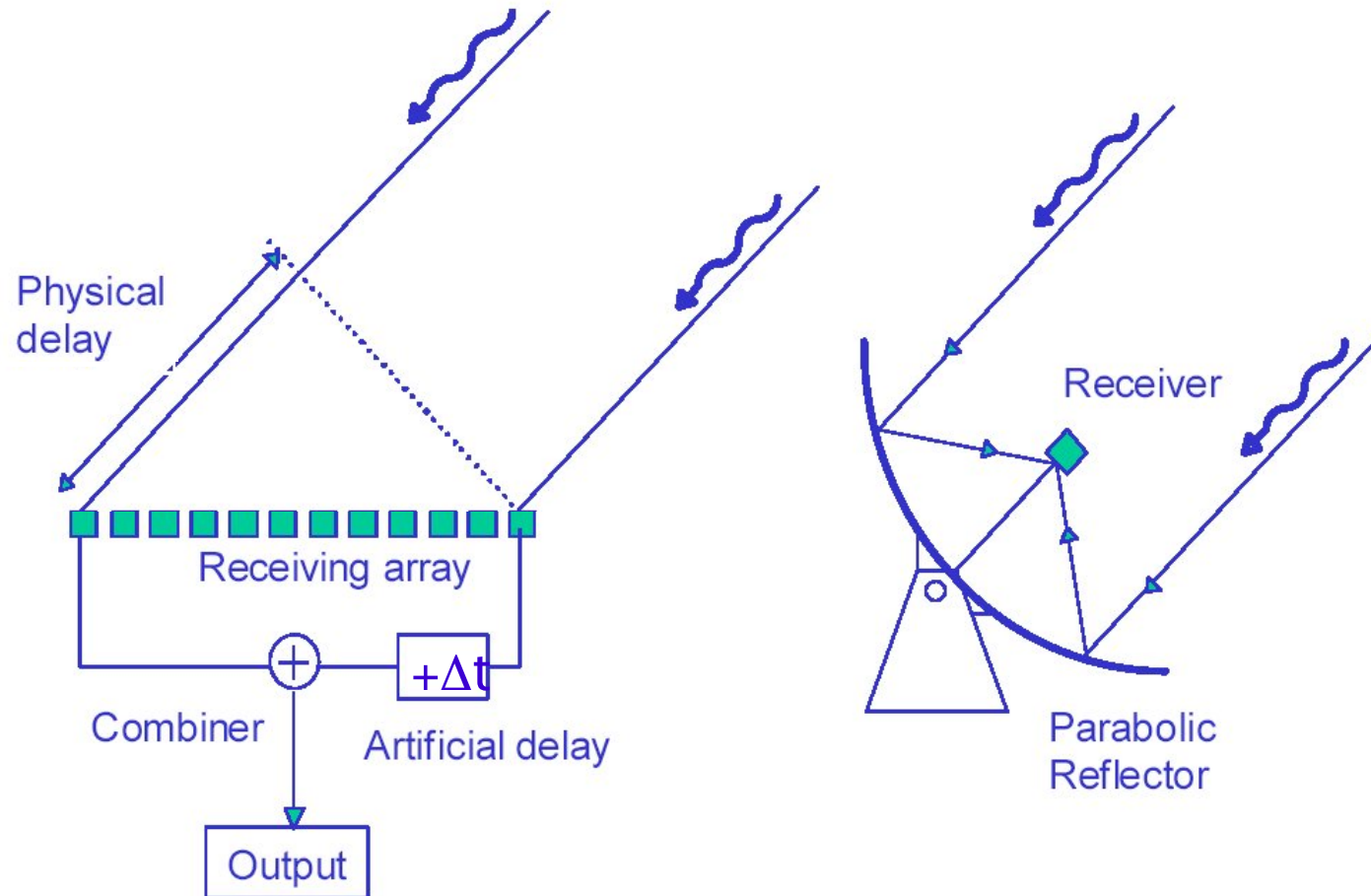
Prof. Michael Garrett

**ASTRON, the Netherlands Institute for Radio Astronomy
Leiden University.**

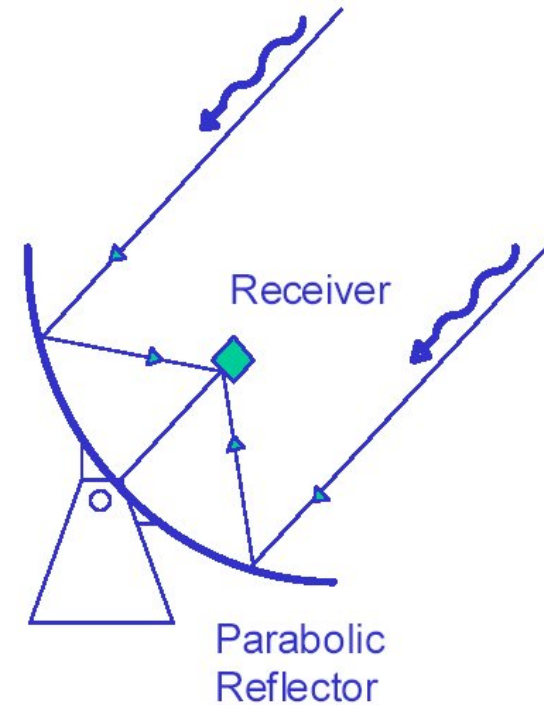
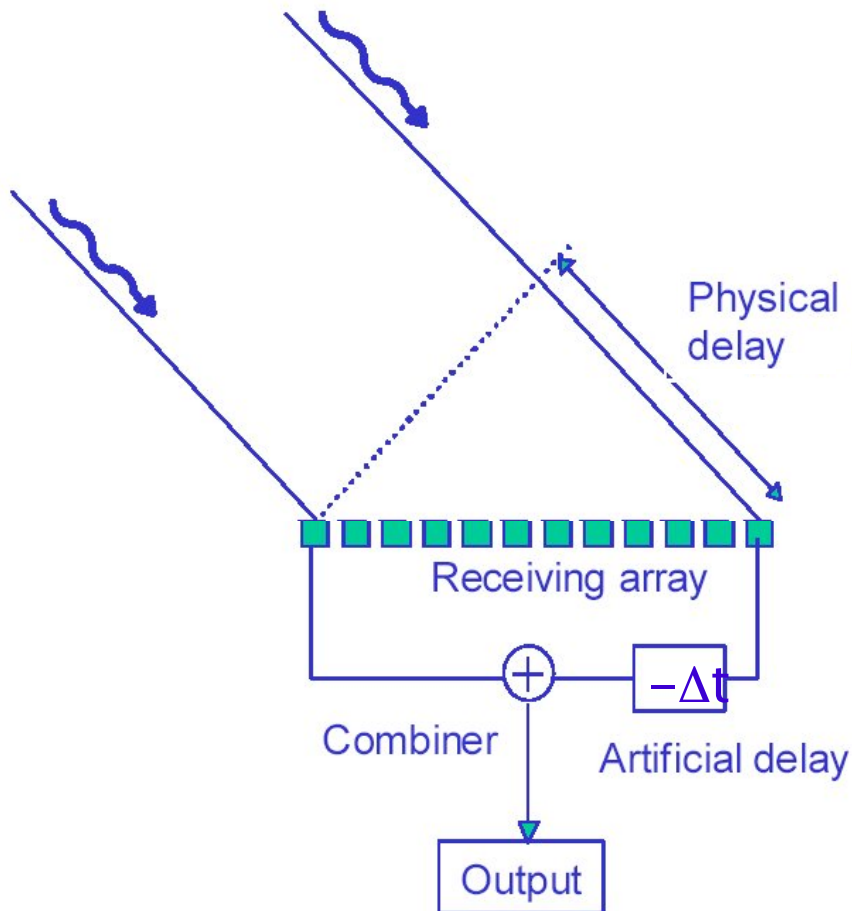
Aperture Array concept



Aperture Array concept

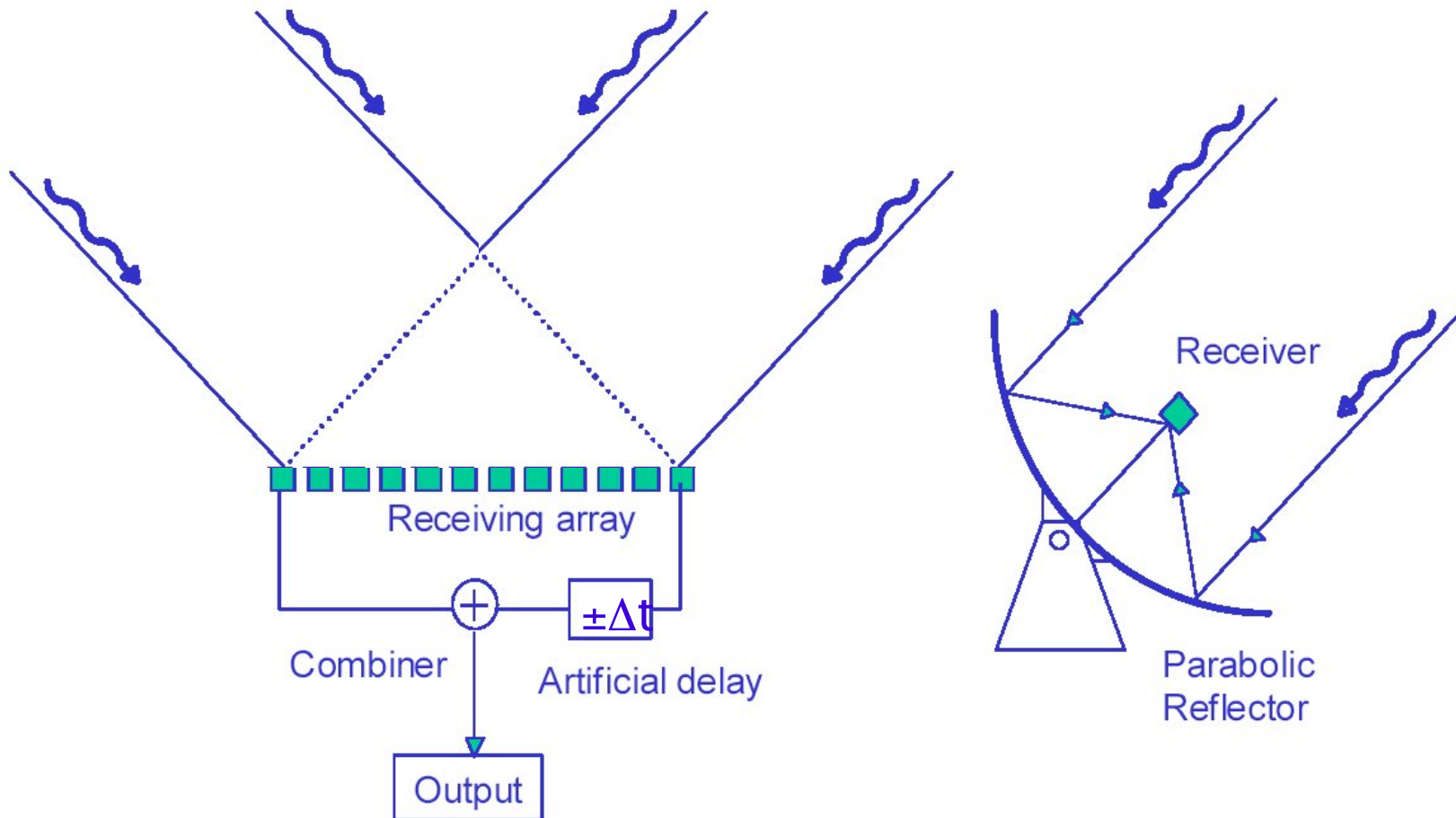


Aperture Array concept



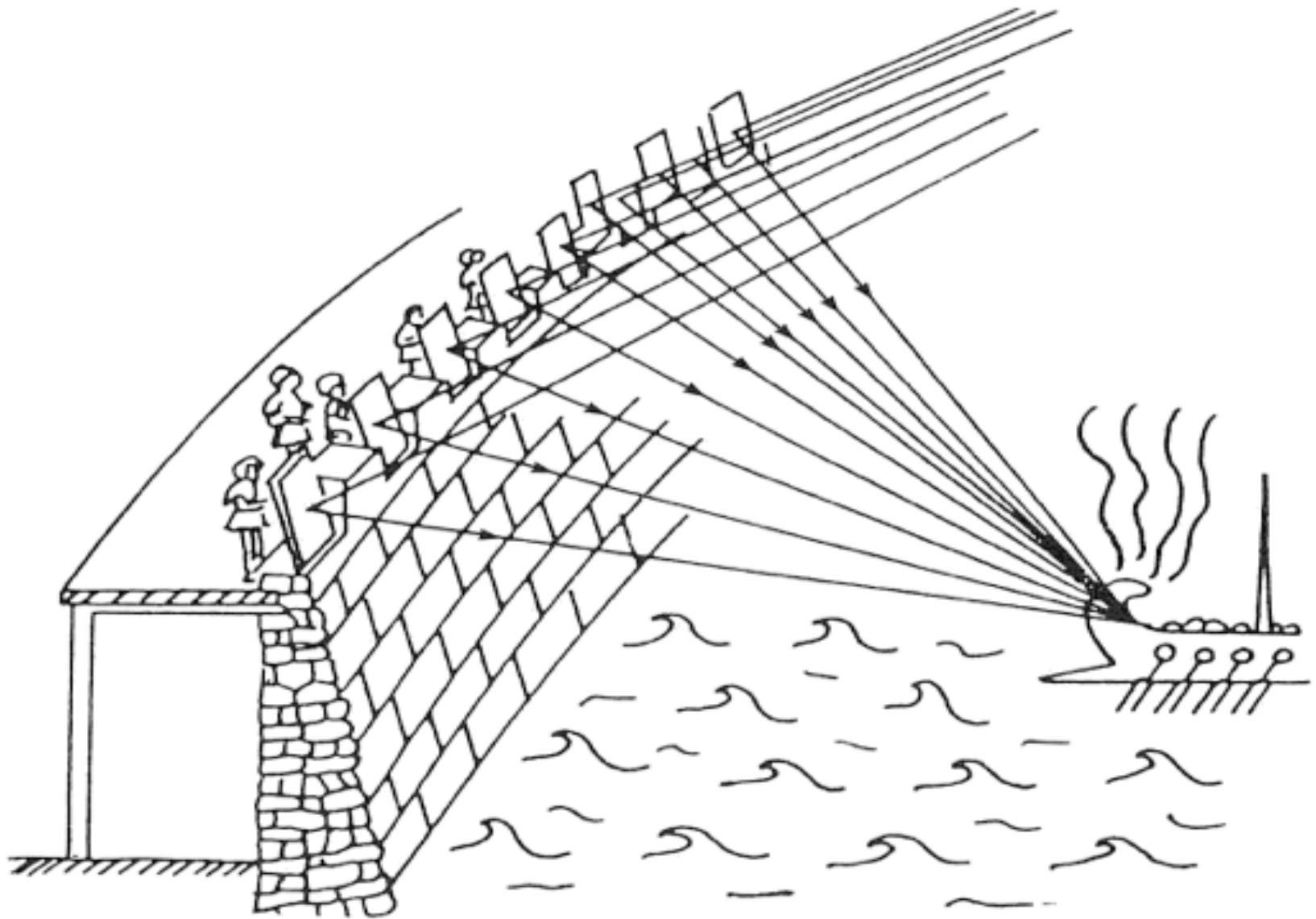
- Unblocked aperture with full view of the whole sky!
- Ultimate flexibility with no moving parts!
- Beams are formed and controlled electronically at element level

Aperture Array concept



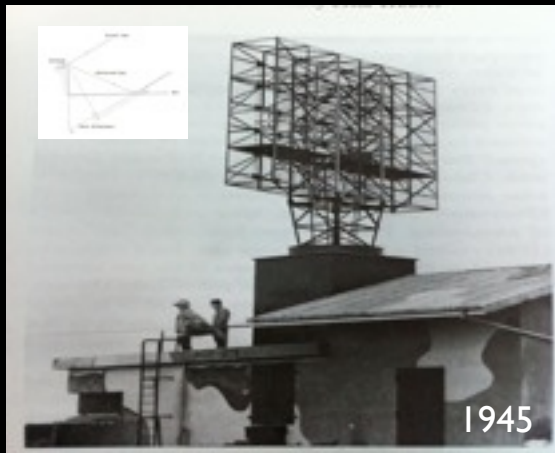
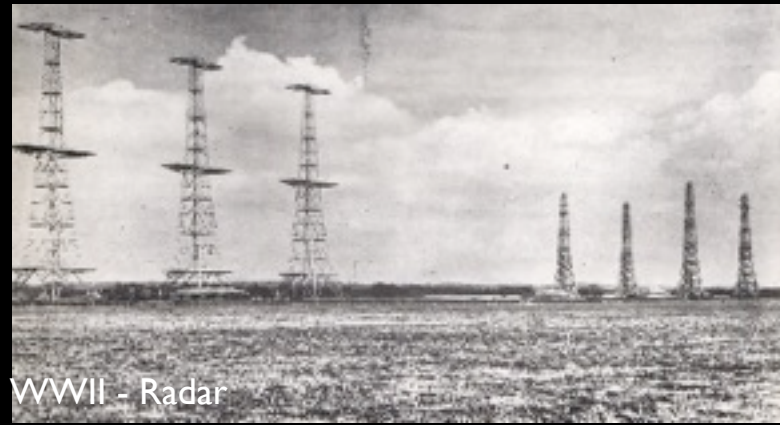
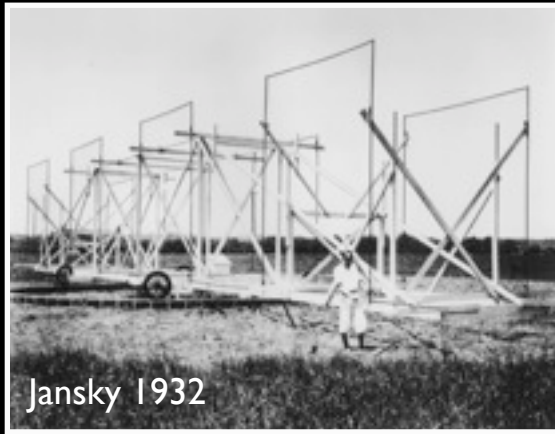
- Unblocked aperture with full view of the whole sky!
- Ultimate flexibility with no moving parts!
- Beams are formed and controlled electronically at element level
- Permits concurrent, possibly associated, multi-beam observations
- Technology of choice at frequencies $< \sim 1.5$ GHz

Not a new idea...



Archimedes (212 BC)

Dipole (Aperture) Arrays - Past



Aperture Array “a lost technology”: 1970-2010...?

Google

radio telescope

Advanced search

SafeSearch moderate ▼

Search

About 2,170,000 results (0.10 seconds)

Everything

Related searches: [arcminute radio telescope](#) [radio telescope array](#) [seti radio telescope](#) [radio telescope diagram](#) [biggest radio telescope](#)

Images

Maps

Videos

News

Shopping

More

Sort by relevance

Sort by subject

Any size

Large

Medium

Icon

Larger than...

Exactly...

Any color

Full color

Black and white

Any type

Face

Photo

Clip art


Line drawing

Standard view

Show sizes

Any time

Past week



The image displays a Google search results page for the query "radio telescope". The page features a grid of approximately 60 search results, primarily images of radio telescopes. These include large parabolic dishes, arrays of smaller dishes, and diagrams illustrating the components and operation of radio telescopes. The search results are organized into rows, with the first row containing larger images and subsequent rows containing smaller images. The page also includes a sidebar with navigation options like "Everything", "Images", "Maps", "Videos", "News", "Shopping", and "More". Additionally, there are filters for "Sort by relevance", "Sort by subject", "Any size", "Any color", "Any type", "Standard view", and "Any time". The search results are related to the query "radio telescope" and include terms like "arcminute radio telescope", "radio telescope array", "seti radio telescope", "radio telescope diagram", and "biggest radio telescope".

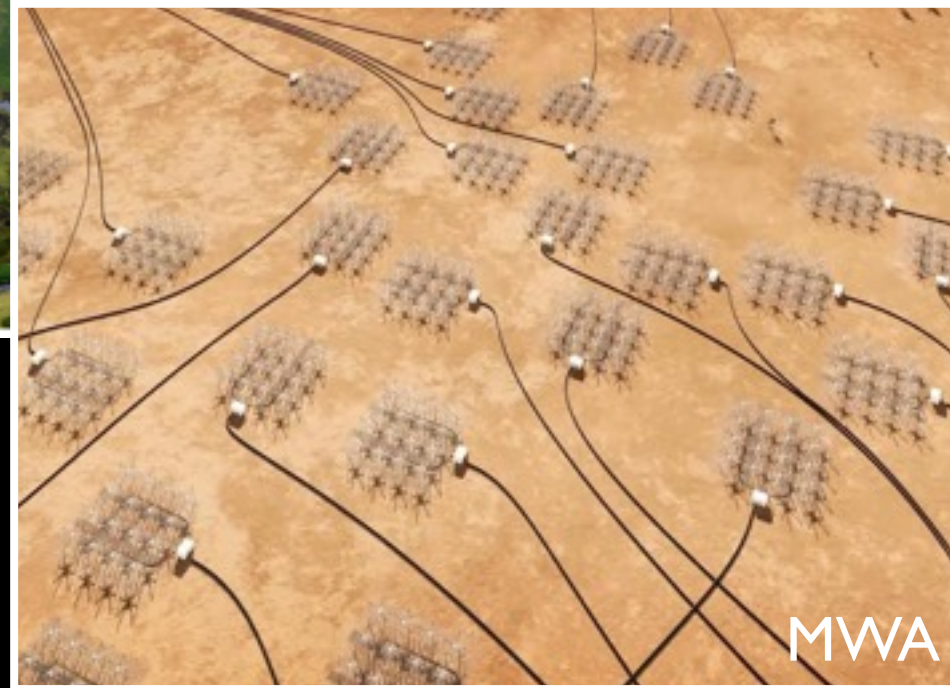
Aperture Arrays - 40 years on - *Present*

- “Radio Astronomy Re-invented” - Cesarsky et al.

International Lofar Stations



LOFAR



Imaging

MWA:

MWA:

MWA:

Non-imaging applications

Imaging

MWA:

MWA:

MWA:

Non-imaging applications

Imaging

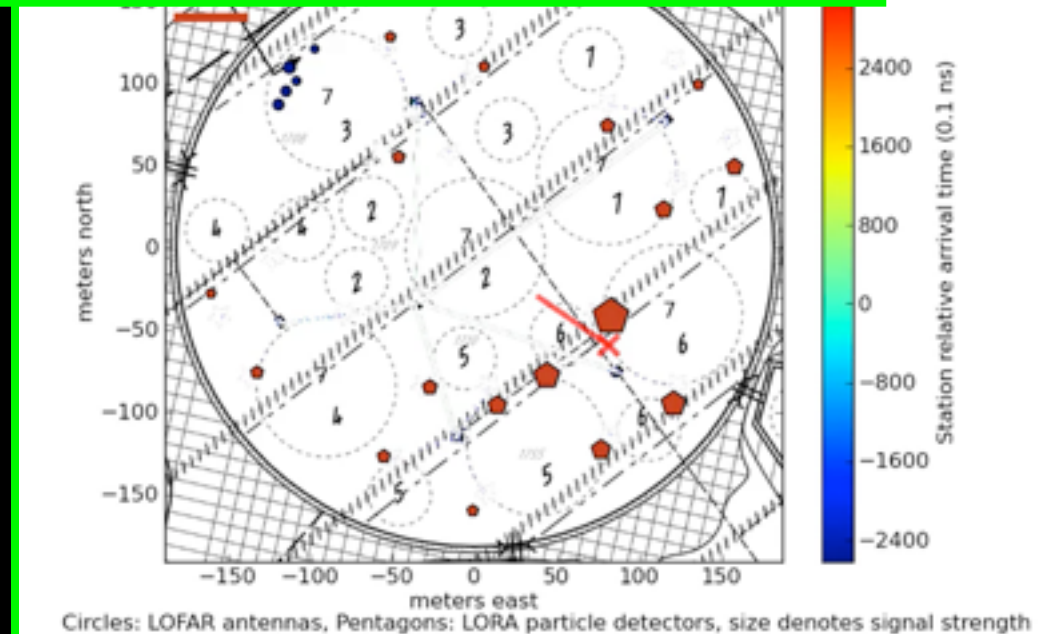
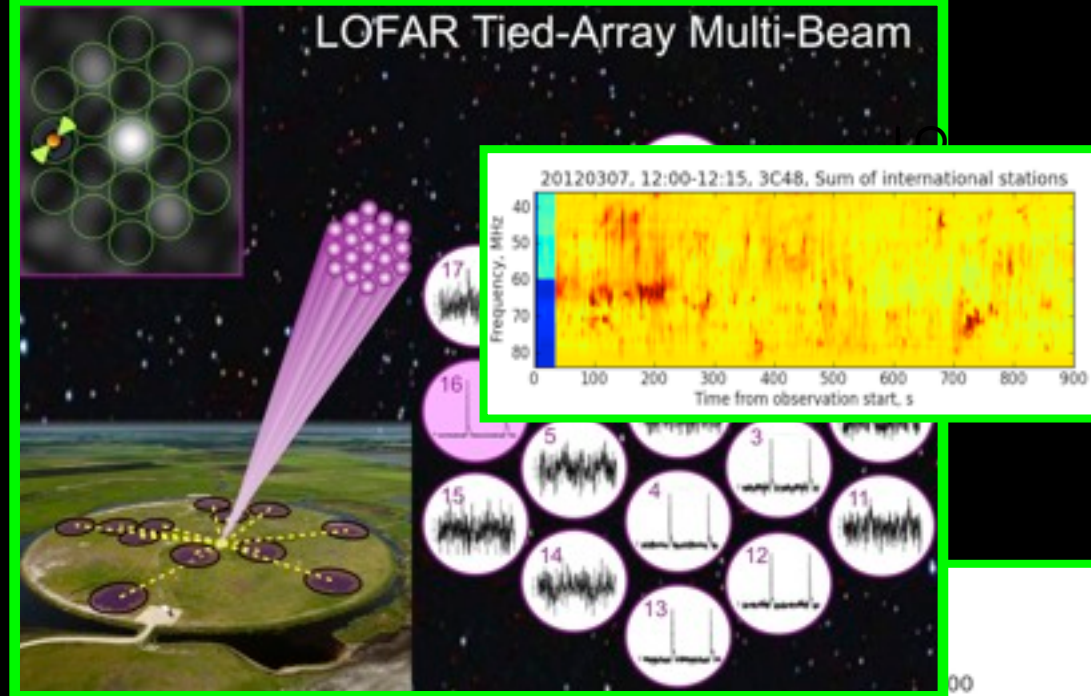
MWA:

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Non-imaging applications

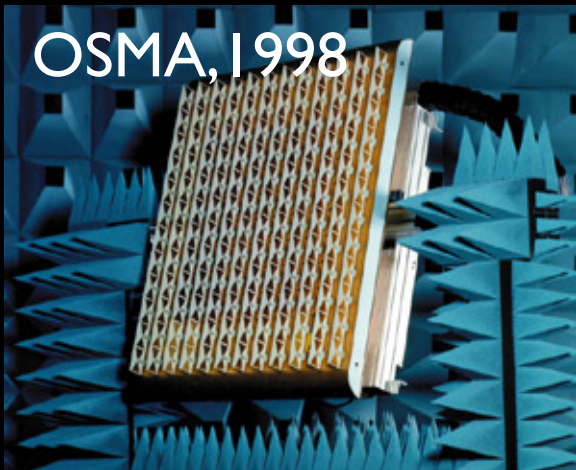
LOFAR Tied-Array Multi-Beam



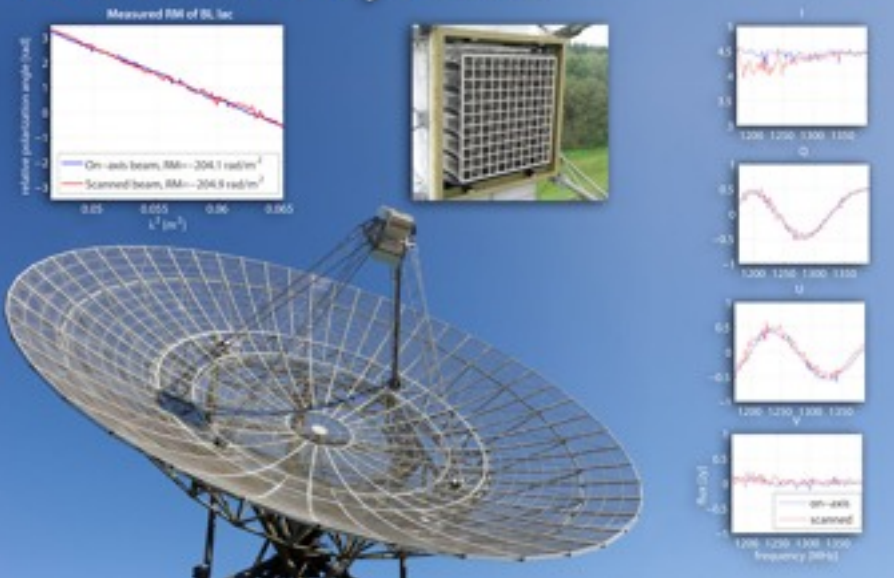
Mid-frequency Aperture Array Developments at ASTRON (1995-2010)

Aperture Arrays R&D focused on:

- concept demonstration,
- integration,
- cost reduction.



Polarimetry with a Phased Array Feed



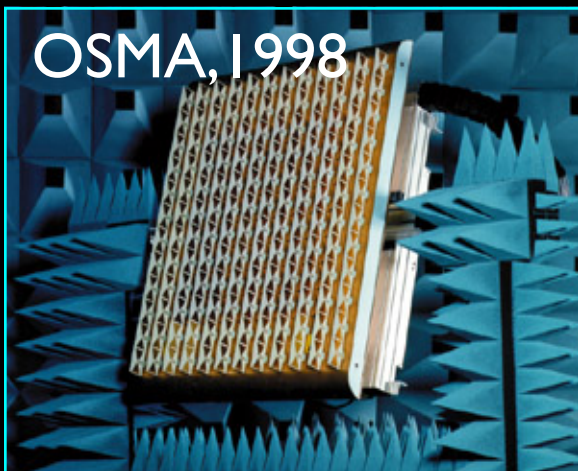
Array Developments at ASTRON (1995-2010)

on:

THEA, 2006



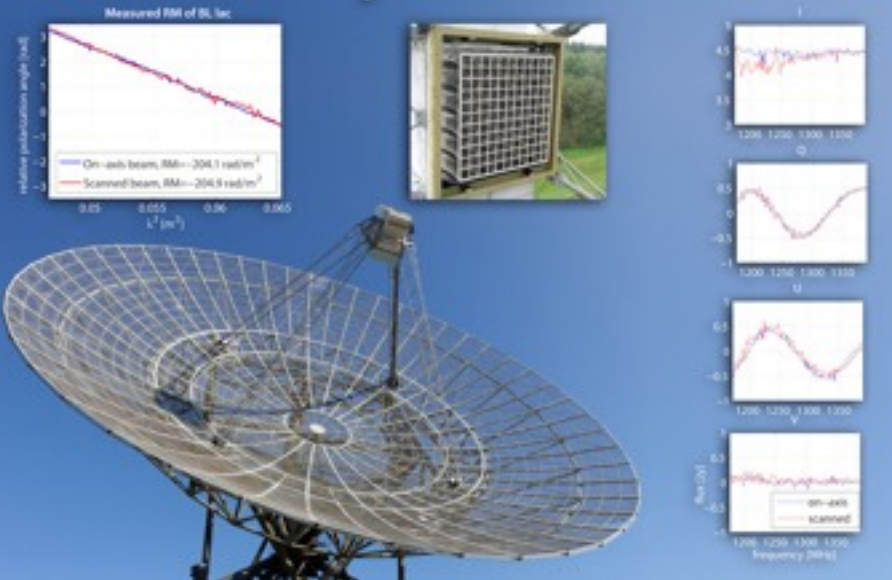
OSMA, 1998



EMBRACE, 2012



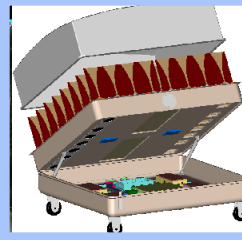
Polarimetry with a Phased Array Feed



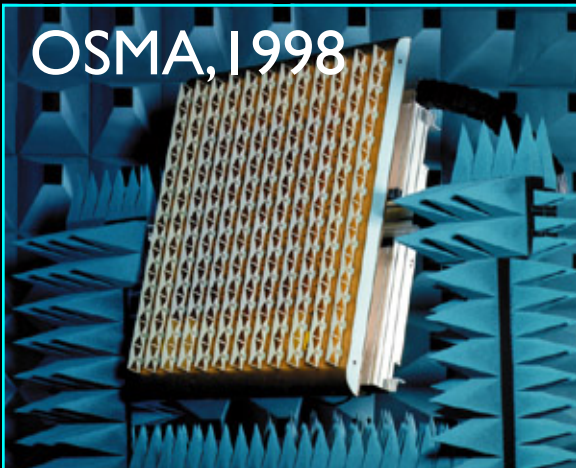
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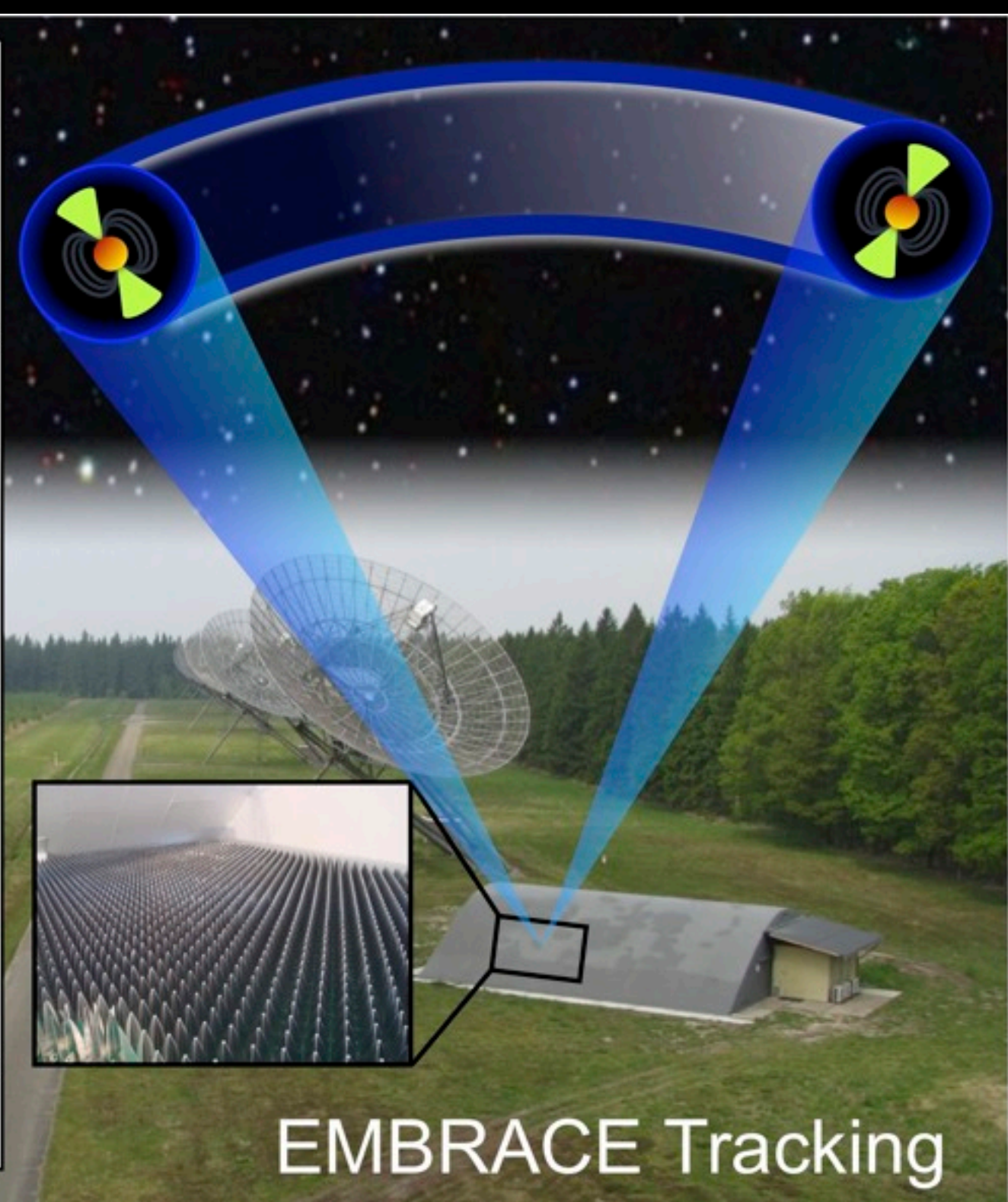
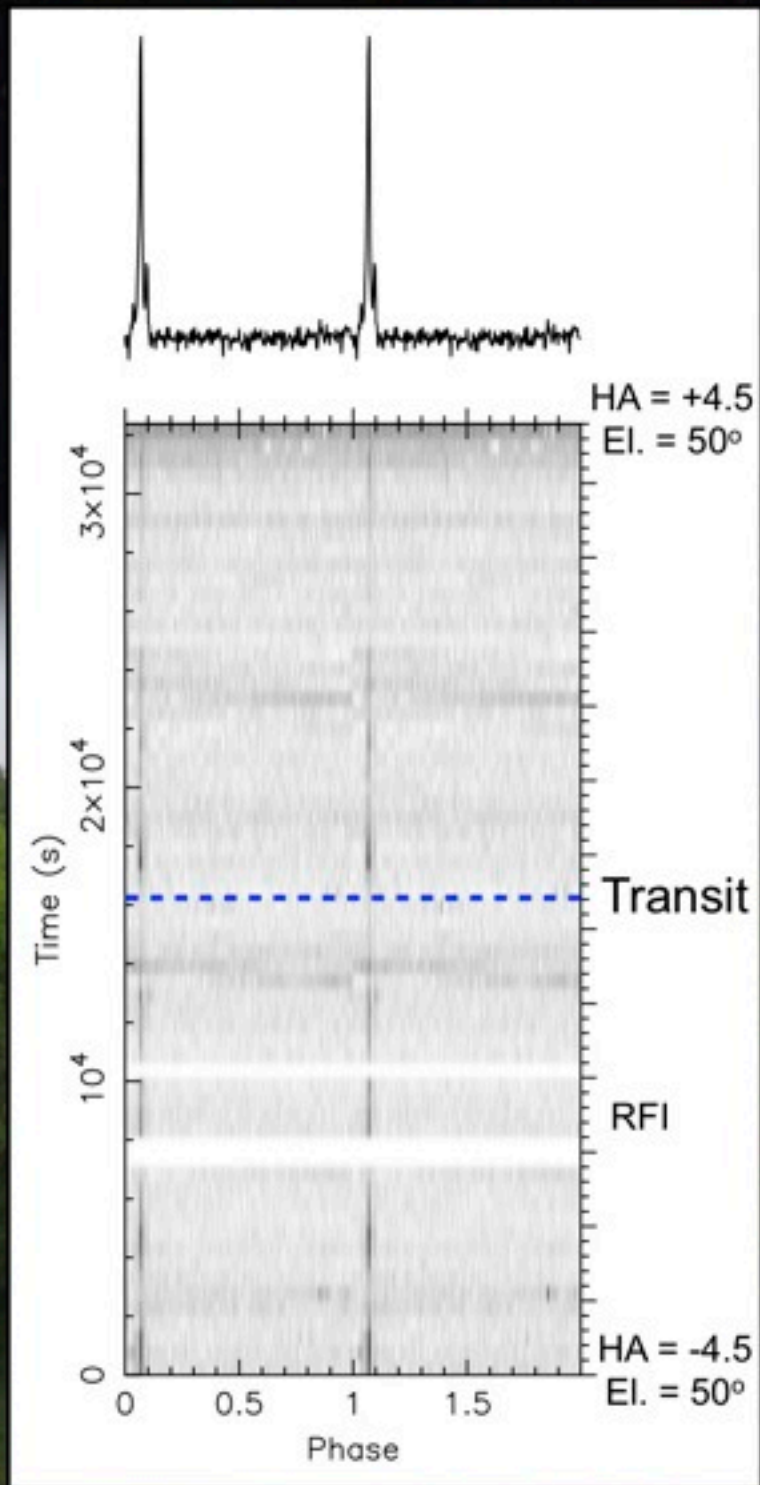
OSMA, 1998

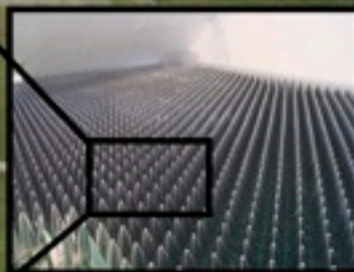
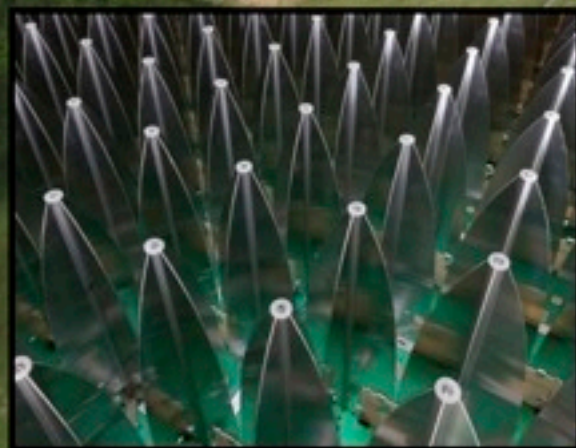
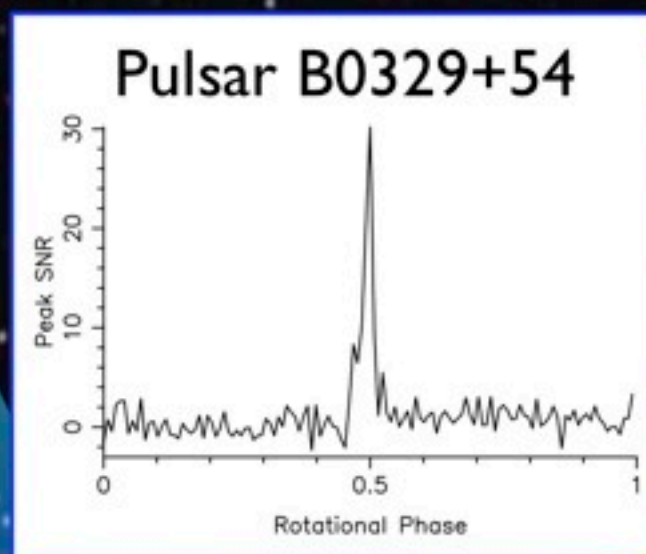
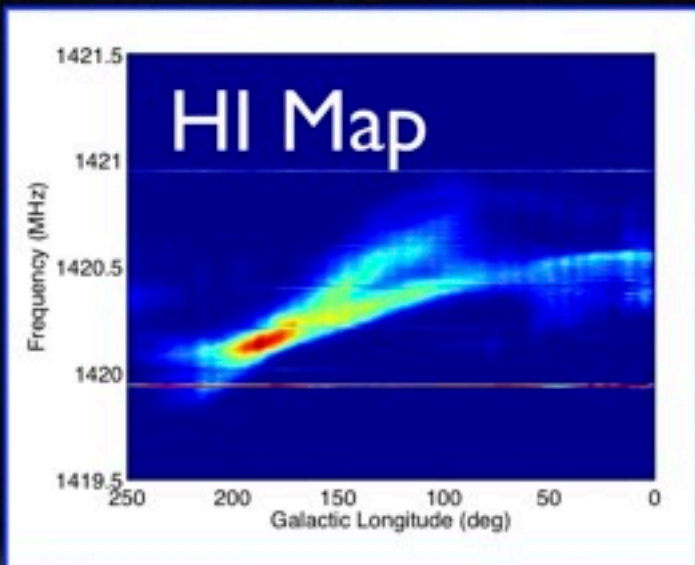


EMBRACE, 2012



Ardenne et al.
Kant et al.
Capellan et al.
Faulkner et al.
bij de Vaate et al.

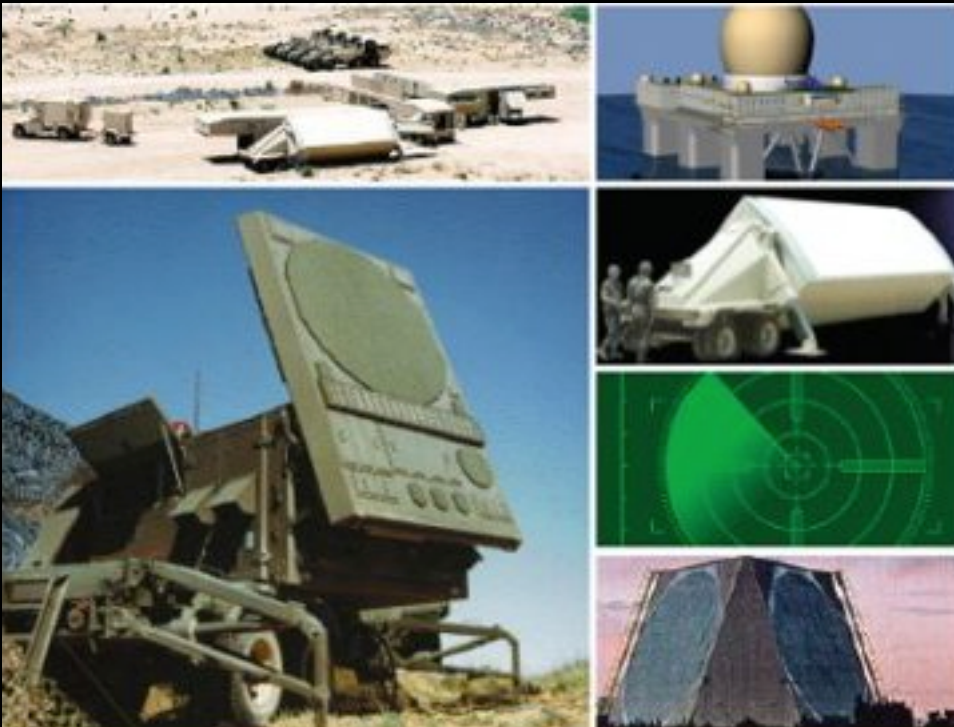




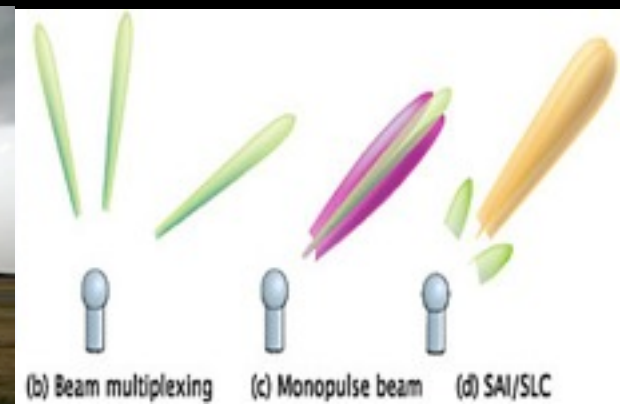
EMBRACE Dual Beam

Mid-frequency Aperture Arrays - beyond Radio Astronomy - Present...

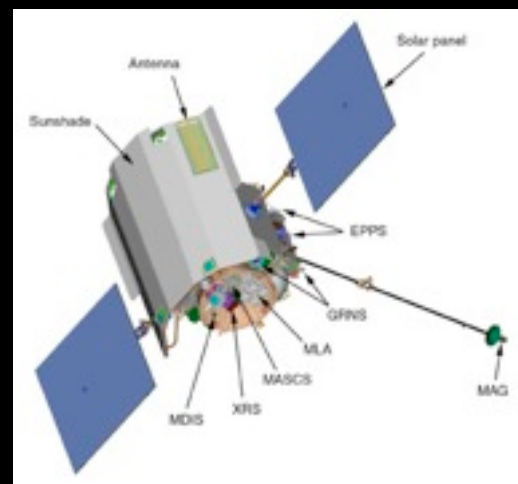
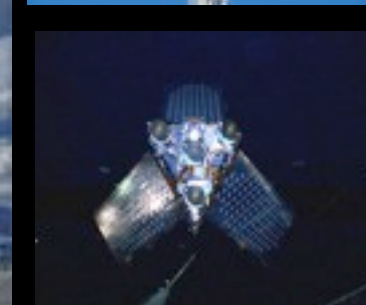
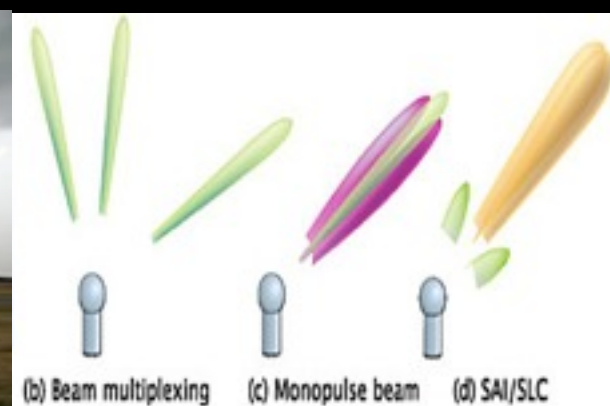
Mid-frequency Aperture Arrays - beyond Radio Astronomy - Present...



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Mid-Frequency Aperture Arrays - the Future

SKA at mid-frequencies:

- simply building a “VLA on steroids” is not good enough!
- need to be as innovative as technology will allow.

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The development of a *scientifically capable* 21cm Dense Aperture Array demonstrator is necessary on route to SKA-2.





That's all Folks!



That's all Folks!

or is it?