

# Introduction to the basic concepts and terminology of radio interferometry



EUROPEAN ARC  
ALMA Regional Centre || Germany



universität**bonn**



Universität zu  
*Köln*

## ALMA community days

German ARC node – March 2017

# Outline

## **Part 1:** by Á. Sánchez-Monge

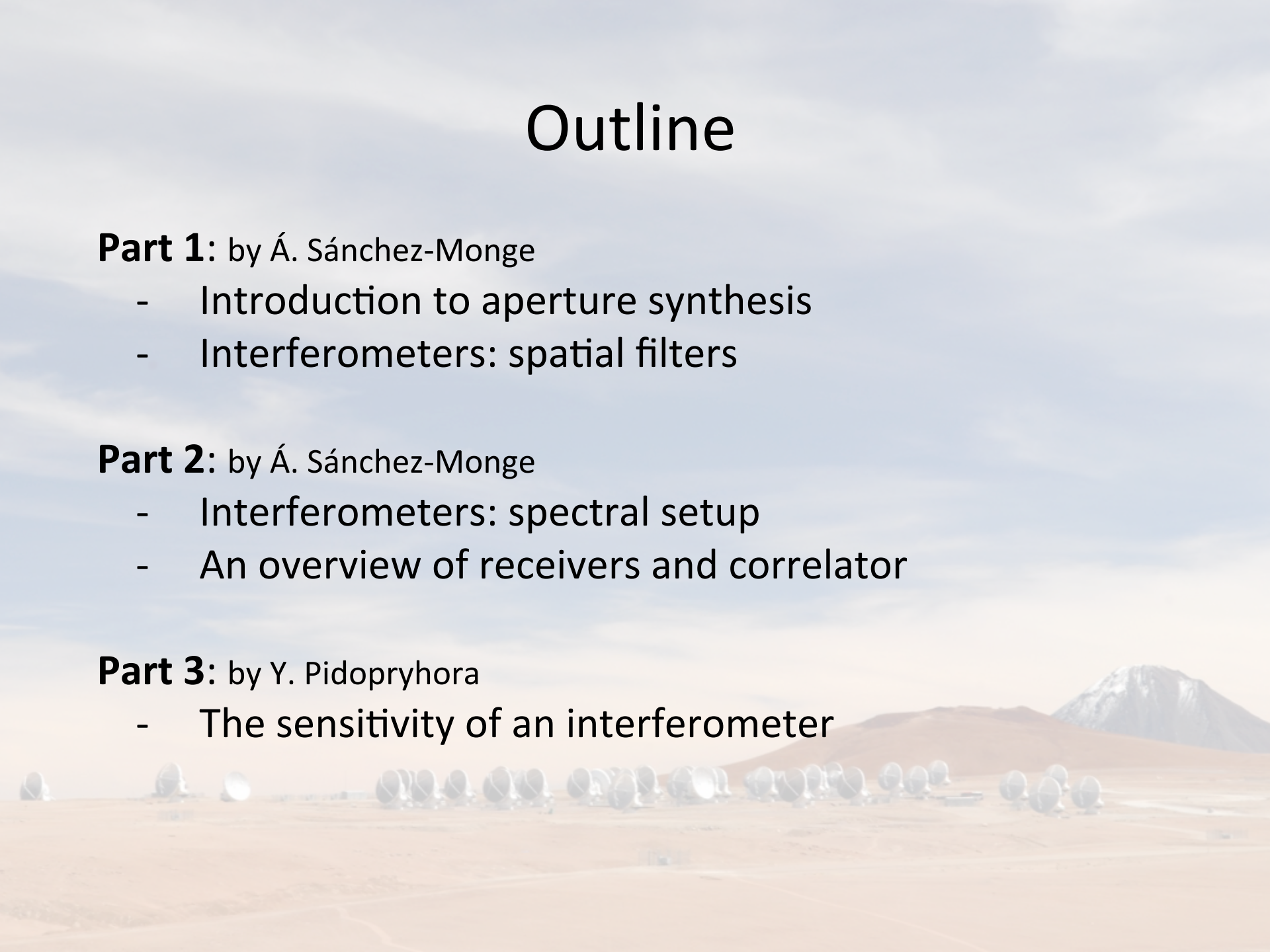
- Introduction to aperture synthesis
- Interferometers: spatial filters

## **Part 2:** by Á. Sánchez-Monge

- Interferometers: spectral setup
- An overview of receivers and correlator

## **Part 3:** by Y. Pidopryhora

- The sensitivity of an interferometer



# Part 1: aperture synthesis, spatial filters

German ARC: ALMA community days (March 2017)

# Telescopes ... vs Radiotelescopes



Il "cannocchiale" di Galileo



Galileo Galilei

# Telescopes ... vs Radiotelesc

Where should I put the eye?  
the eye?



INAF - Osservatorio Astronomico di Cagliari

Il **NUOVO** "cannocchiale" di Cagliari (a Sardinia) Galileo



Galileo Galilei

# Atacama Large Millimeter/submillimeter Array



Image credit: Mélisse Bonfand

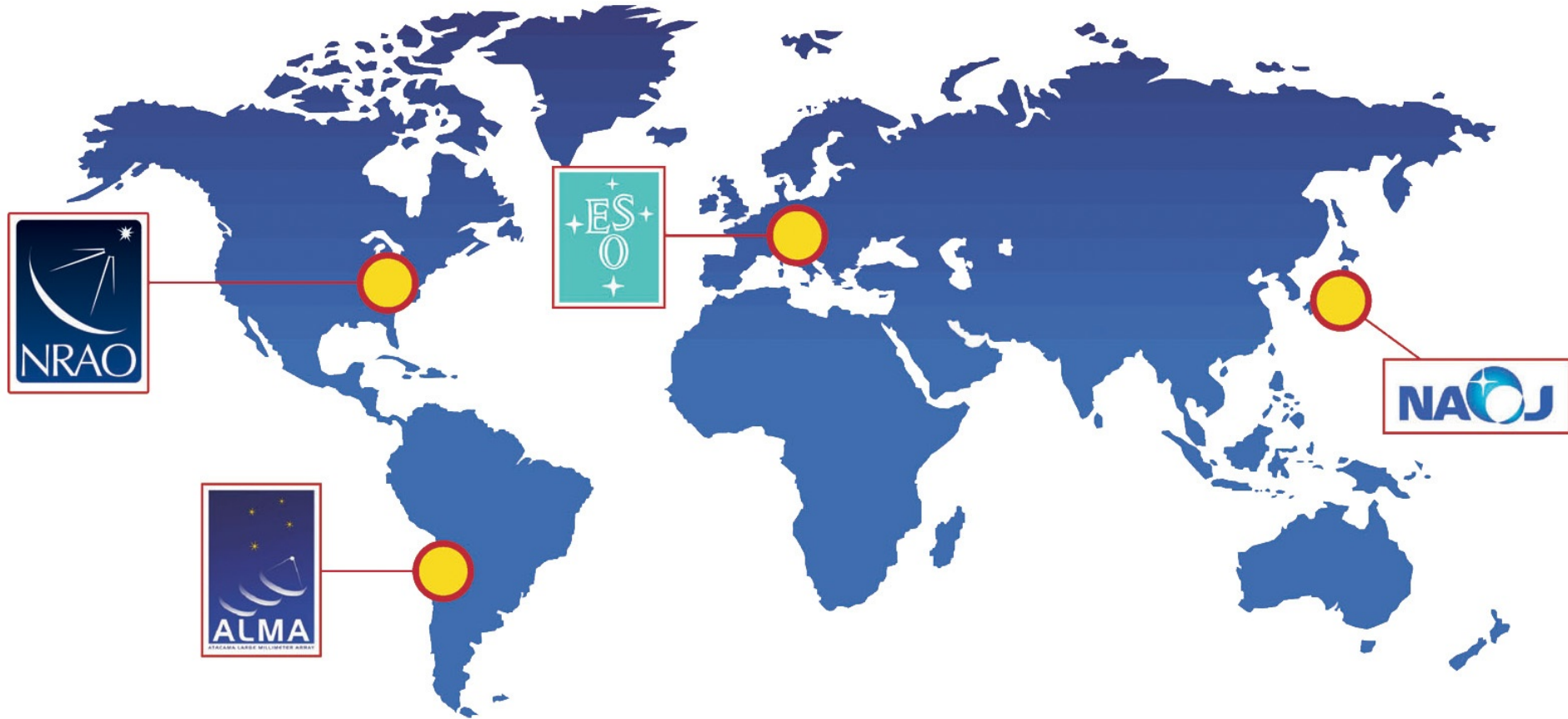
# Where is ALMA?

# Atacama desert (Chile)

- ... on the Chajnantor Plateau
- at 5000 m height
- ... control center
- at 2900 m height



# What is ALMA?



International collaboration:

3 ARC (ALMA Regional Centers) + JAO (Joint ALMA Observatory)



# What is ALMA?

ALMA in Cycle 5 is ...



# What is ALMA?

ALMA in Cycle 5 is ...

**43x**

**12m antennas**

10x

7m antennas (ACA)

3x

12m antennas (TP)



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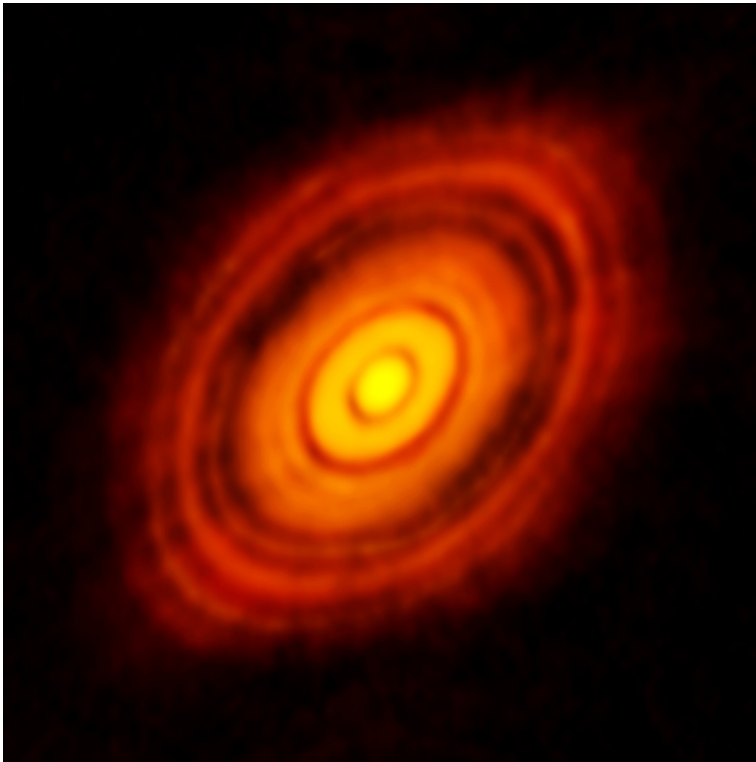
ALMA in Cycle 5 is ...

43x	12m antennas
10x	7m antennas (ACA)
<b>3x</b>	<b>12m antennas (TP)</b>



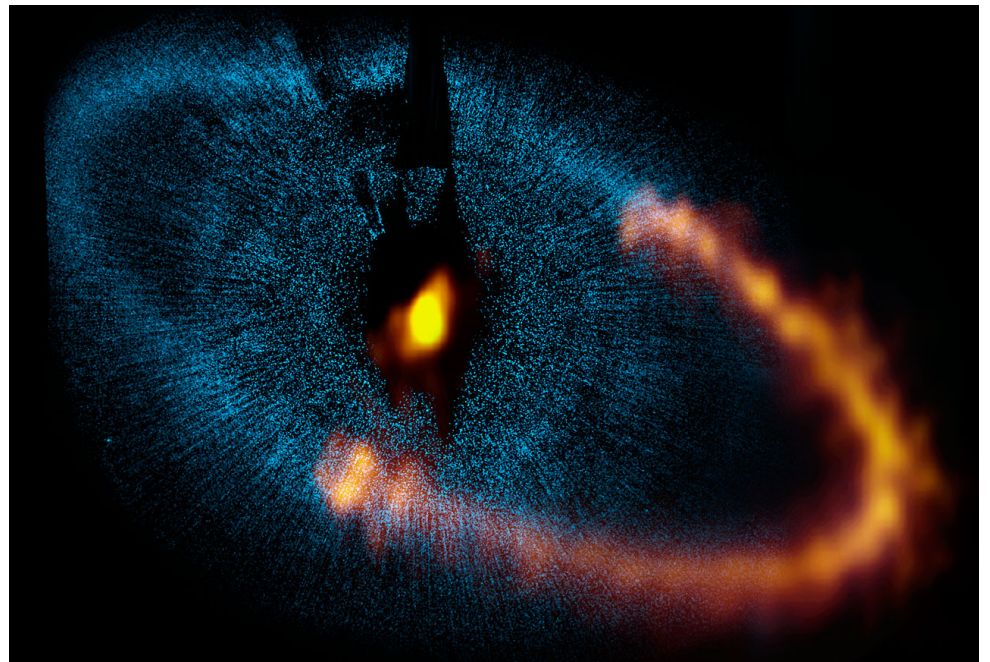
# What can ALMA do?

HL Tau



protoplanetary disks

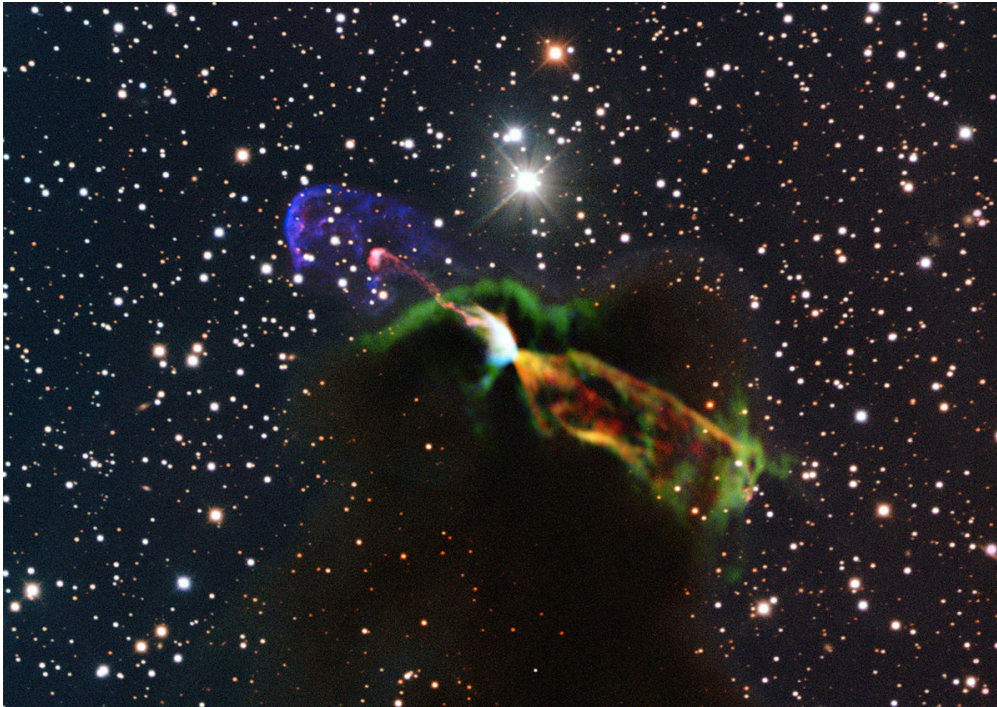
Formalhaut



debris disks

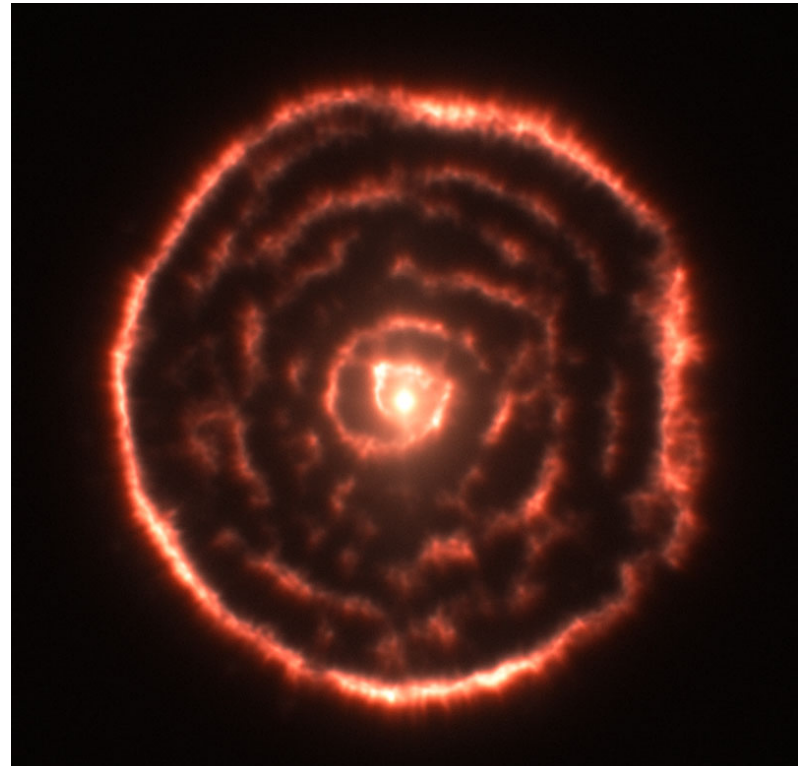
# What can ALMA do?

Herbig-Haro 46/47



molecular outflows and jets

R Sculptoris



red giants and old stars

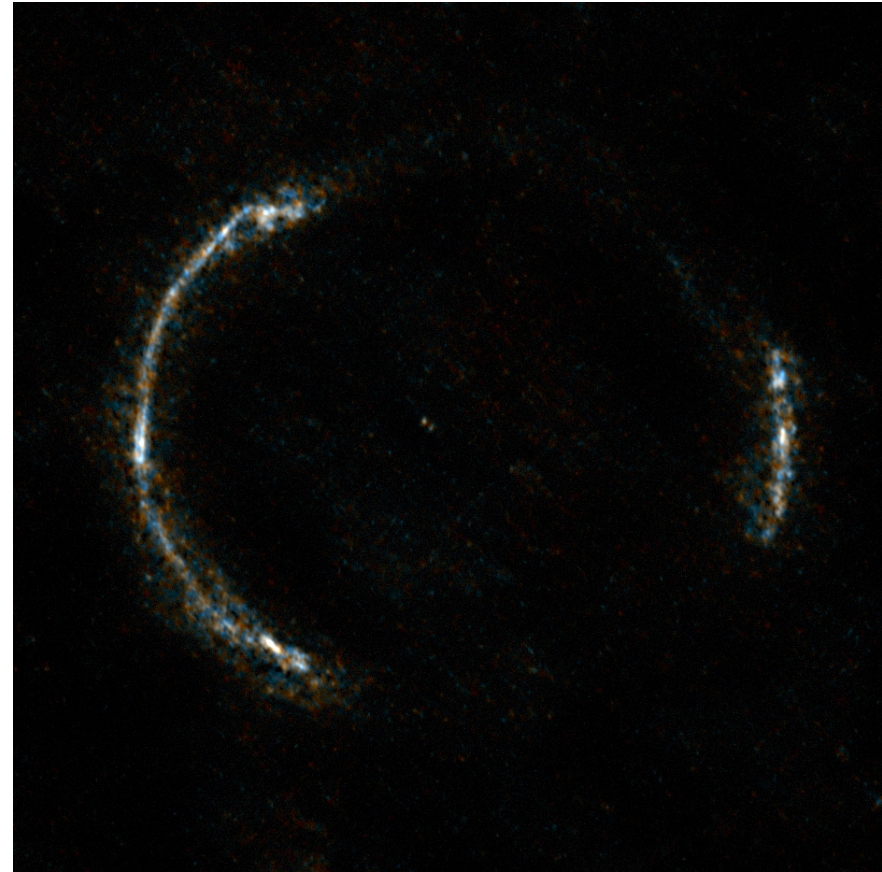
# What can ALMA do?

Antennae galaxies

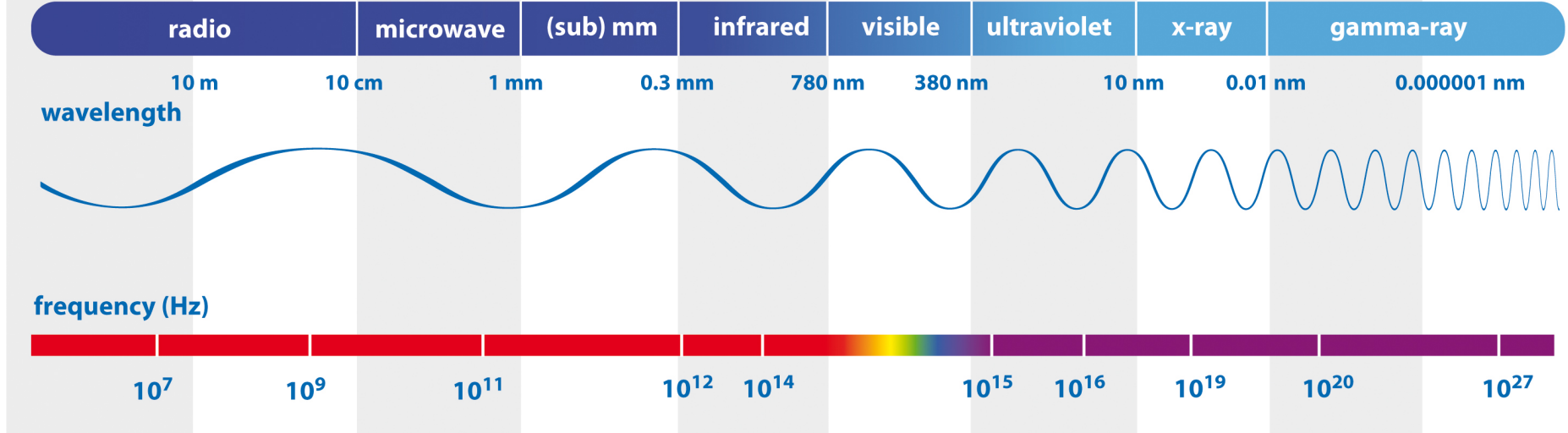


galaxy mergers

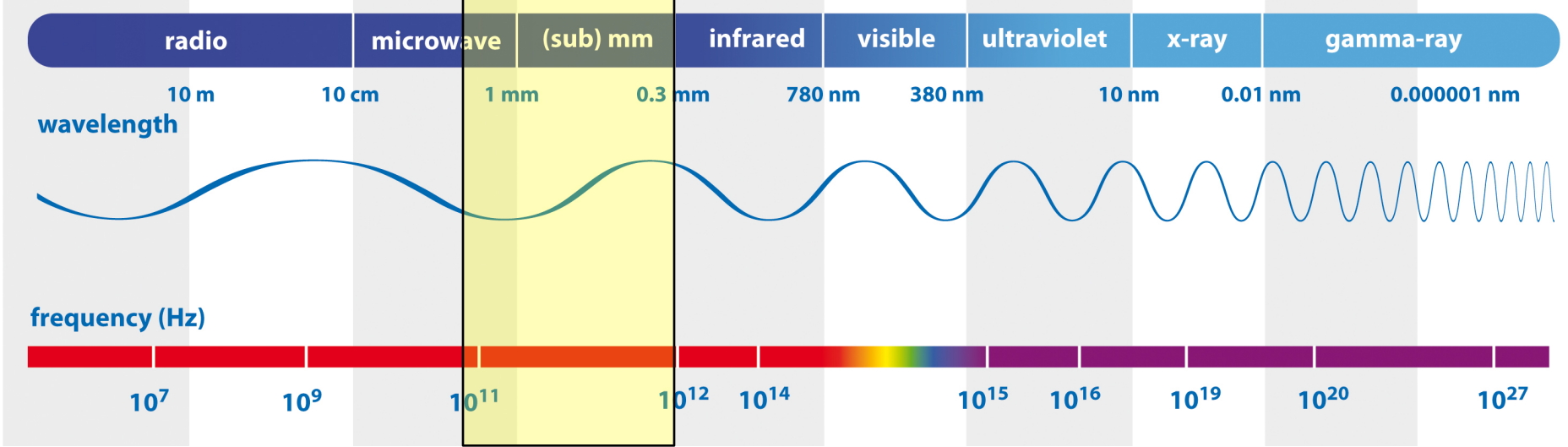
SPD.81



lensed galaxies







ALMA observable range  
**“Cold Universe”**

# Why is ALMA on the Chajnantor plateau?

... at this altitude (5000 m) the water vapor in atmosphere is low

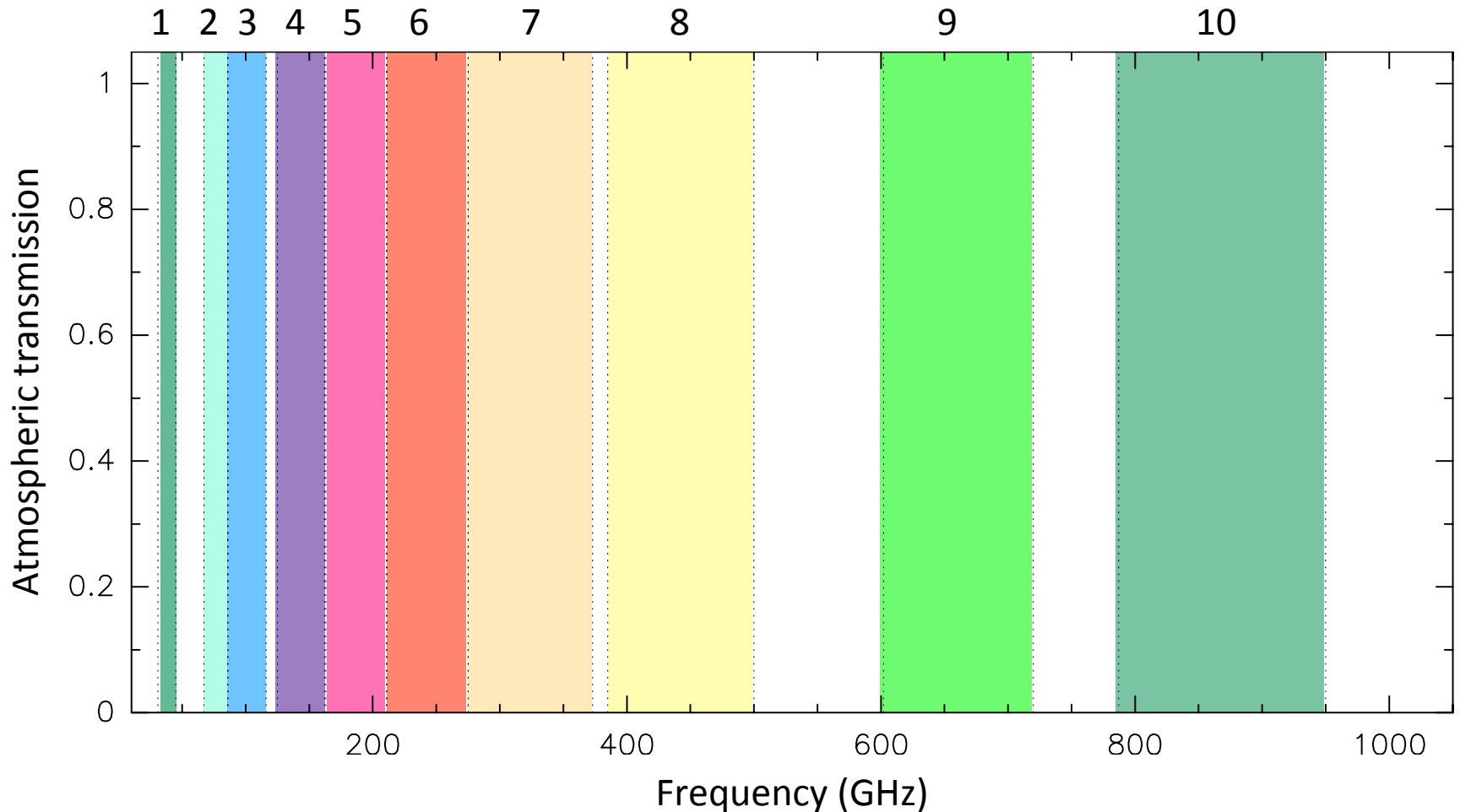
1 feet = 0.3 meters



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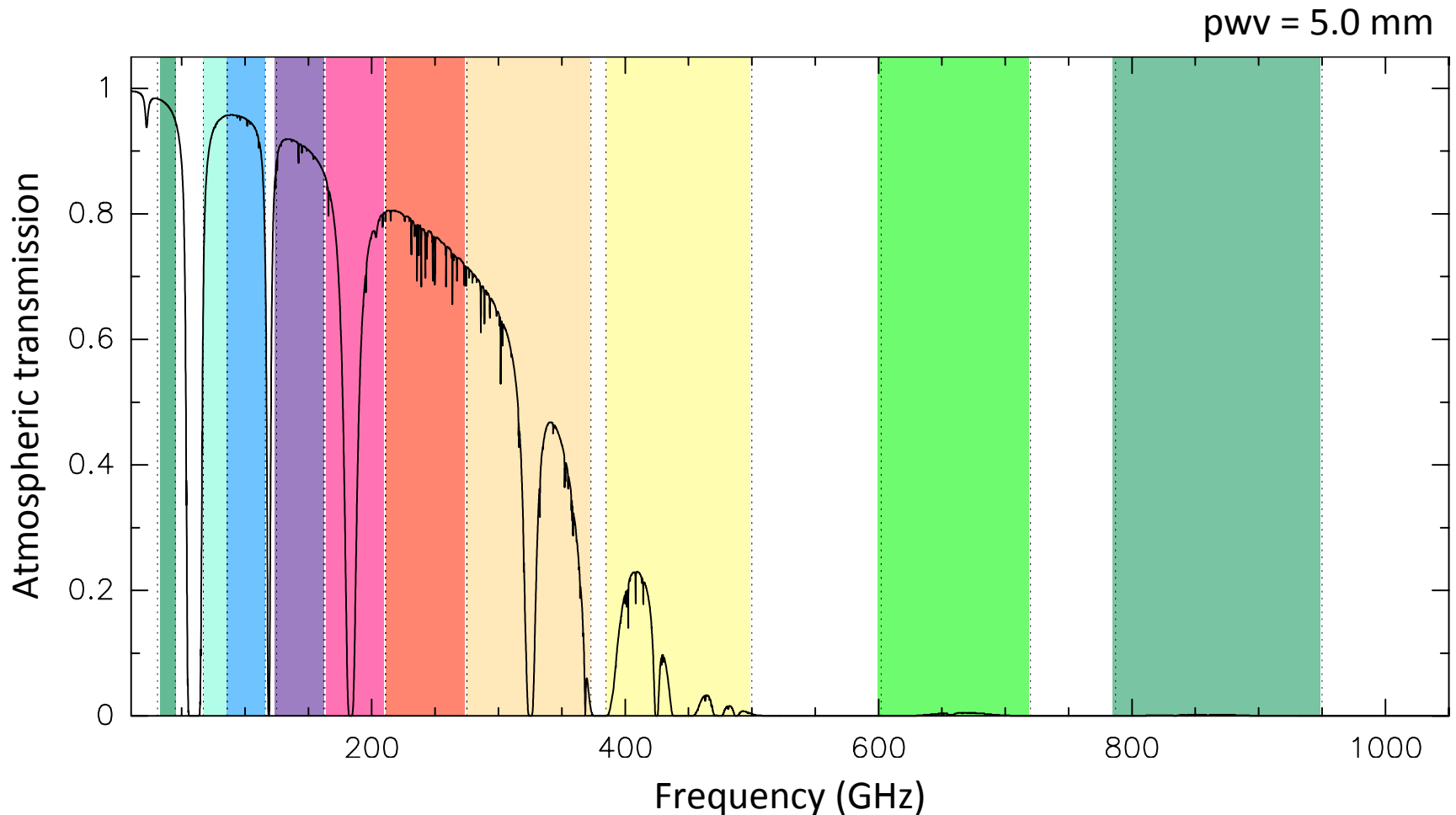
**ALMA frequency bands**



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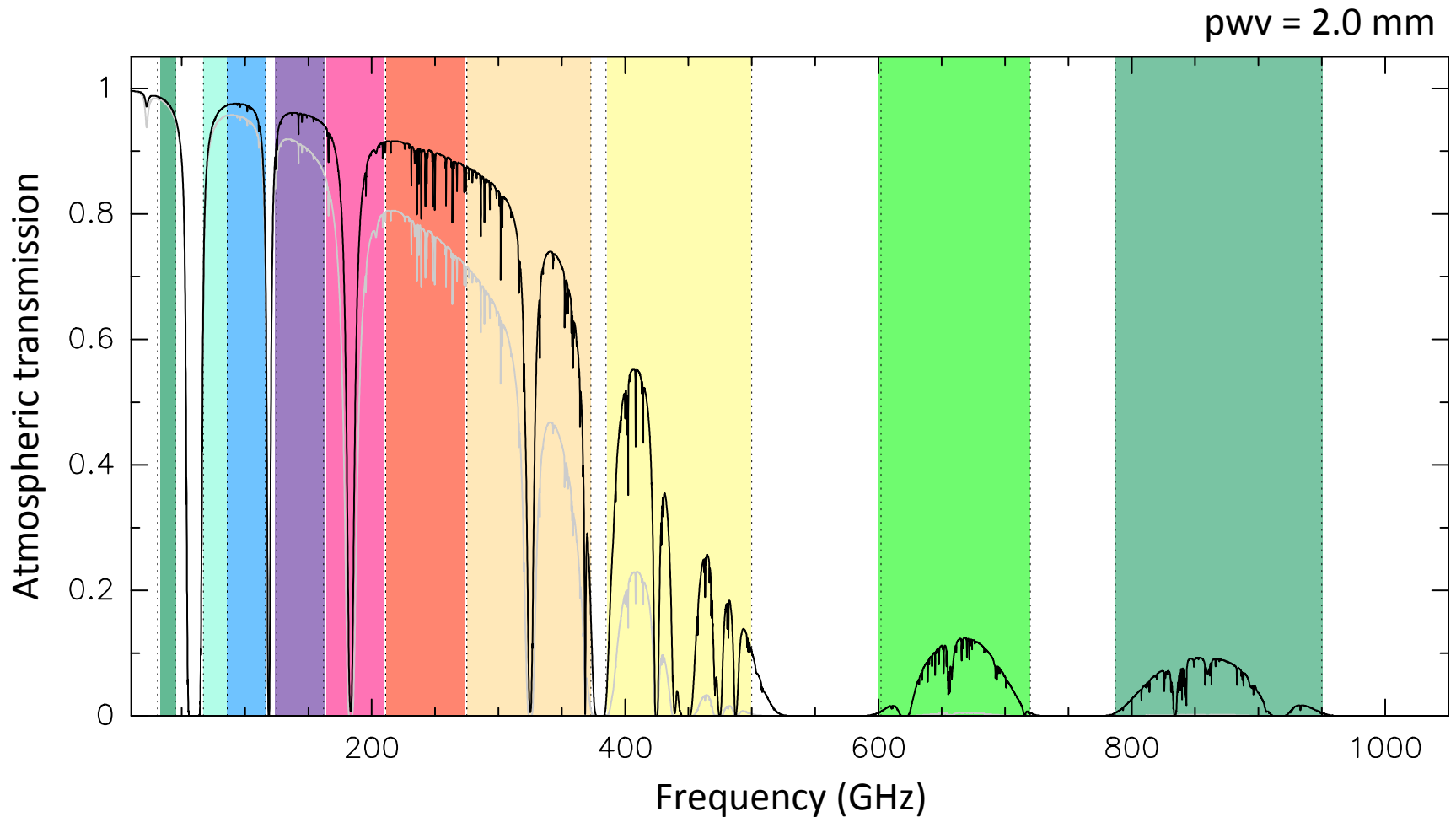
## ALMA frequency bands



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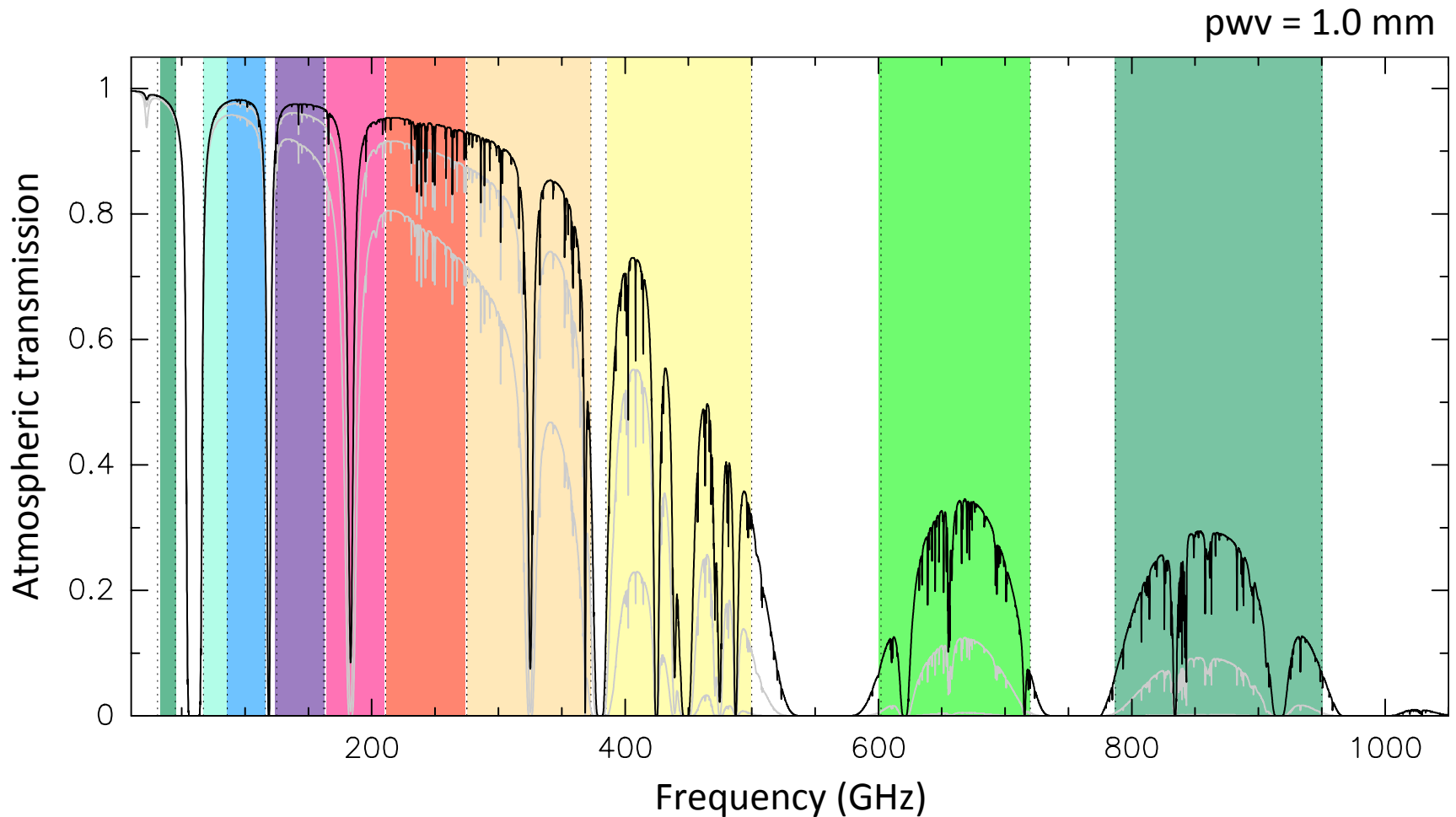
## ALMA frequency bands



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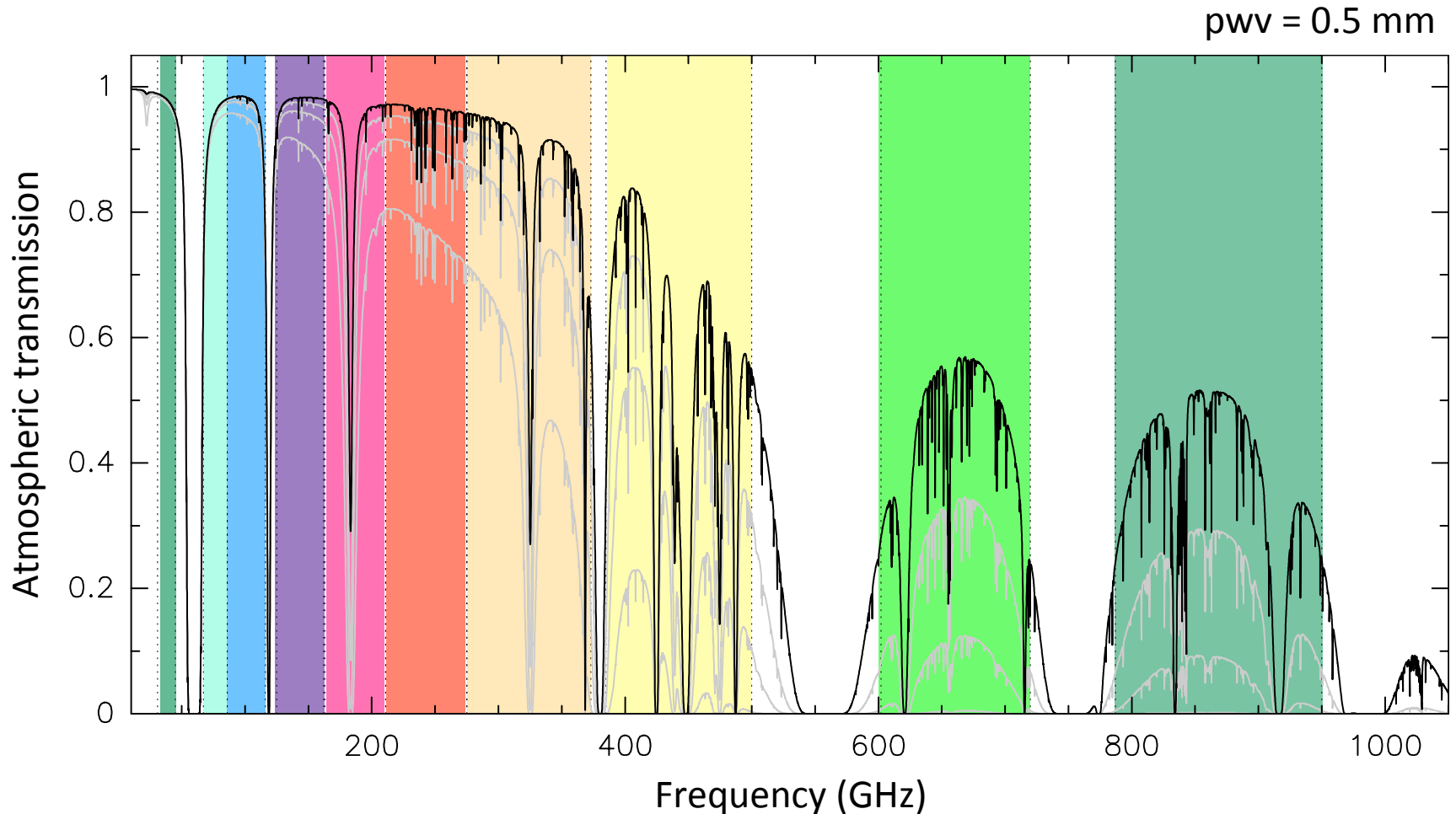
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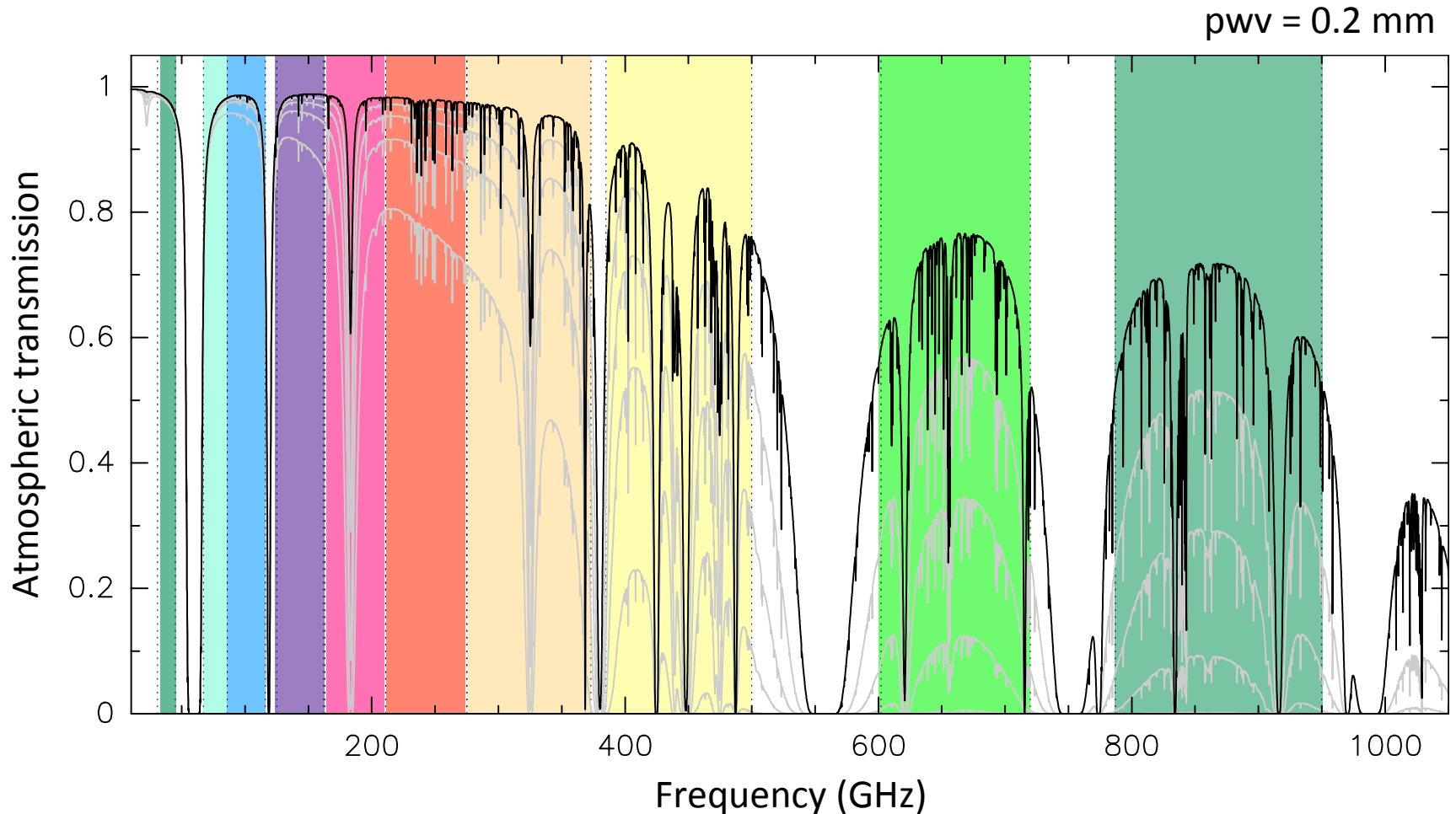
## ALMA frequency bands



# Why is ALMA on the Chajnantor plateau?

... at this altitude (5000 m) the water vapor in atmosphere is low

## ALMA frequency bands





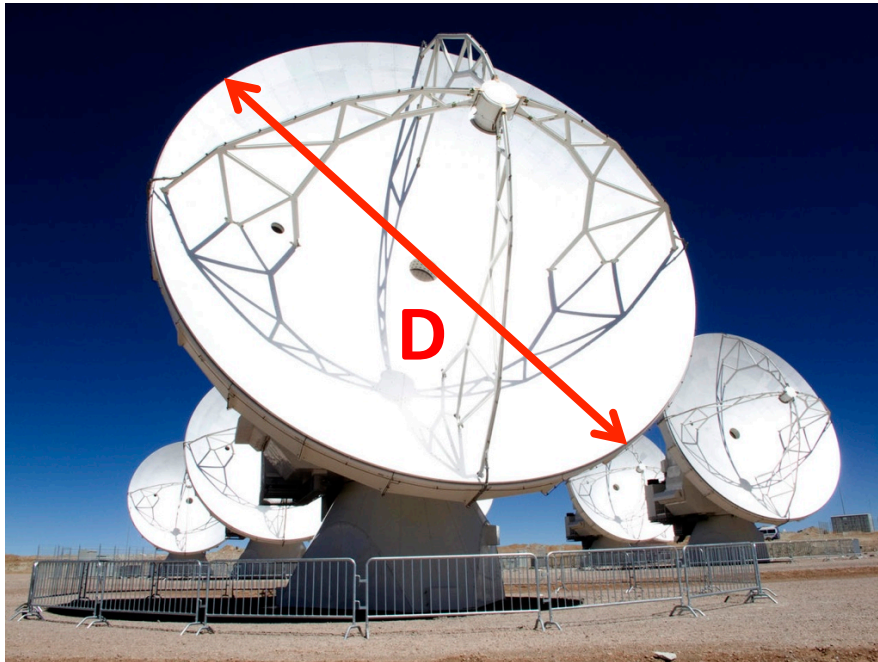
## Why so many antennas? ... instead of one



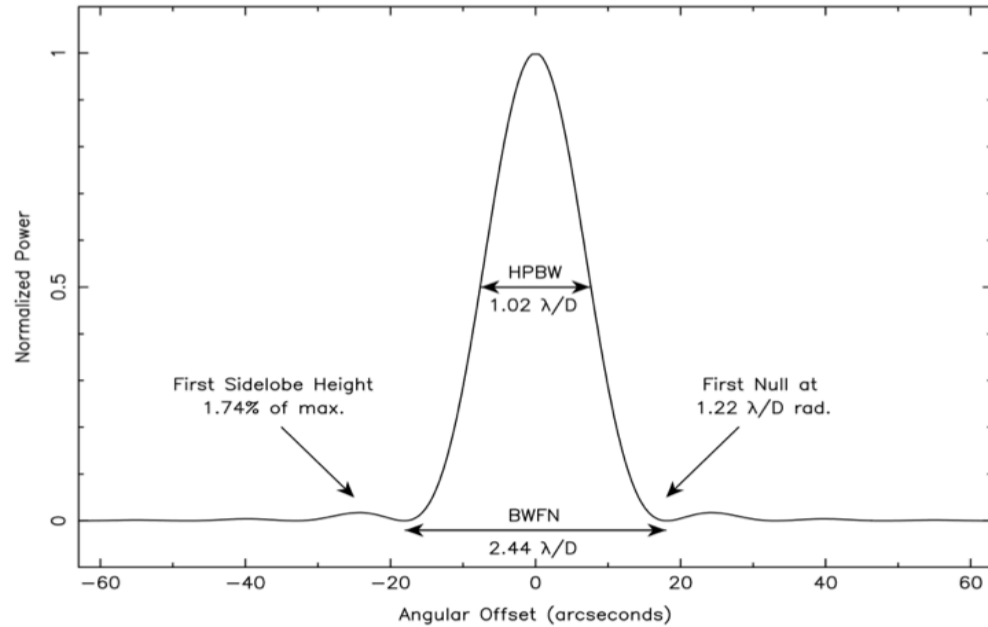
Image credit: Mélisse Bonfand

# Single-dish response

Single-dish with diameter  $D$

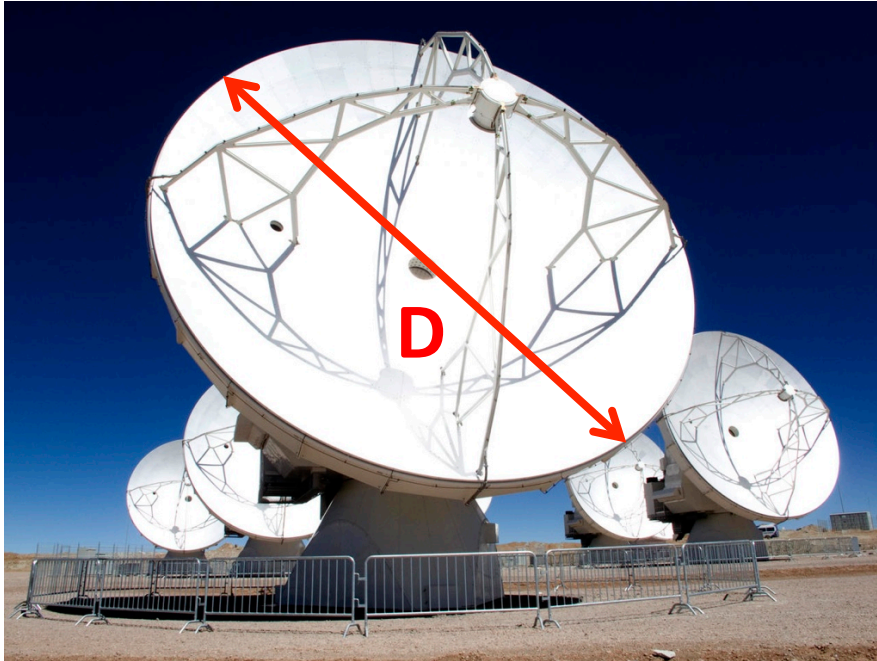


(1D) antenna power response

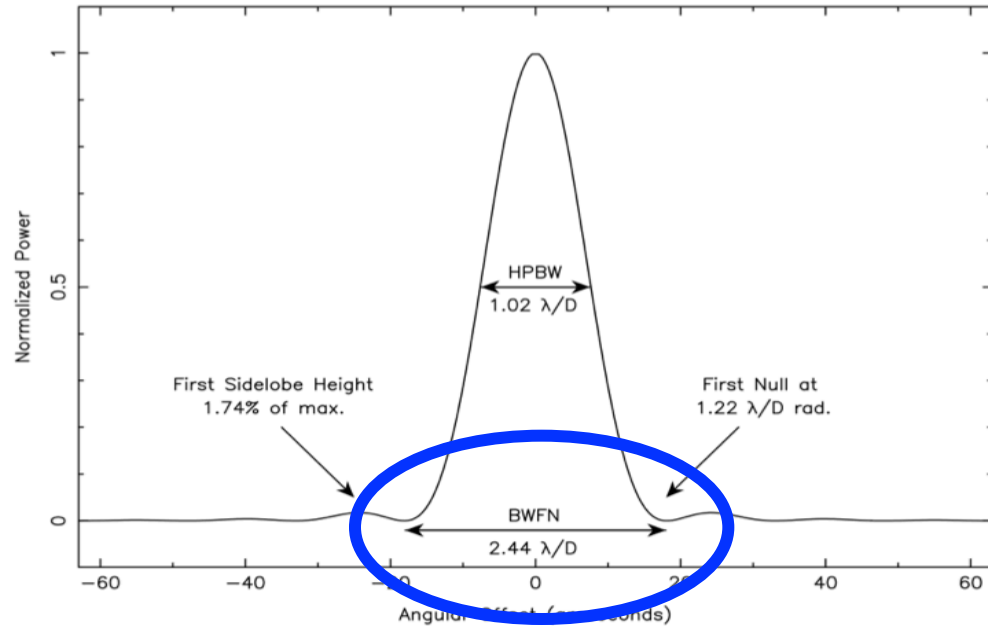


# Single-dish response

Single-dish with diameter  $D$



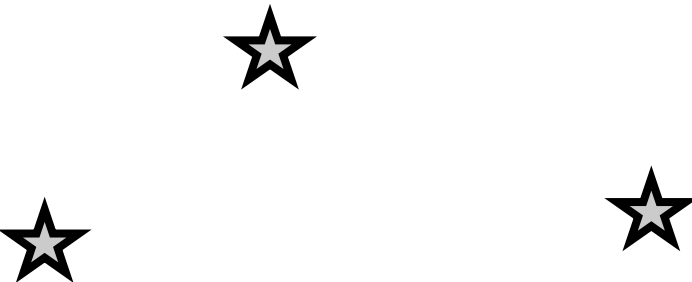
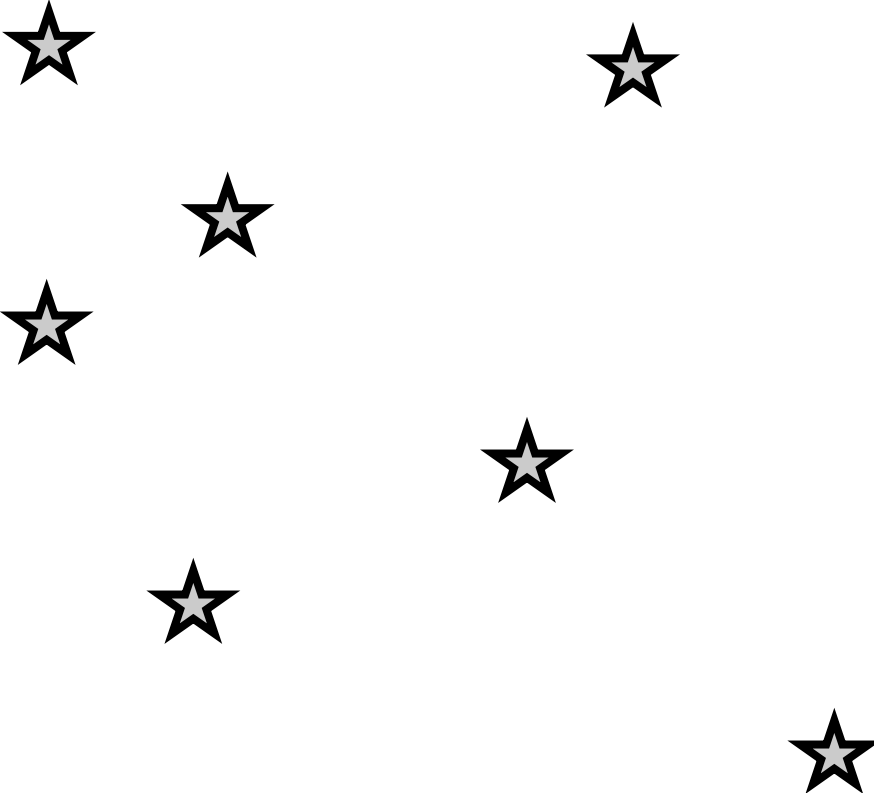
(1D) antenna power response



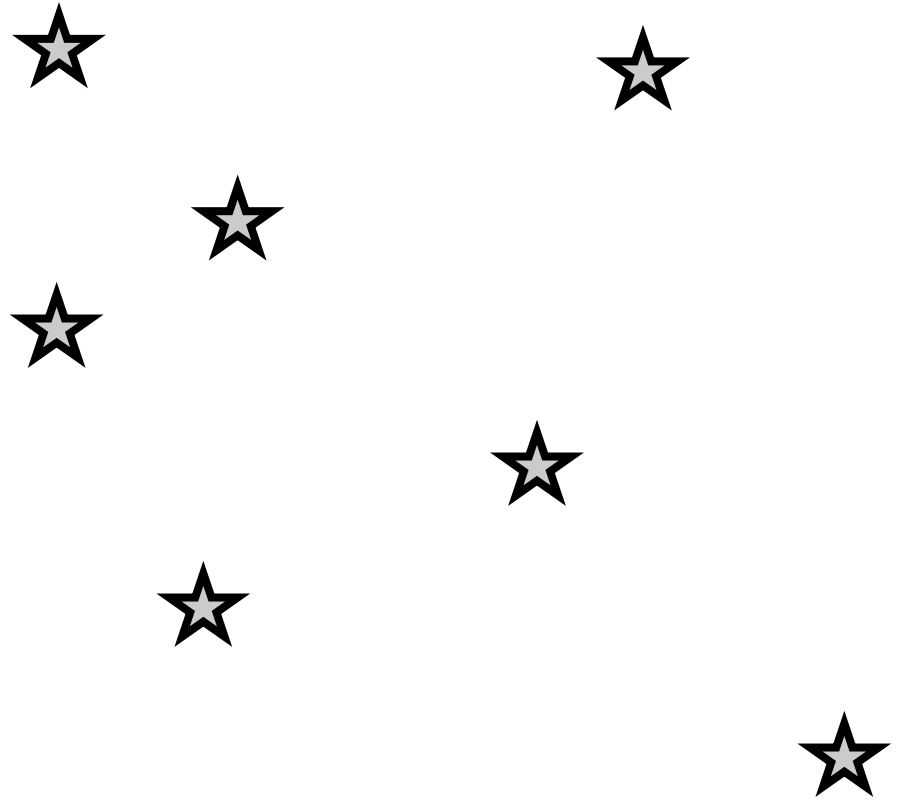
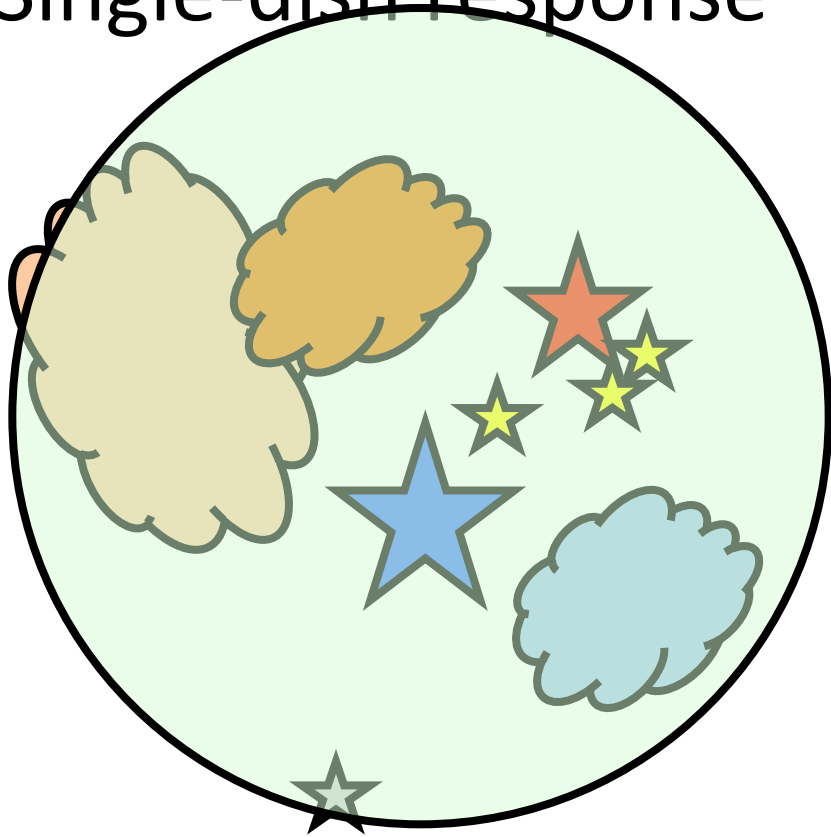
$$PB = 1.22 \frac{\lambda}{D}$$

PRIMARY BEAM

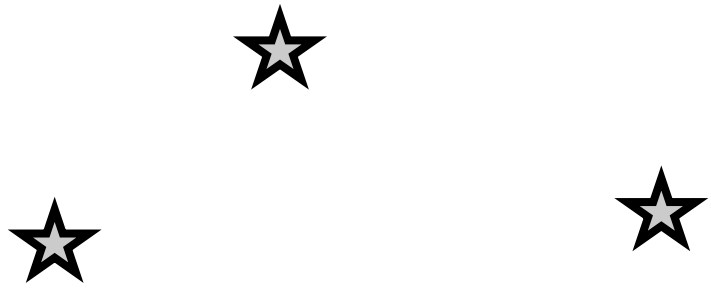
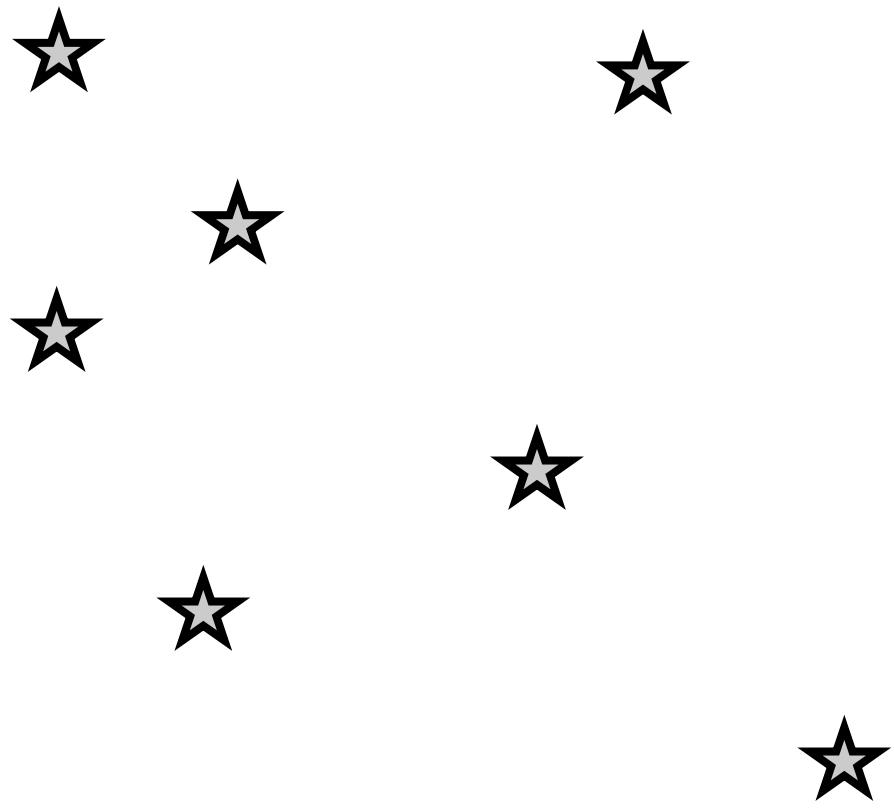
# Single-dish response



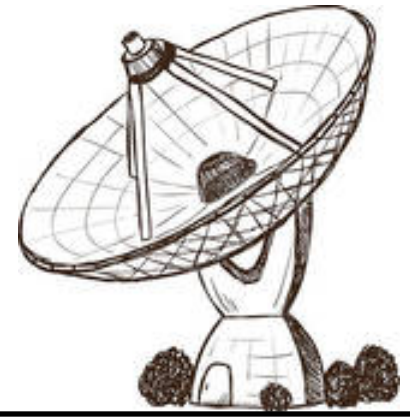
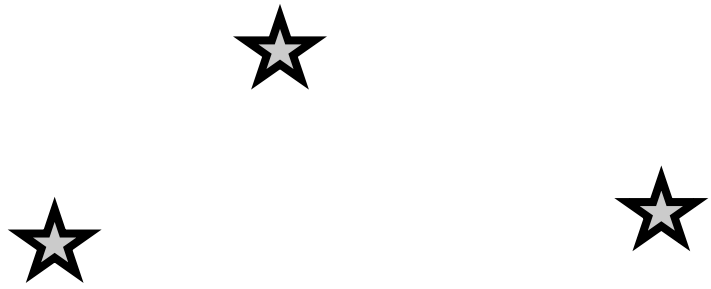
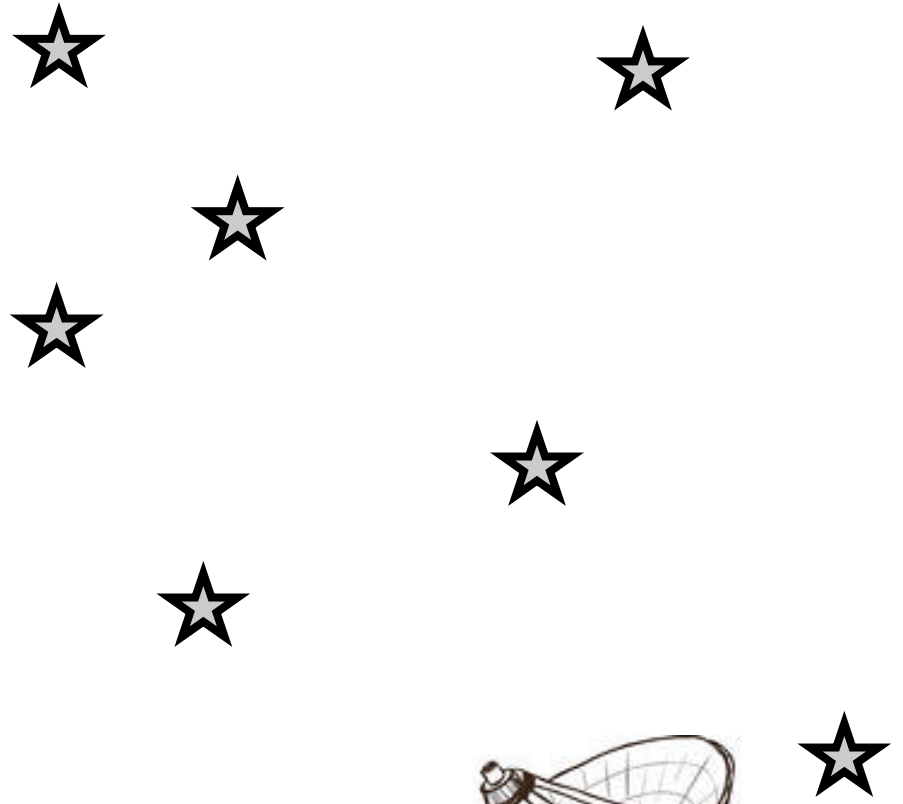
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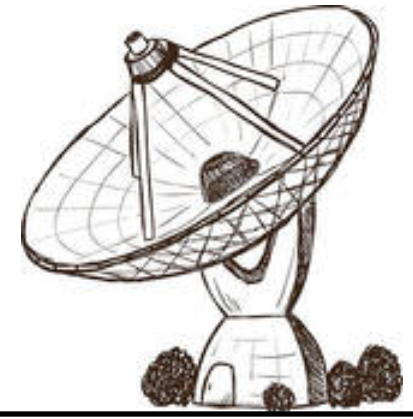
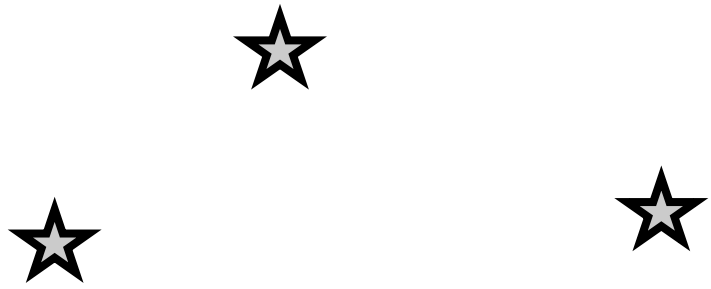
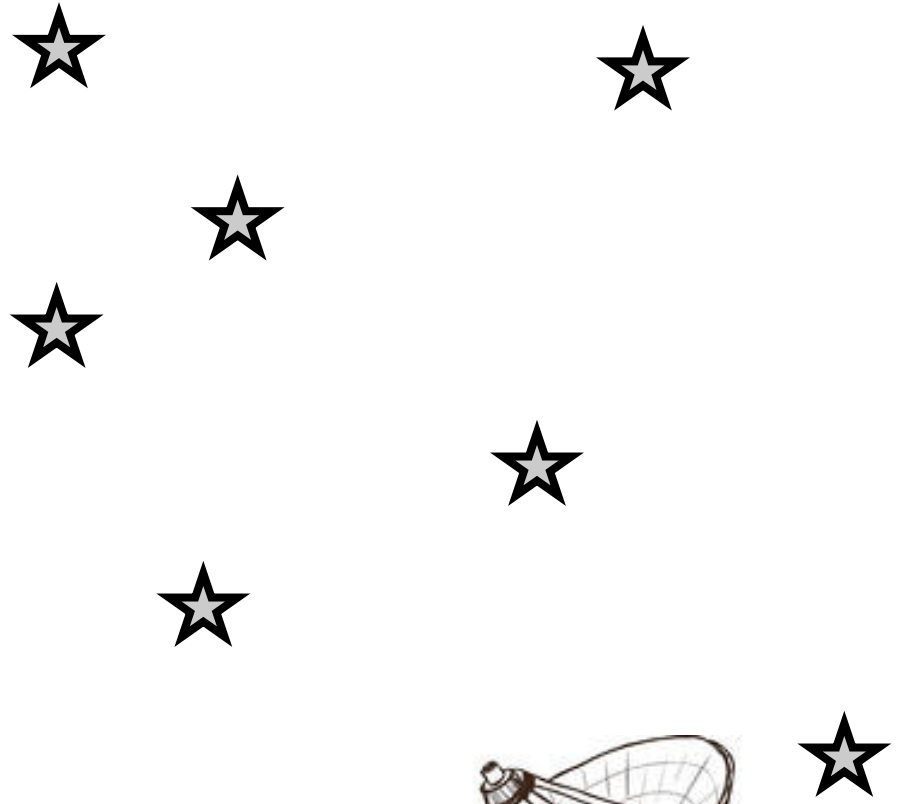
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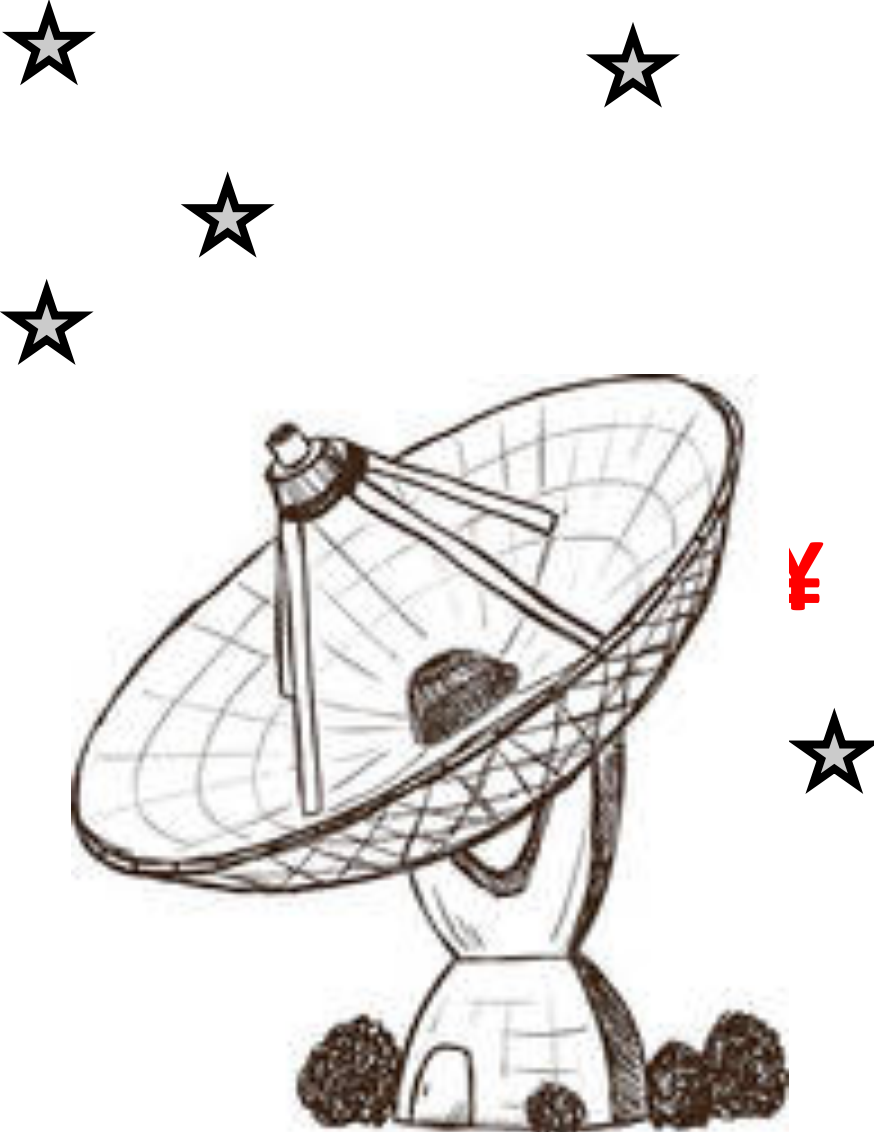


# Single-dish response

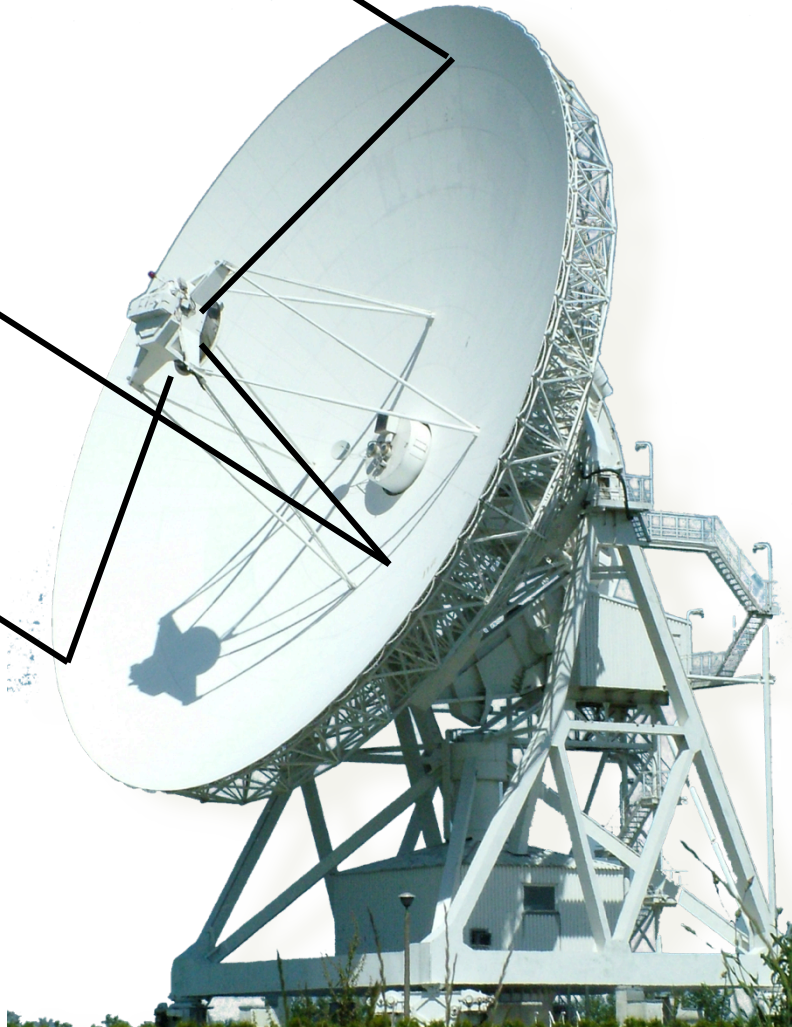




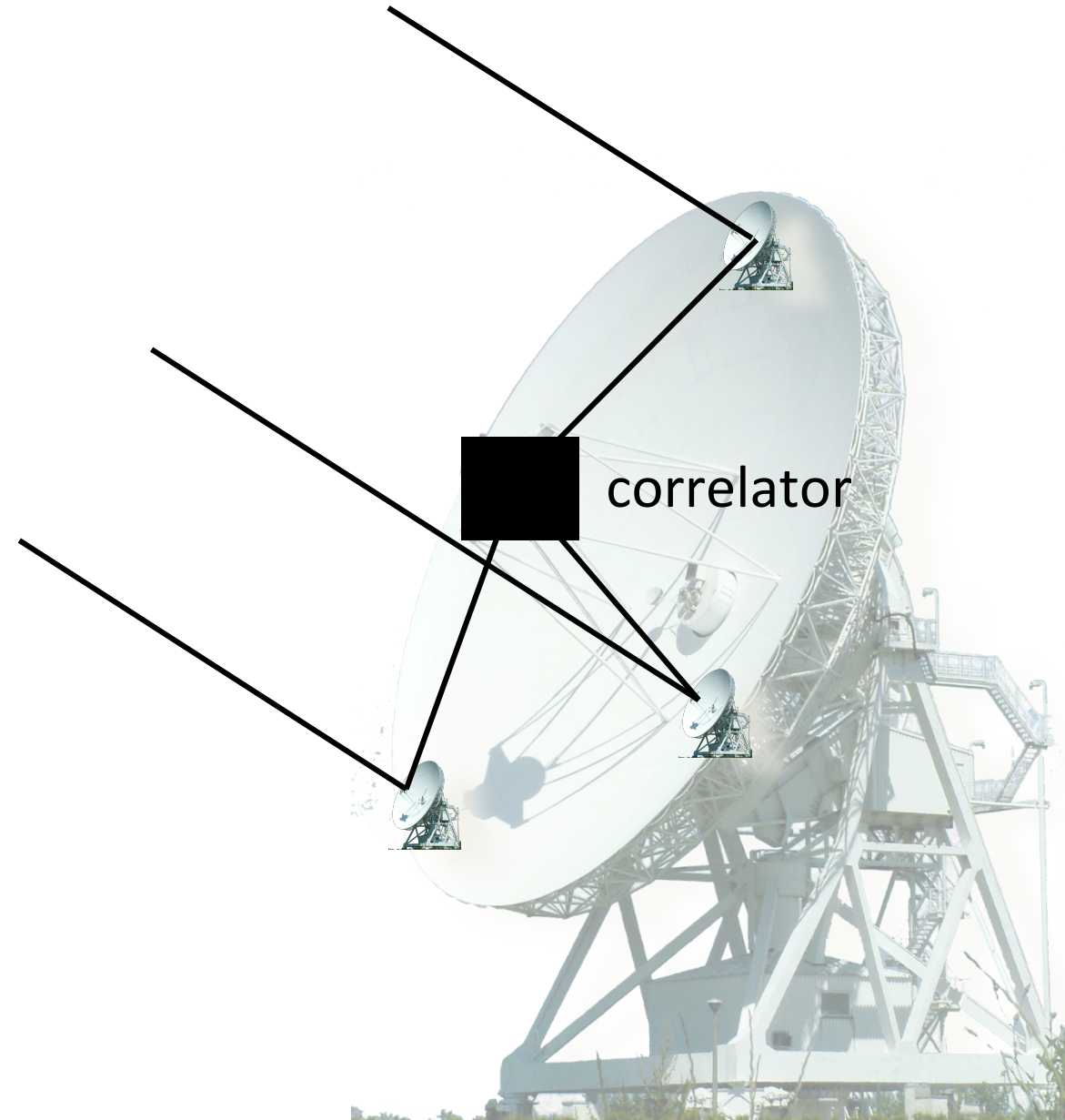
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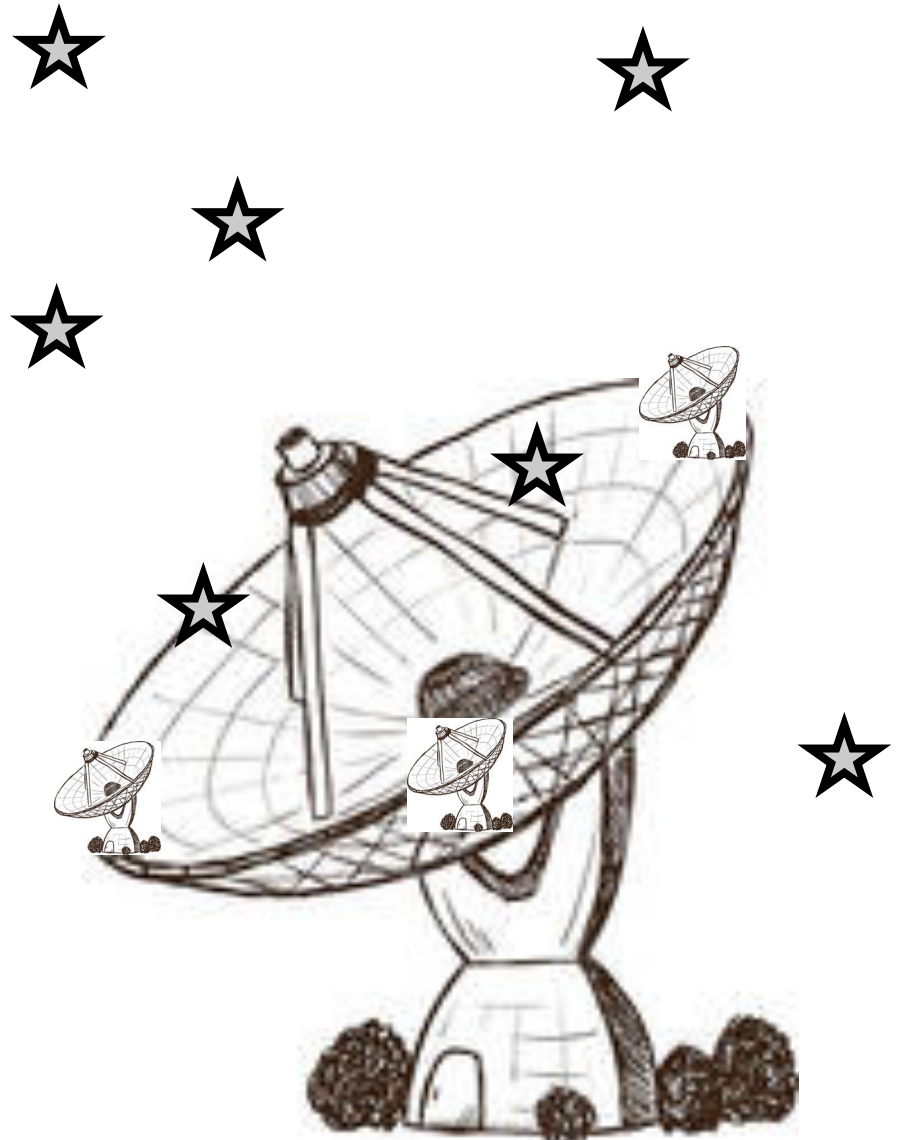
# Interferometer – multiple dishes



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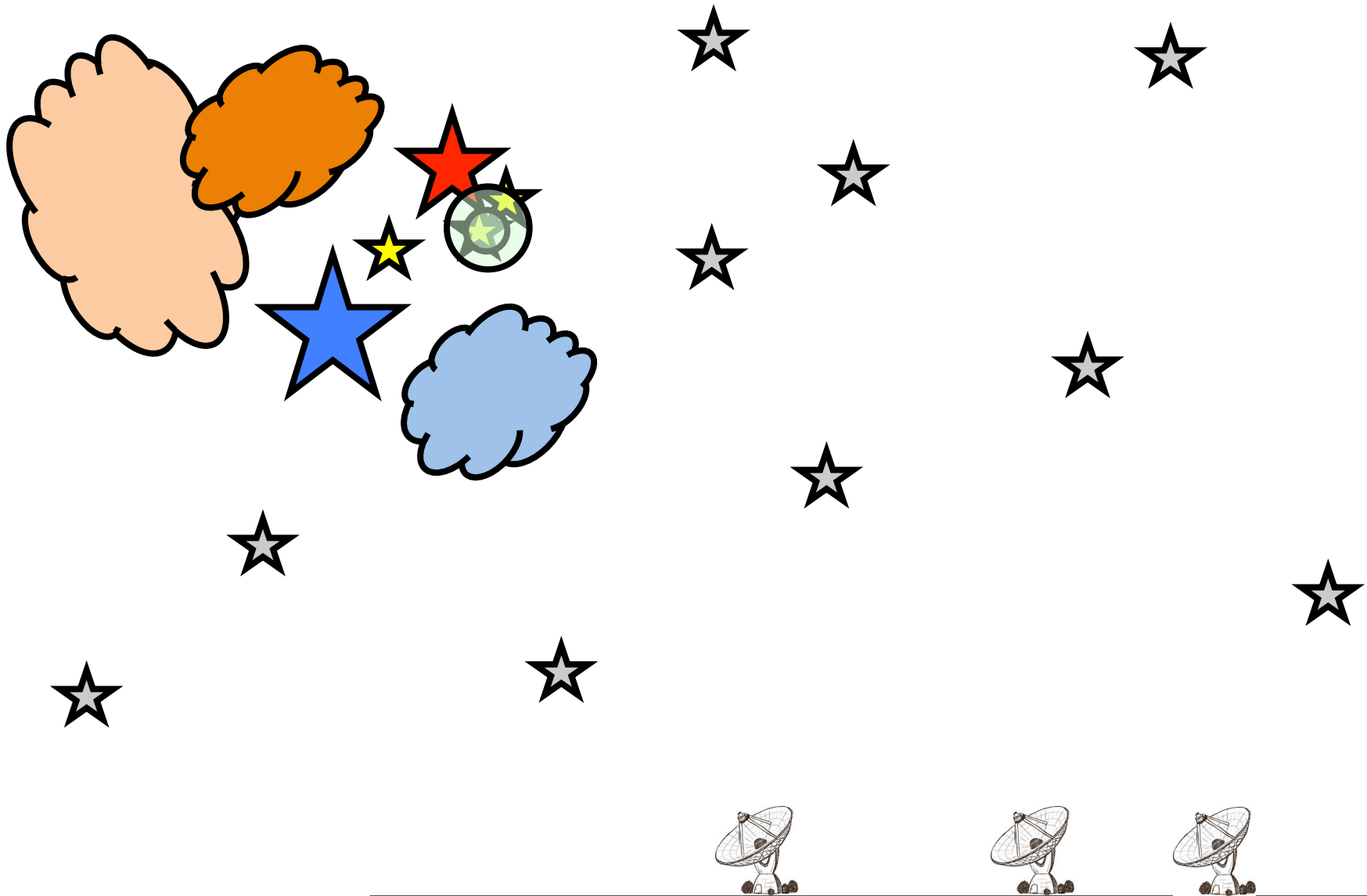
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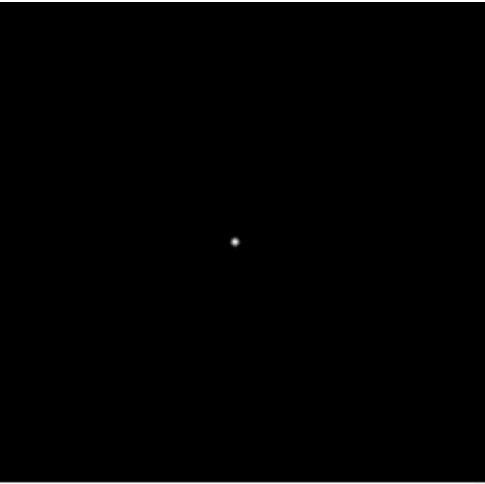


# Interferometer – multiple dishes



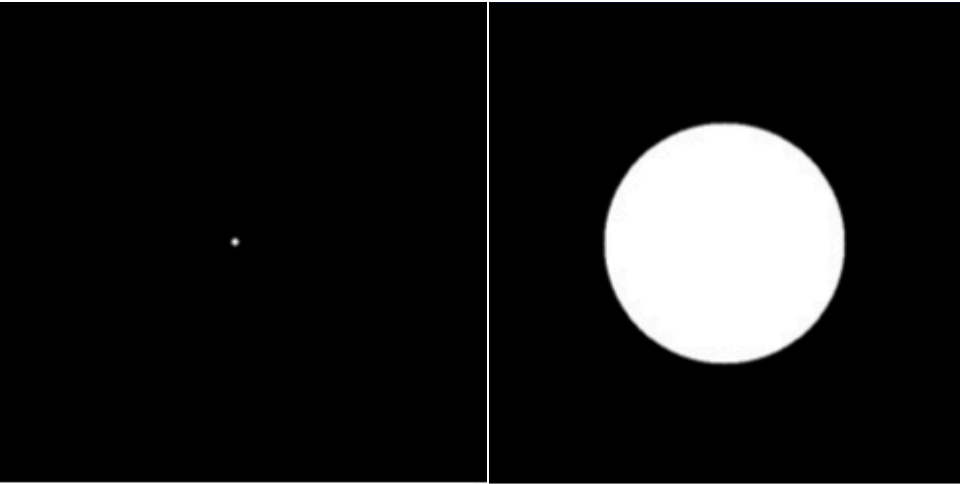
# Interferometer – multiple dishes

Small Single-Dish



# Interferometer – multiple dishes

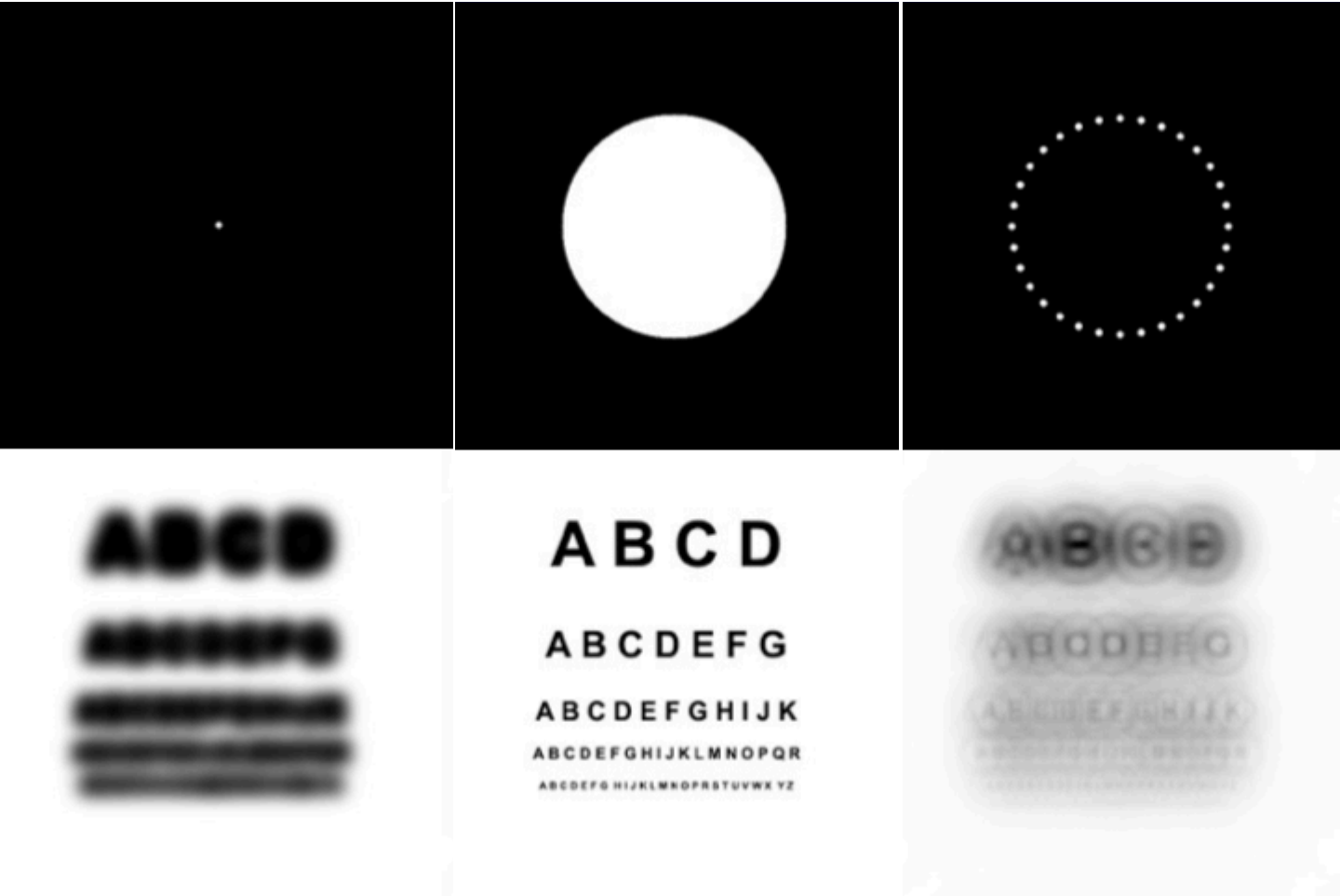
## Large Single-Dish





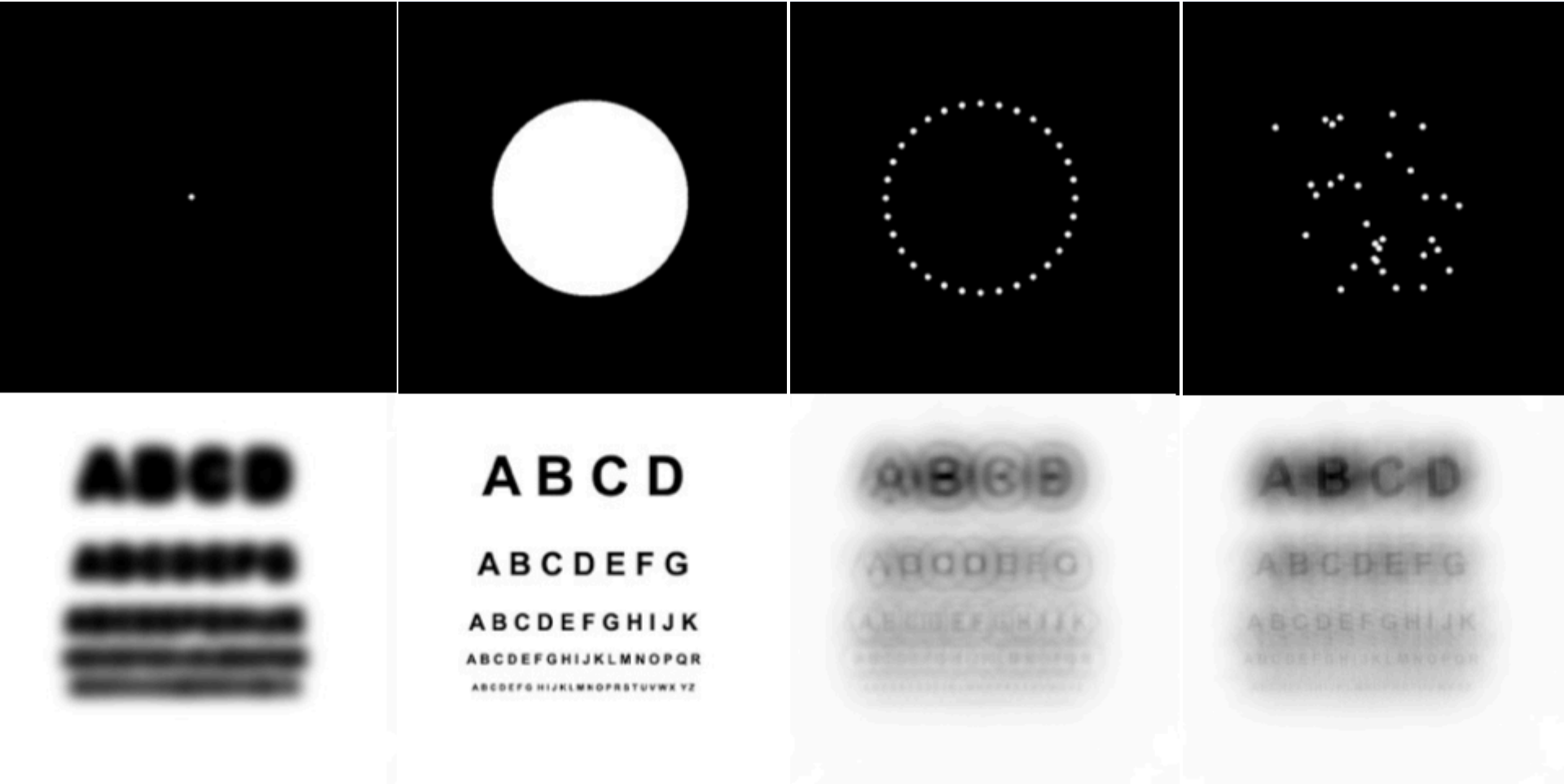
# Interferometer – multiple dishes

“Circular” dishes



# Interferometer – multiple dishes

“Random” dishes



# Interferometry – visibilities

... a bit of equations (Fourier Transform)

$$V(u, v) = \iint I(l, m) e^{2\pi i(ul+vm)} dl dm$$

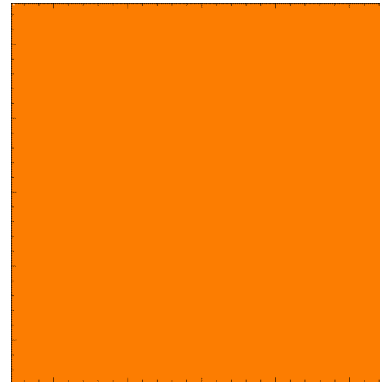
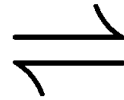
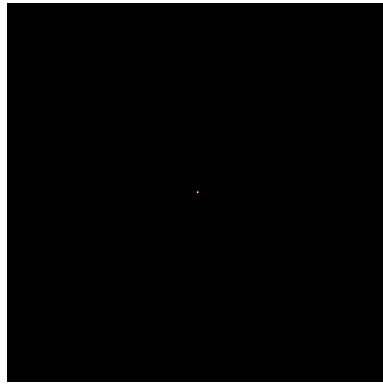
# Interferometry – visibilities

... a bit of equations (Fourier Transform)

$$V(u, v) = \int \int I(l, m) e^{2\pi i(ul + vm)} dl dm$$

$I(l, m)$

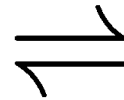
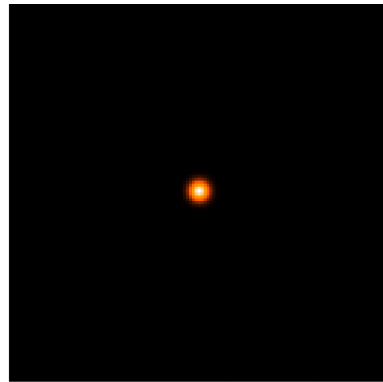
$\delta$  Function



$V(u, v)$

Constant

Gaussian



Gaussian

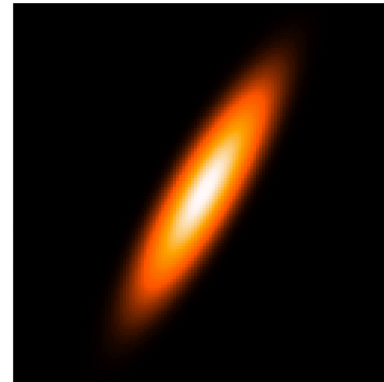
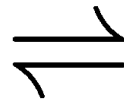
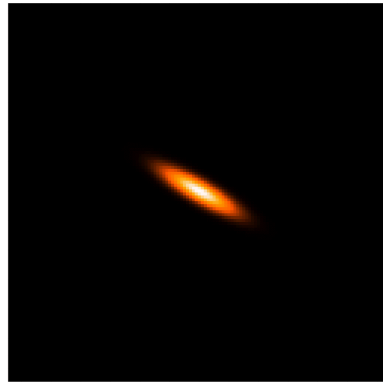
# Interferometry – visibilities

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$$V(u, v) = \iint I(l, m) e^{2\pi i(ul + vm)} dl dm$$

$I(l, m)$

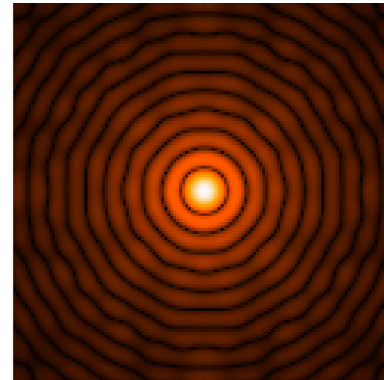
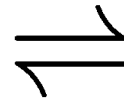
elliptical  
Gaussian



$V(u, v)$

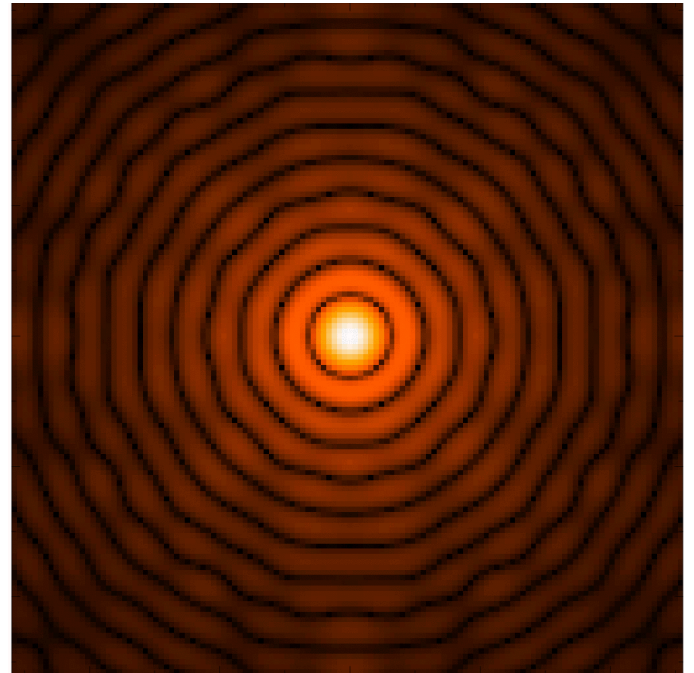
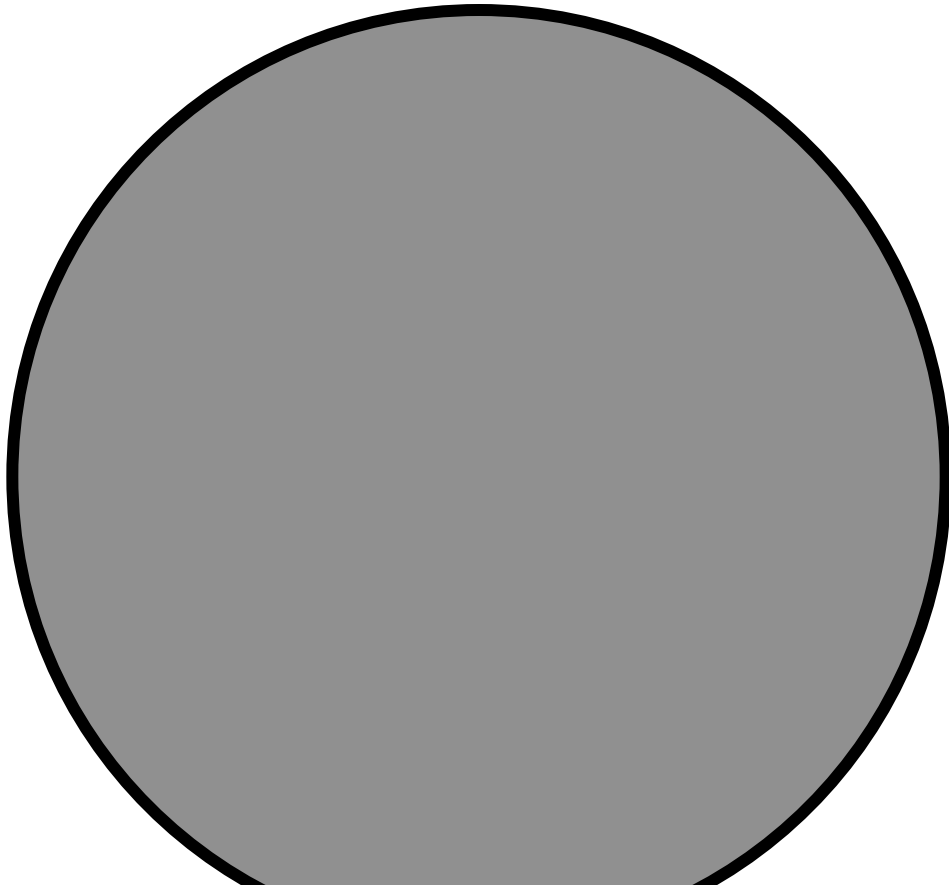
elliptical  
Gaussian

Disk

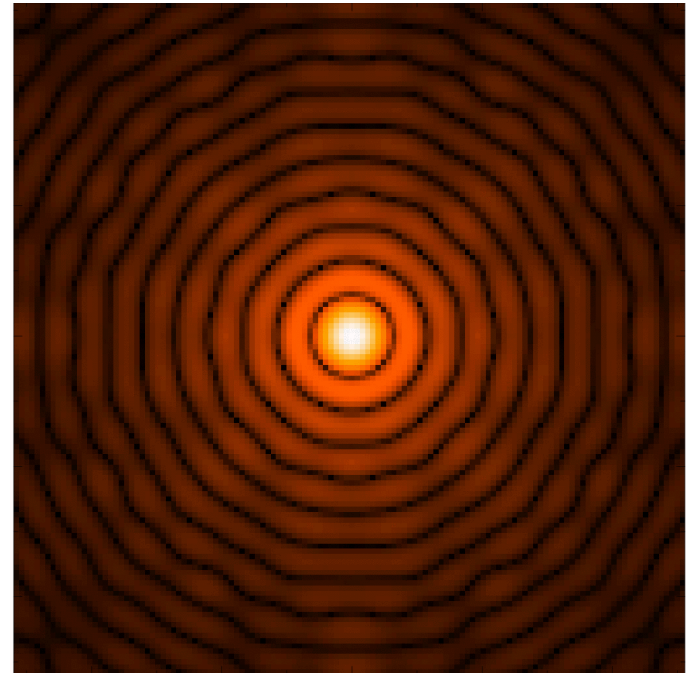
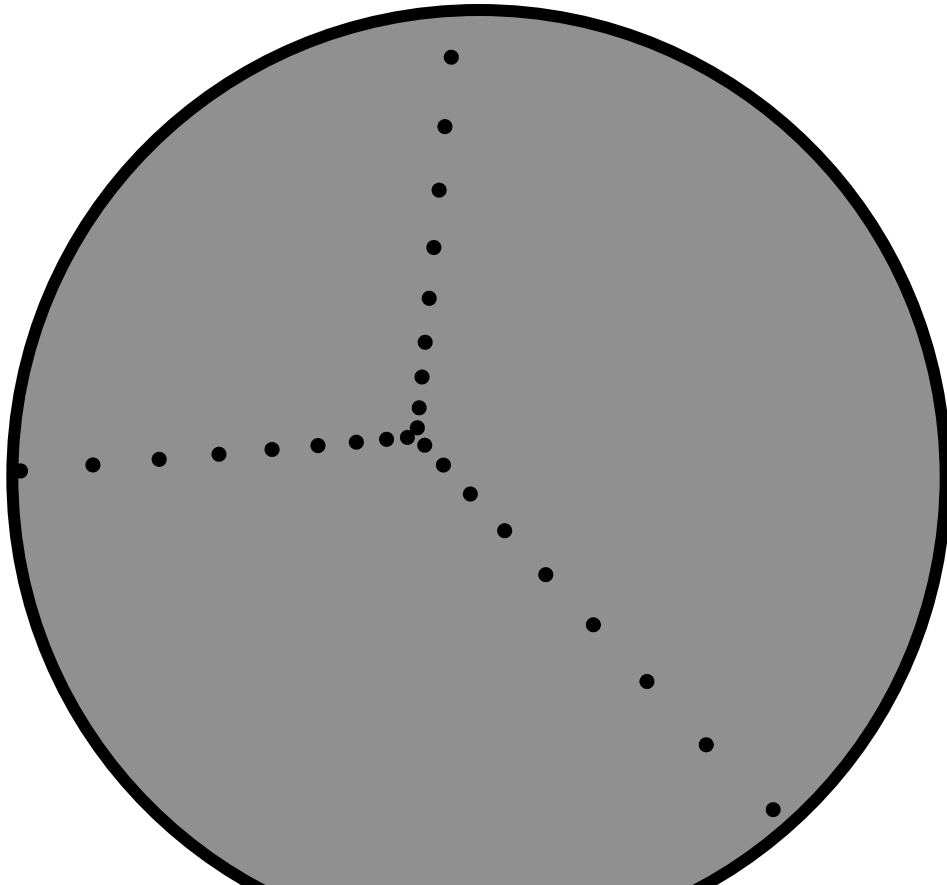


Bessel

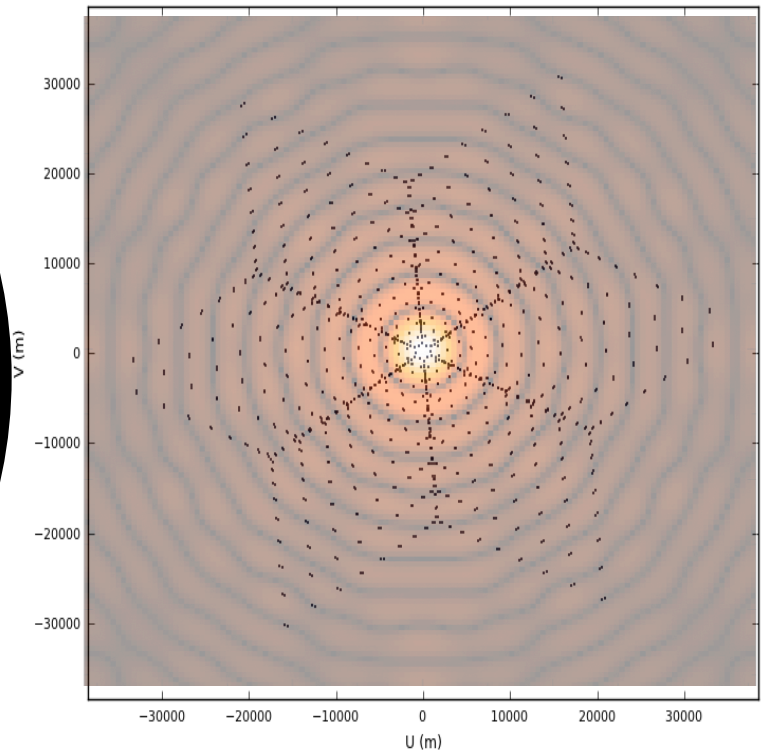
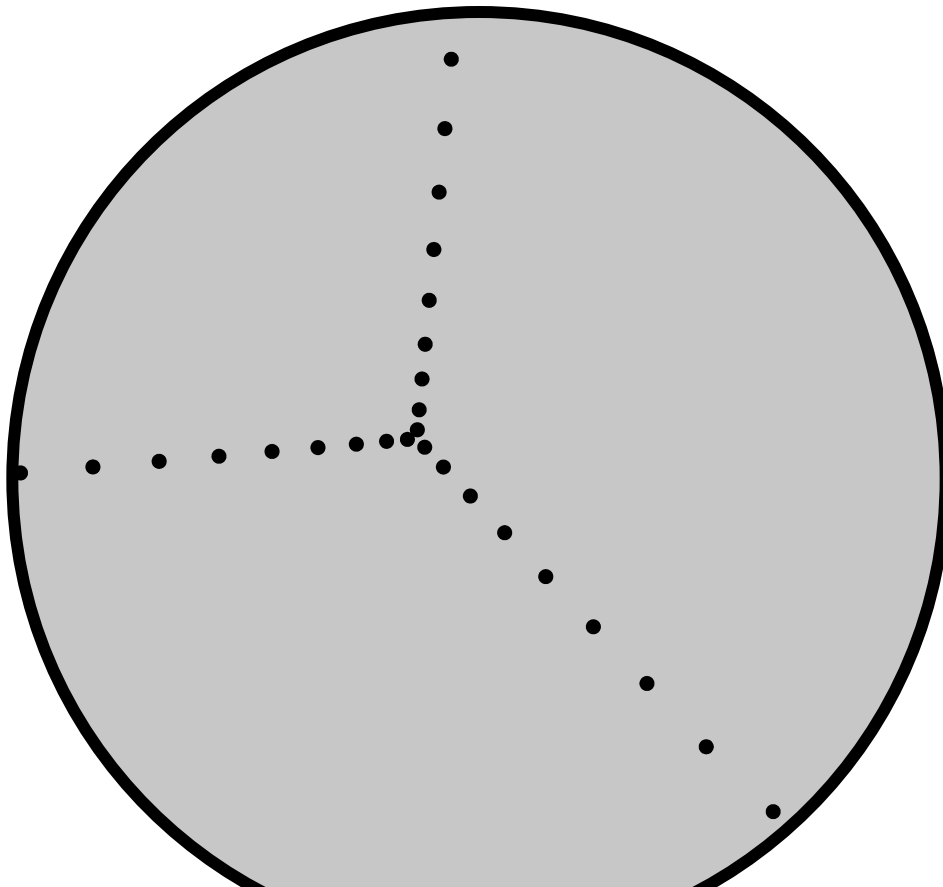
# Interferometry – spatial filters



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# Interferometry – spatial filters



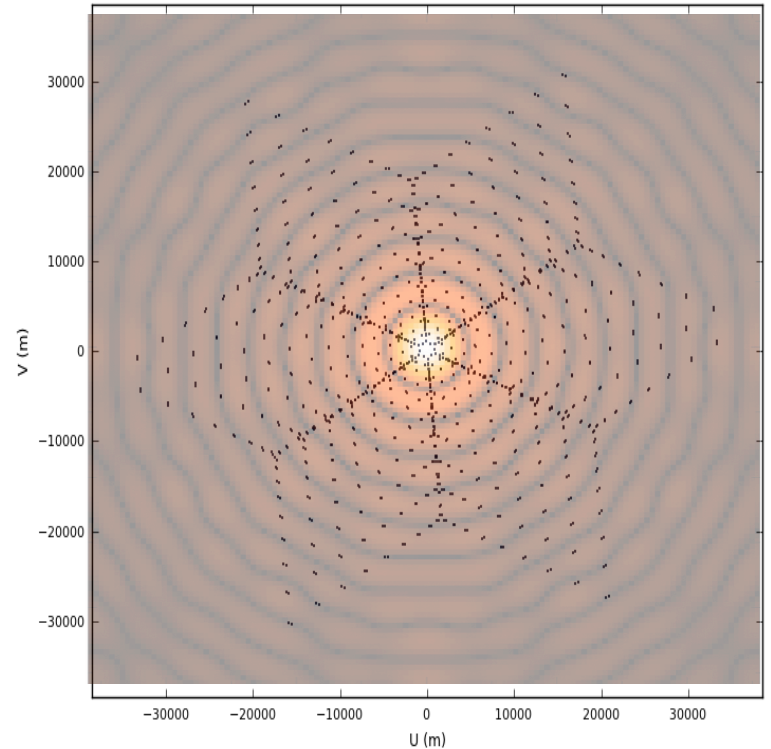
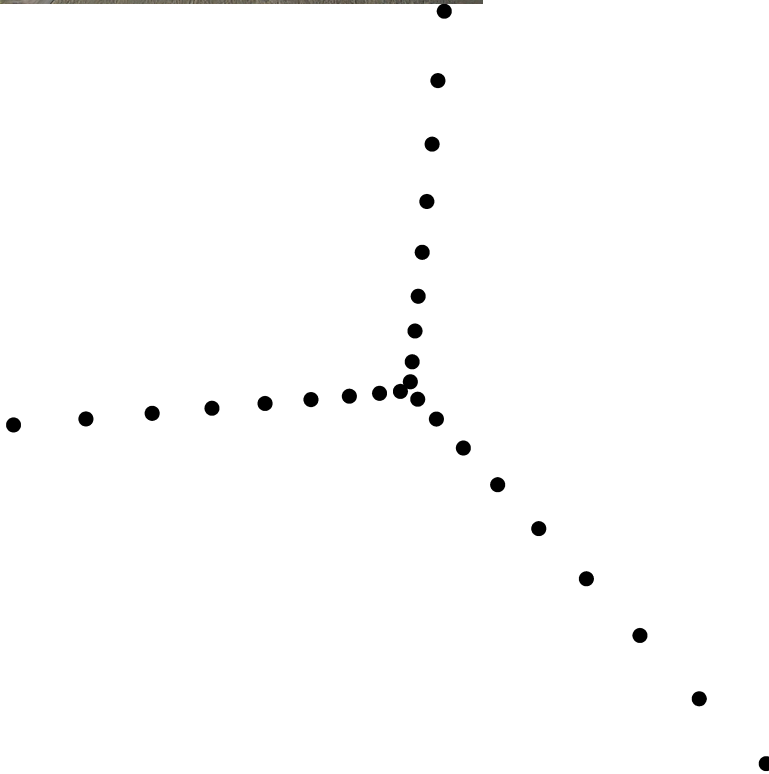


# Example: VLA



## Very Large Array (VLA)

- 27 antennas of 25 meters (diameter)
- observing from cm to mm wavelengths
- in New Mexico (USA)



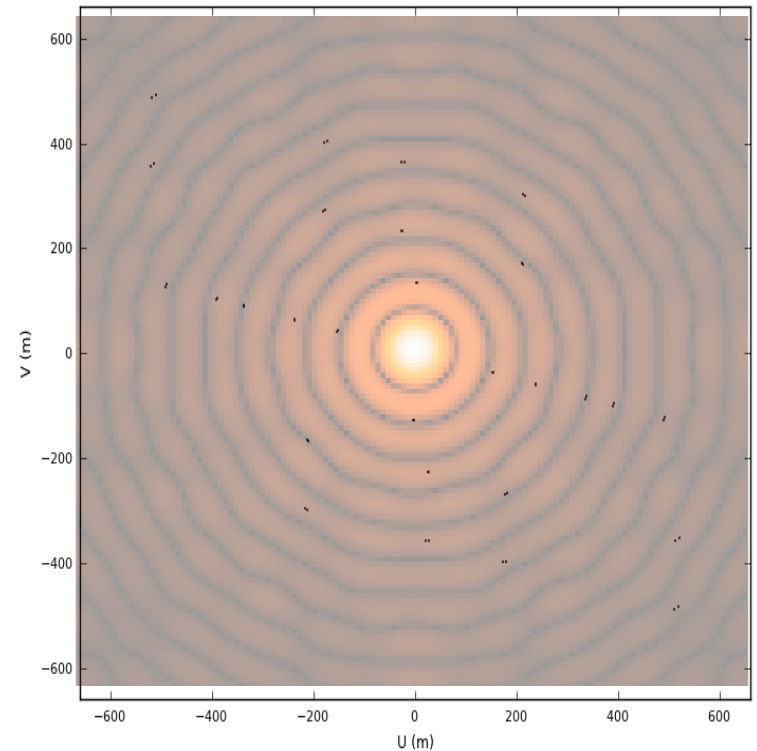
# Example: PdBI



## Plateau de Bure Interferometer (PdBI)

- 6 antennas of 15 meters (diameter)
- observing from mm to submm
- in Grenoble (France)

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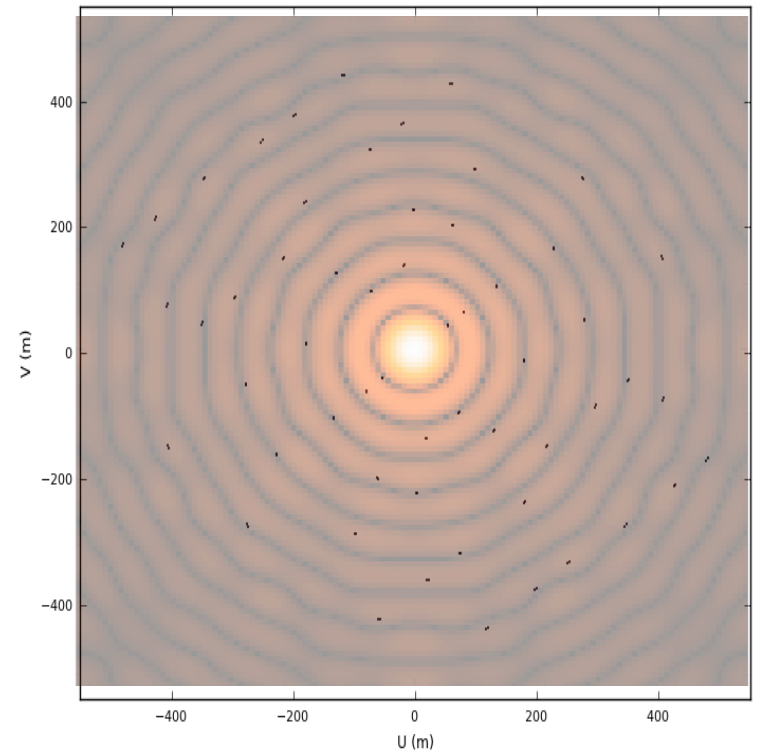
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# Example: SMA



## SubMillimeter Array (SMA)

- 8 antennas of 6 meters (diameter)
- observing from mm to submm
- in Hawaii (USA)

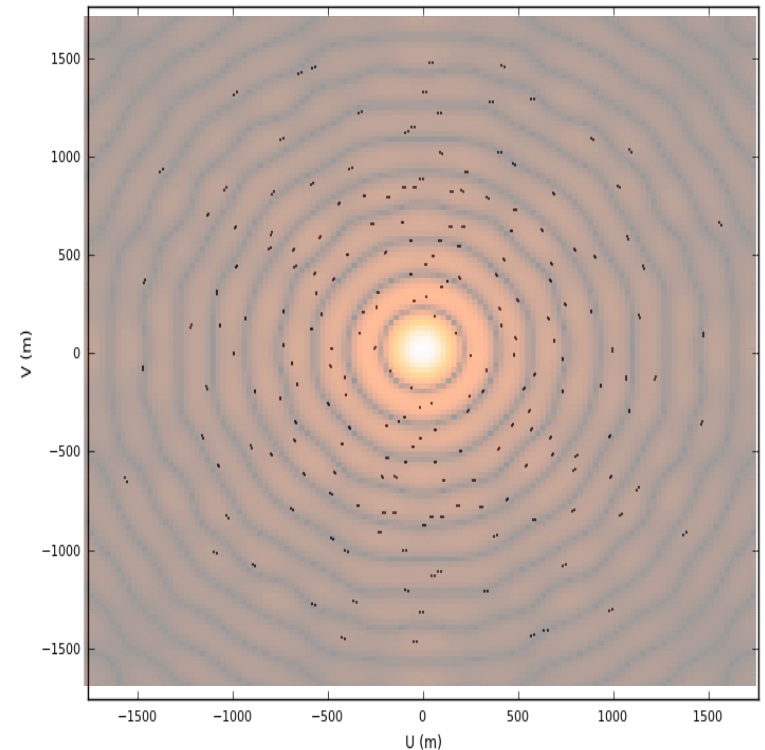


# Example: CARMA



## Combined Array for Research in mm Astro (CARMA)

- 23 antennas of 10.4/6.1/3.5 meters
- observing from cm to mm wavelengths
- in California (USA)

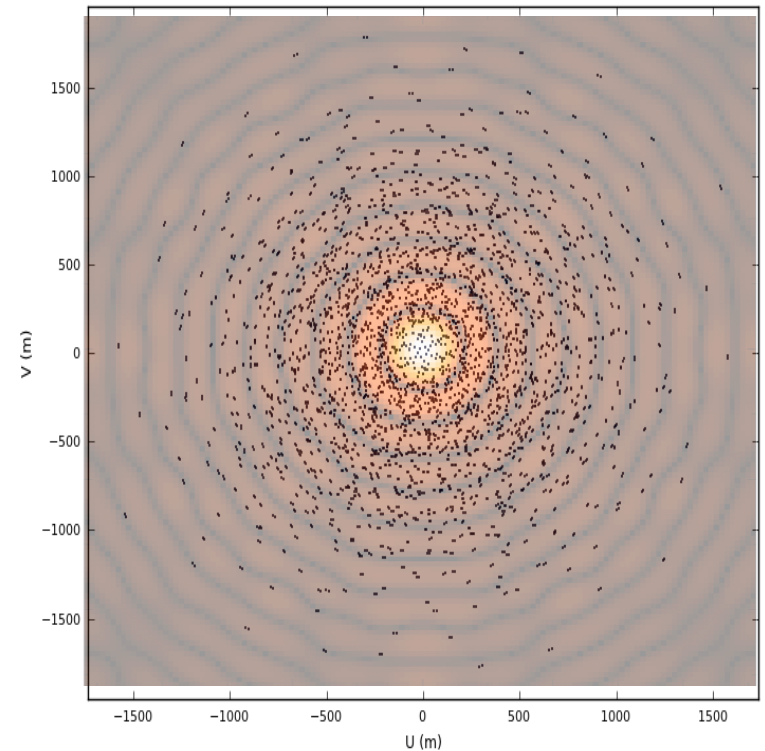
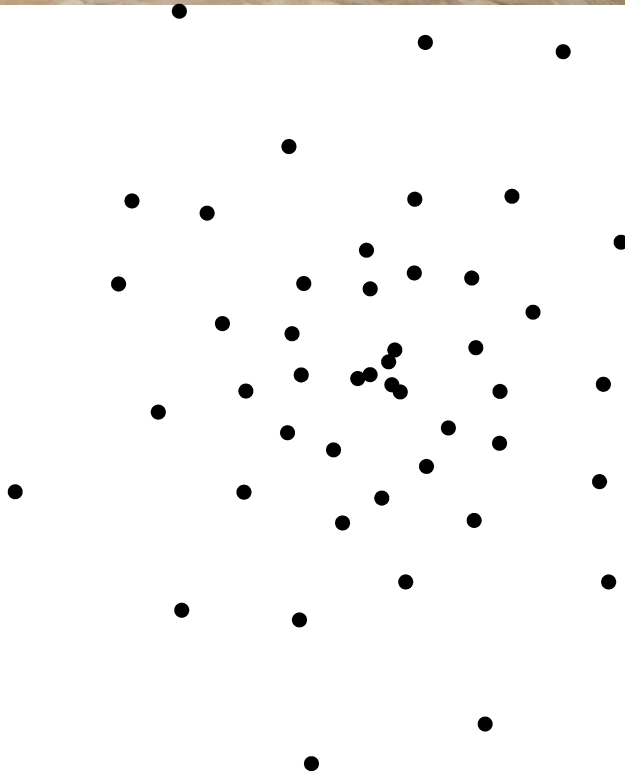


# Example: ALMA



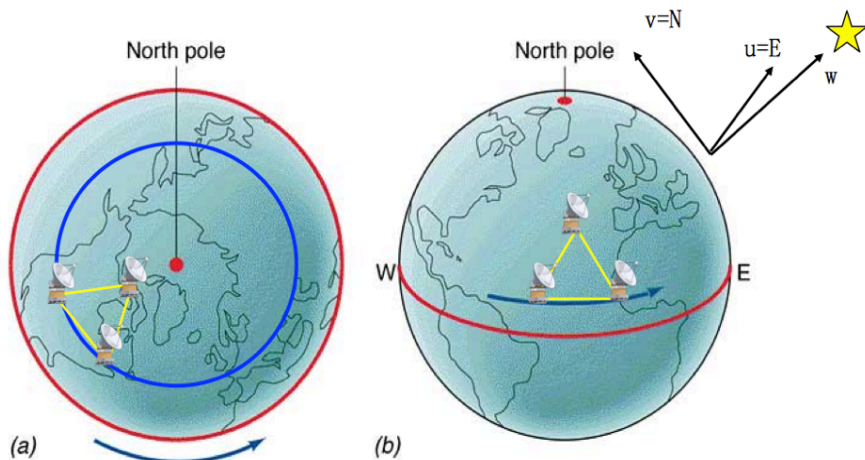
## Atacama Large mm/submm Array (ALMA)

- 50 antennas of 12/7 meters
- observing from mm to submm
- in Llano Chajnantor (Chile)

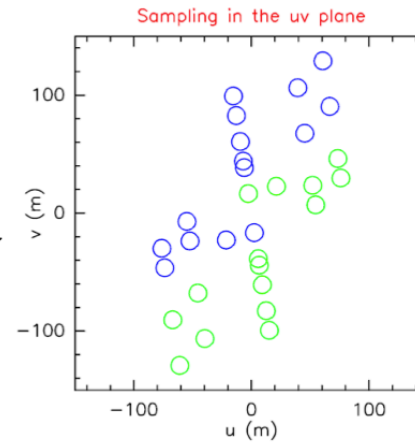


# Interferometry – snapshots vs Earth rotation

physical distance between antennas is **constant**



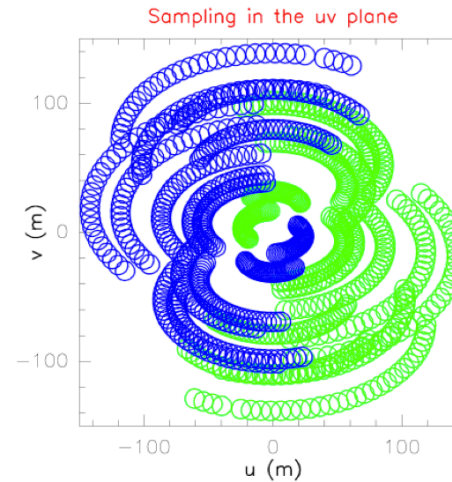
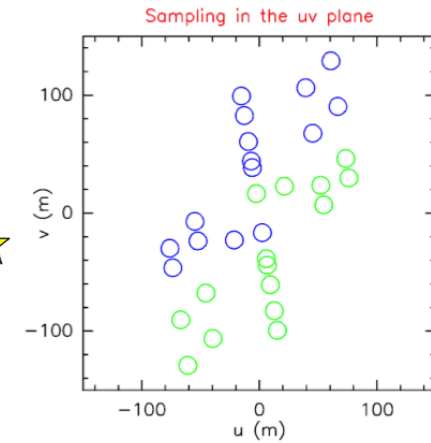
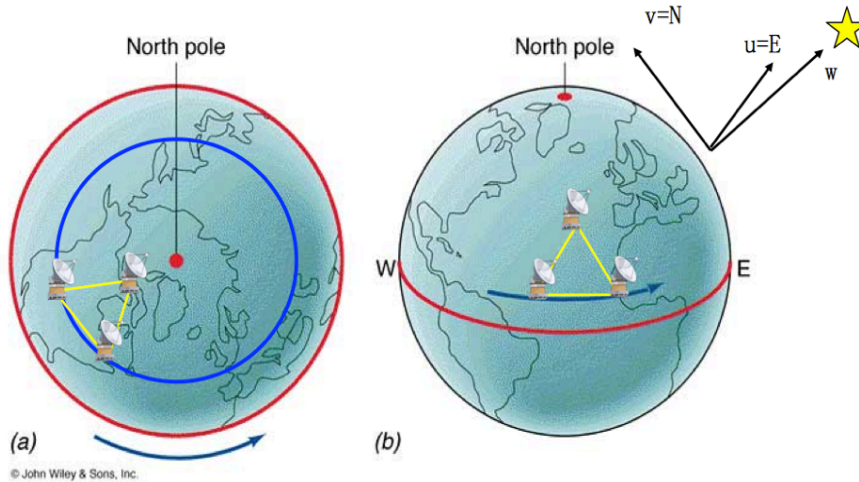
© John Wiley & Sons, Inc.



# Interferometry – snapshots vs Earth rotation

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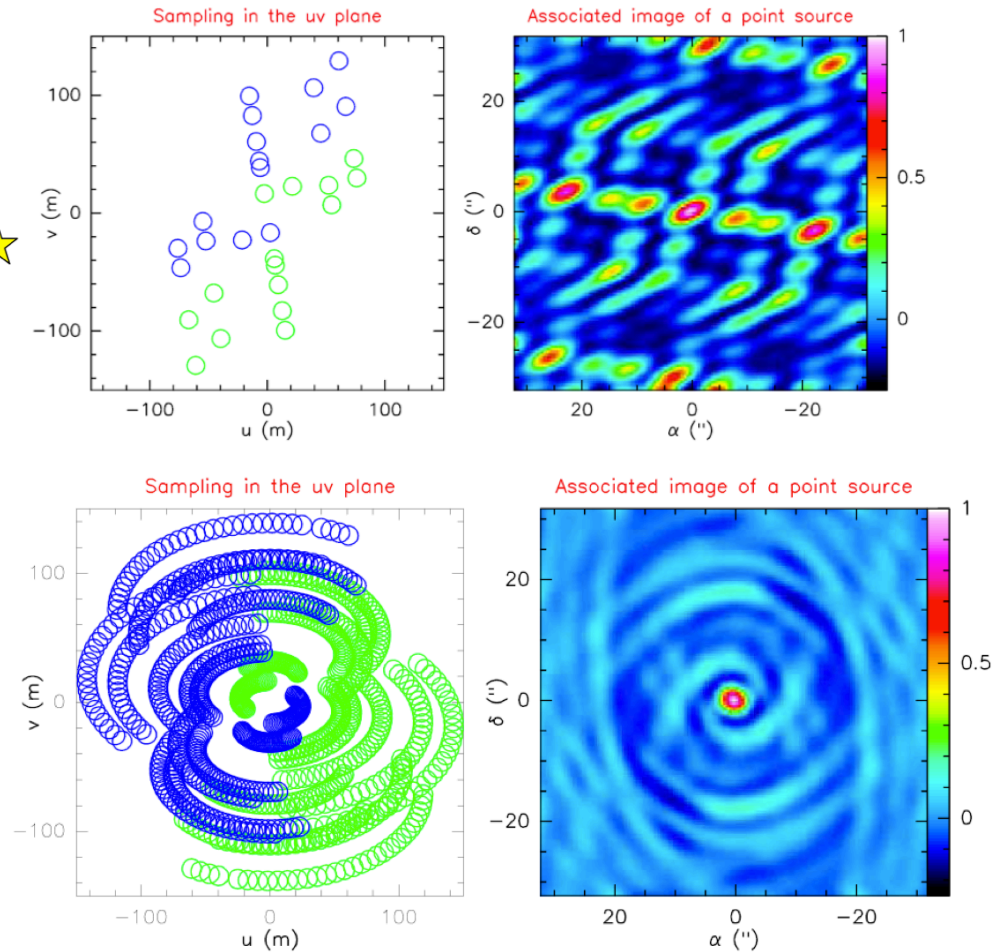
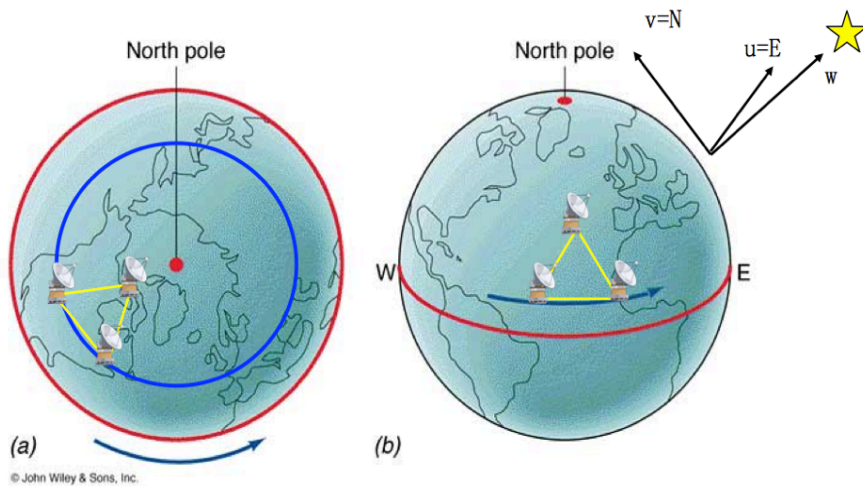
with Earth rotation, projected distances [altitude, azimuth] are **NOT constant**



# Interferometry – snapshots vs Earth rotation

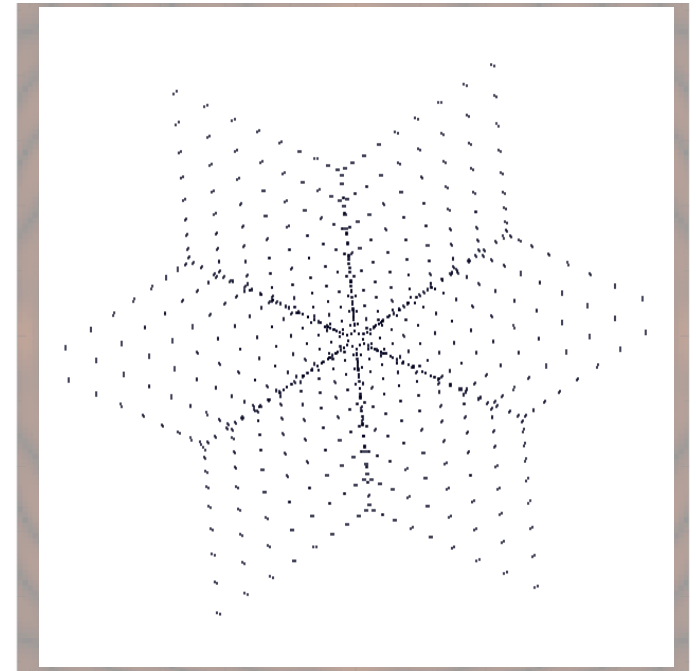
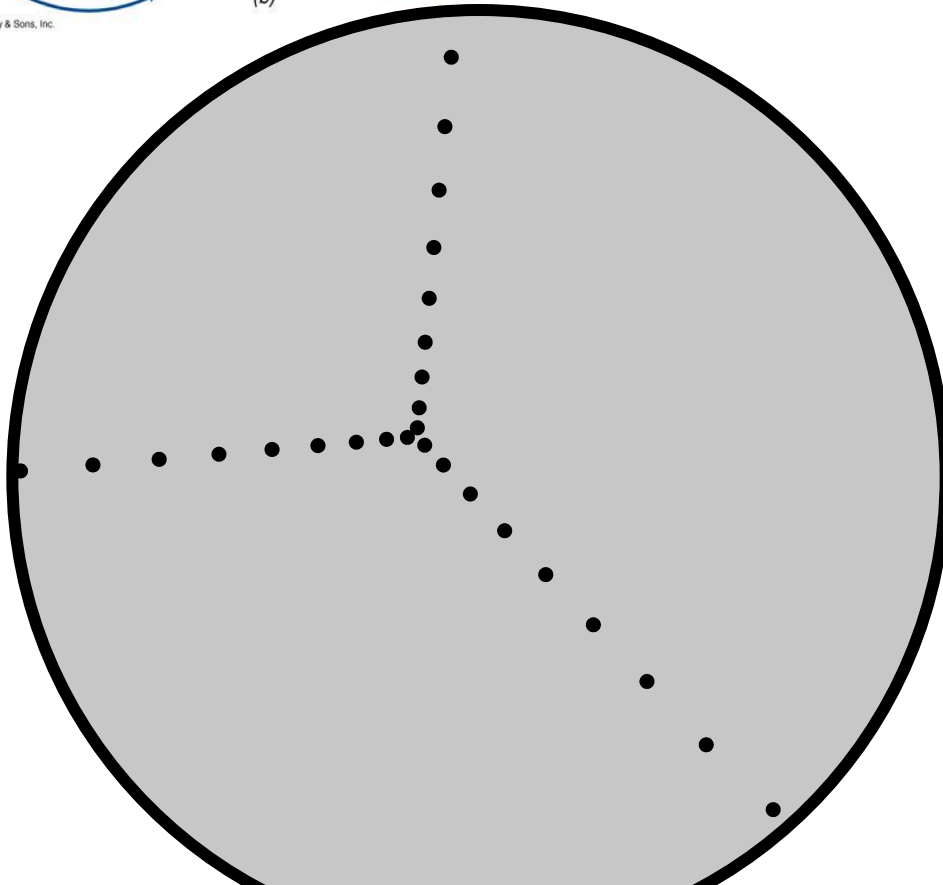
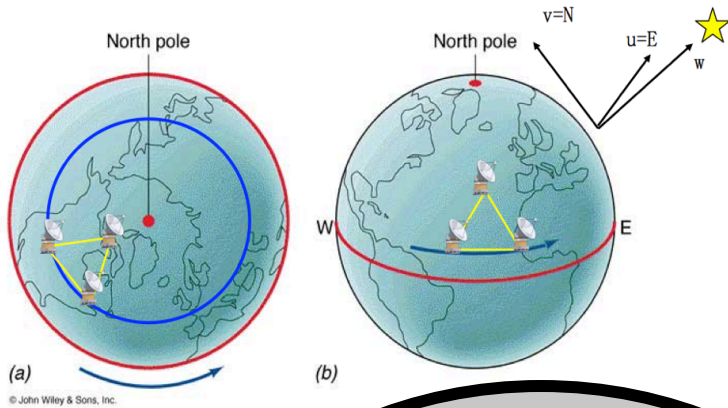
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with Earth rotation, projected distances [altitude, azimuth] are **NOT constant**

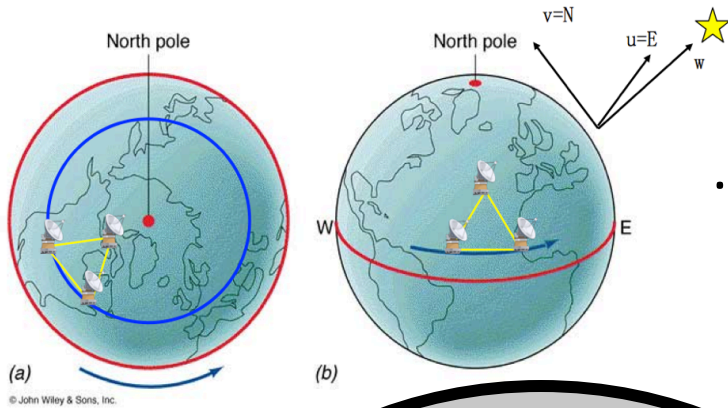




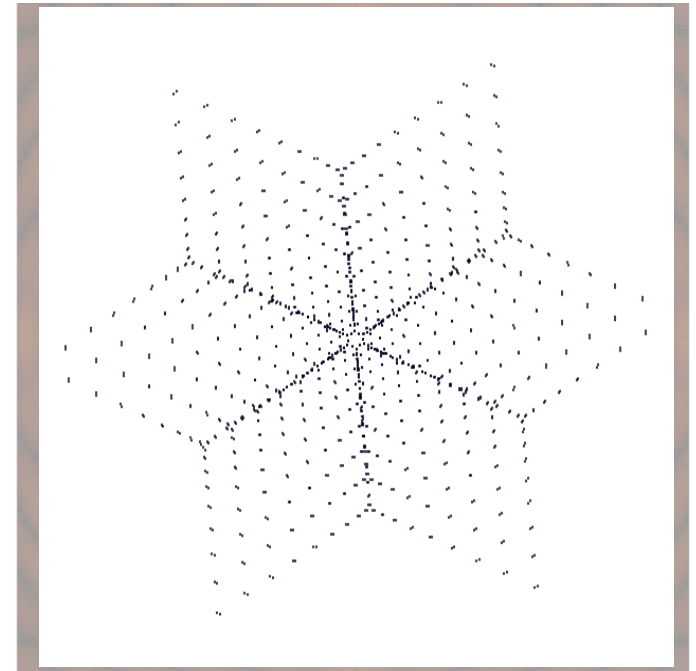
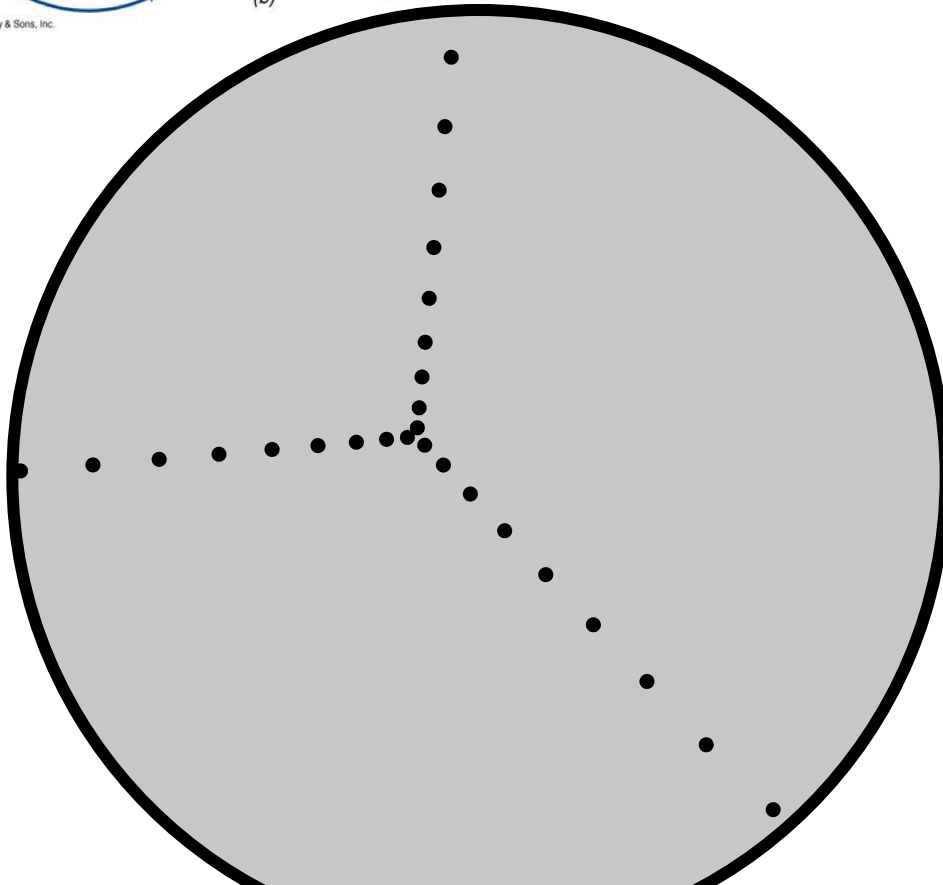
# Interferometry – snapshots vs Earth rotation



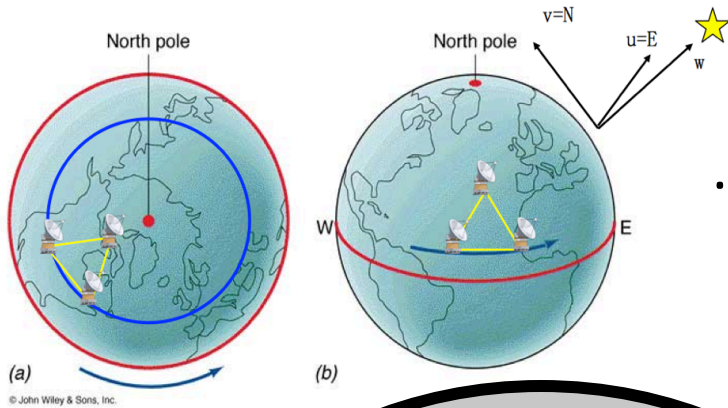
# Interferometry – snapshots vs Earth rotation



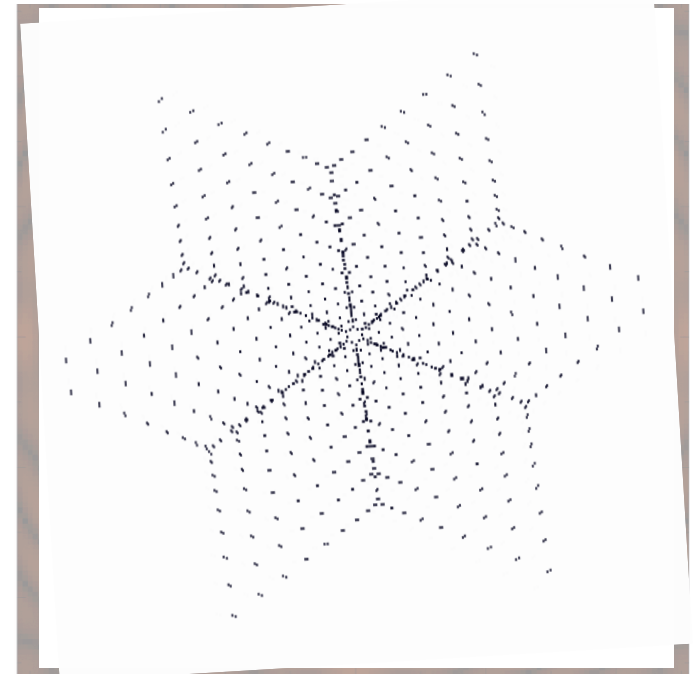
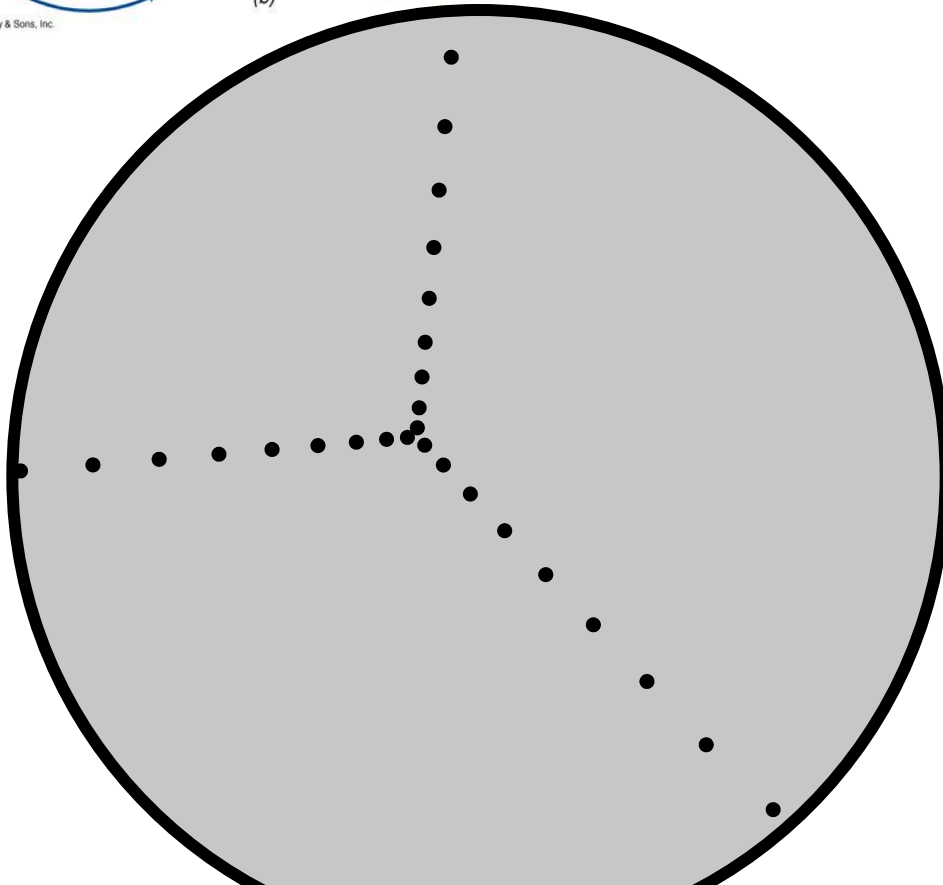
... we can just wait for the Earth to rotate



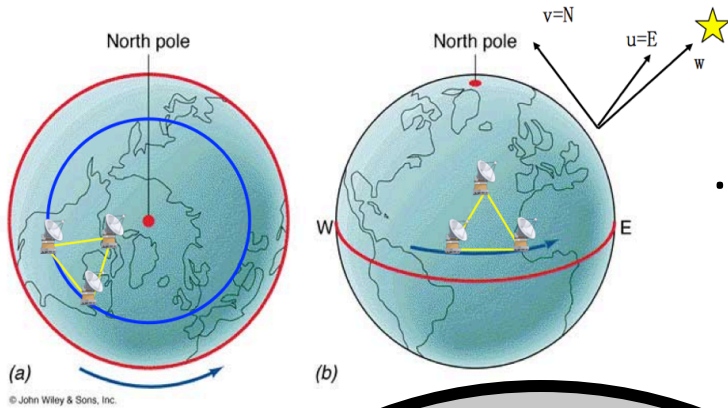
# Interferometry – snapshots vs Earth rotation



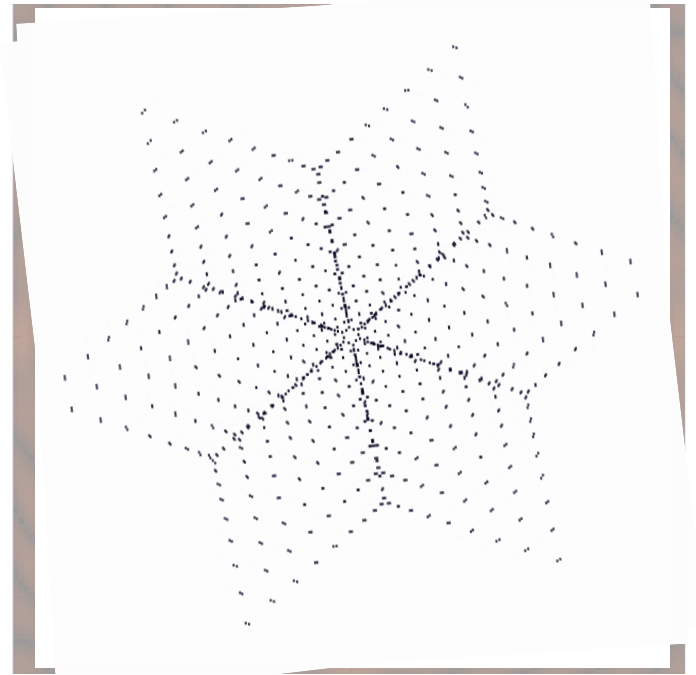
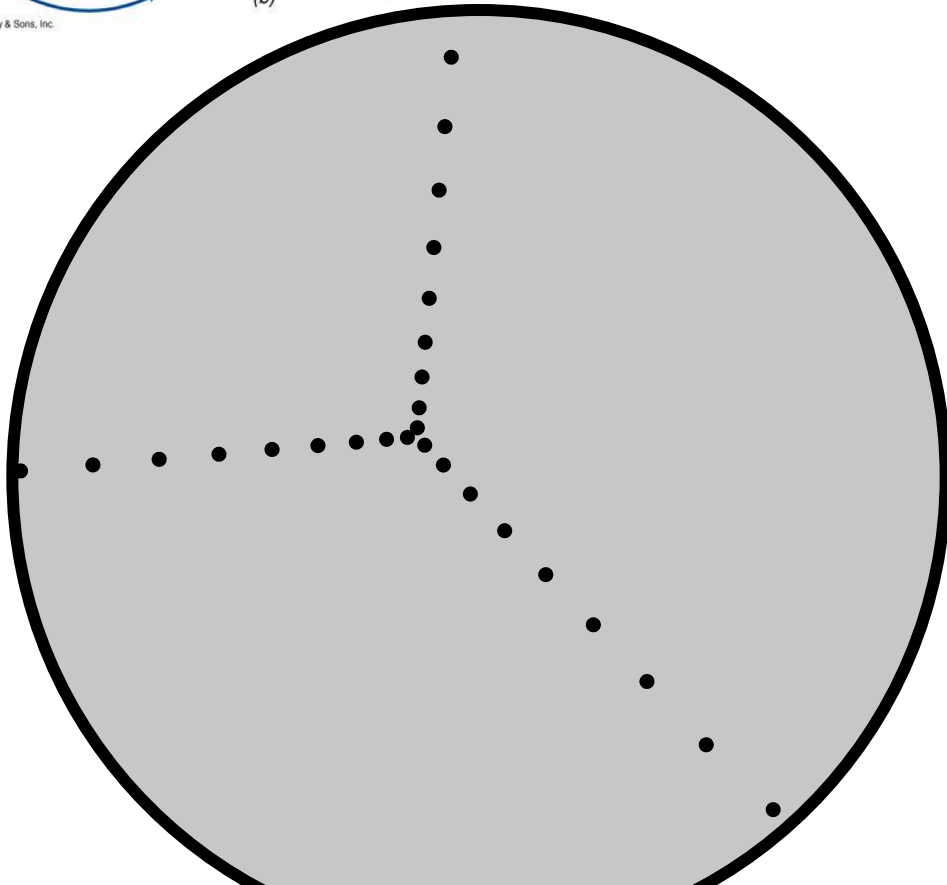
... we can just wait for the Earth to rotate



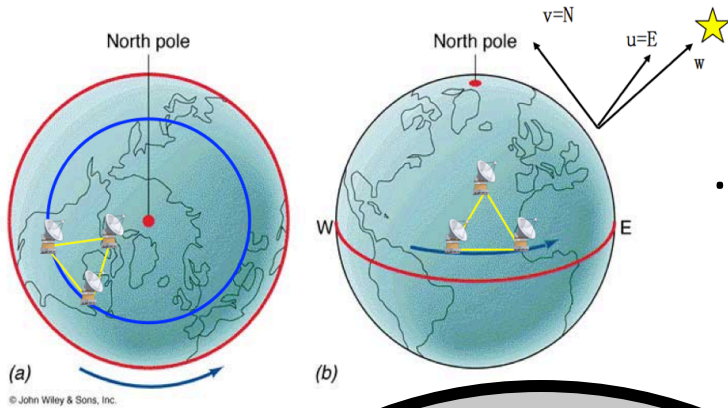
# Interferometry – snapshots vs Earth rotation



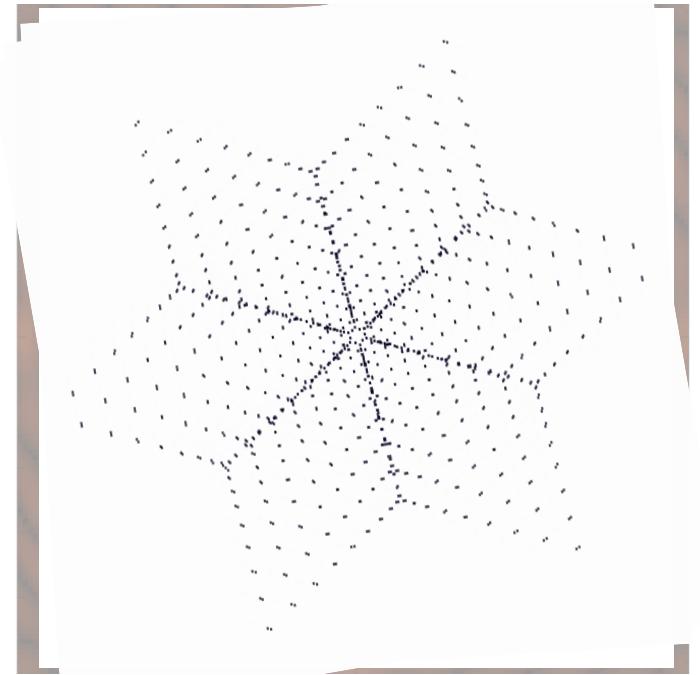
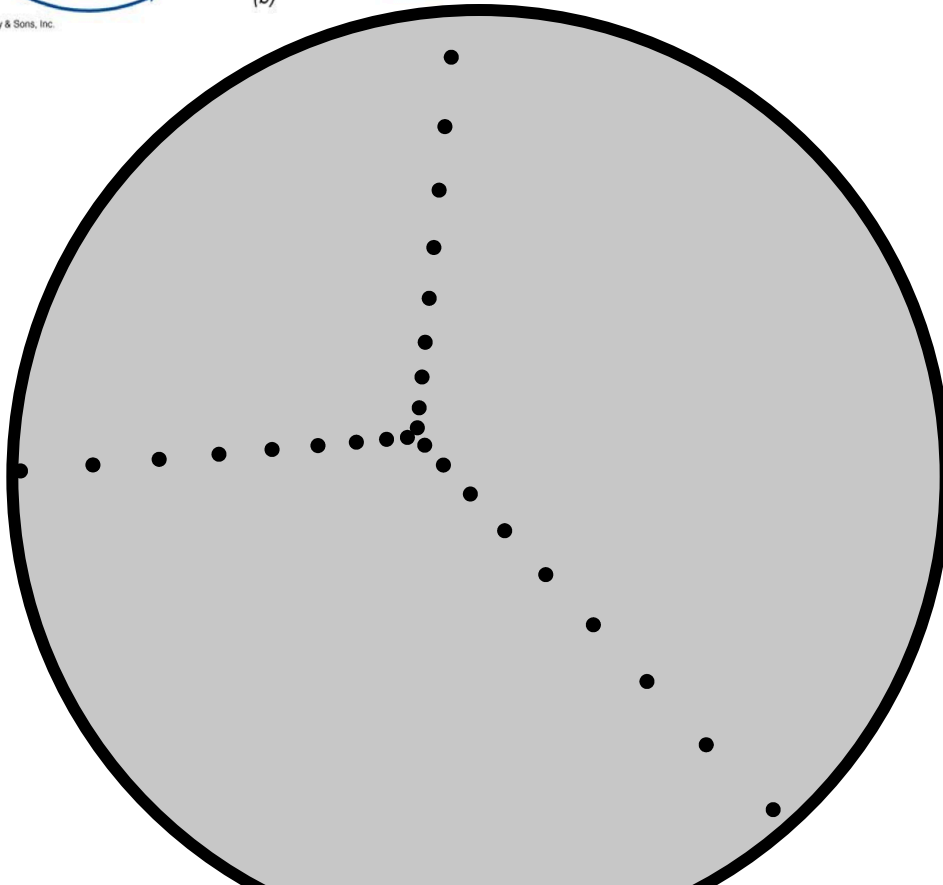
... we can just wait for the Earth to rotate



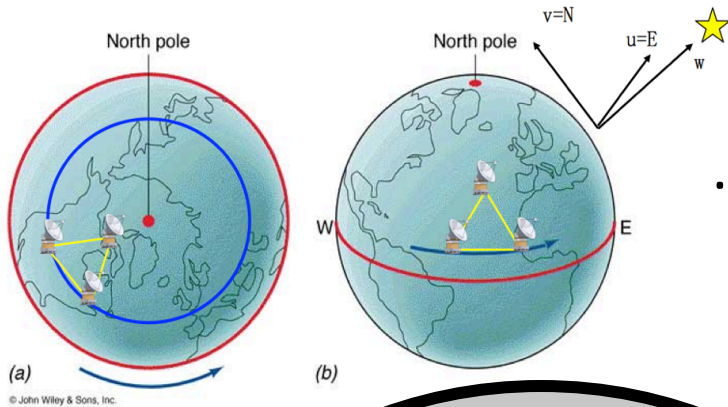
# Interferometry – snapshots vs Earth rotation



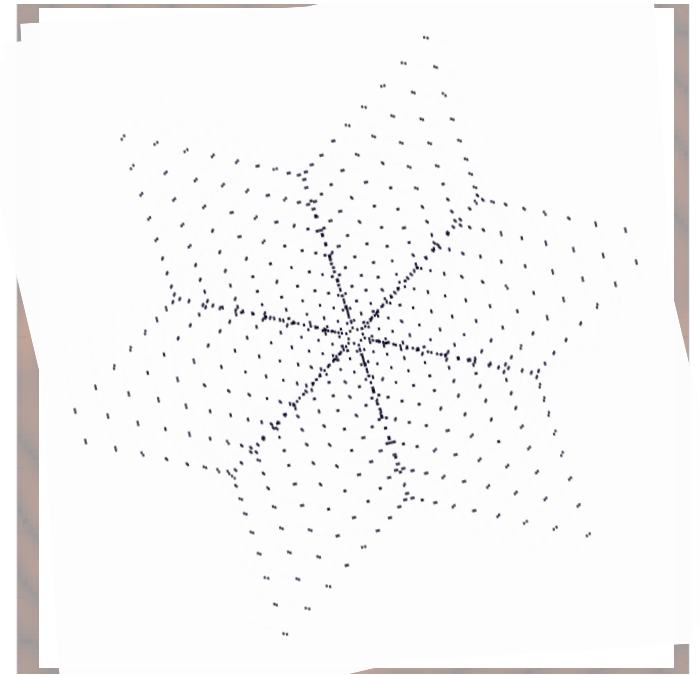
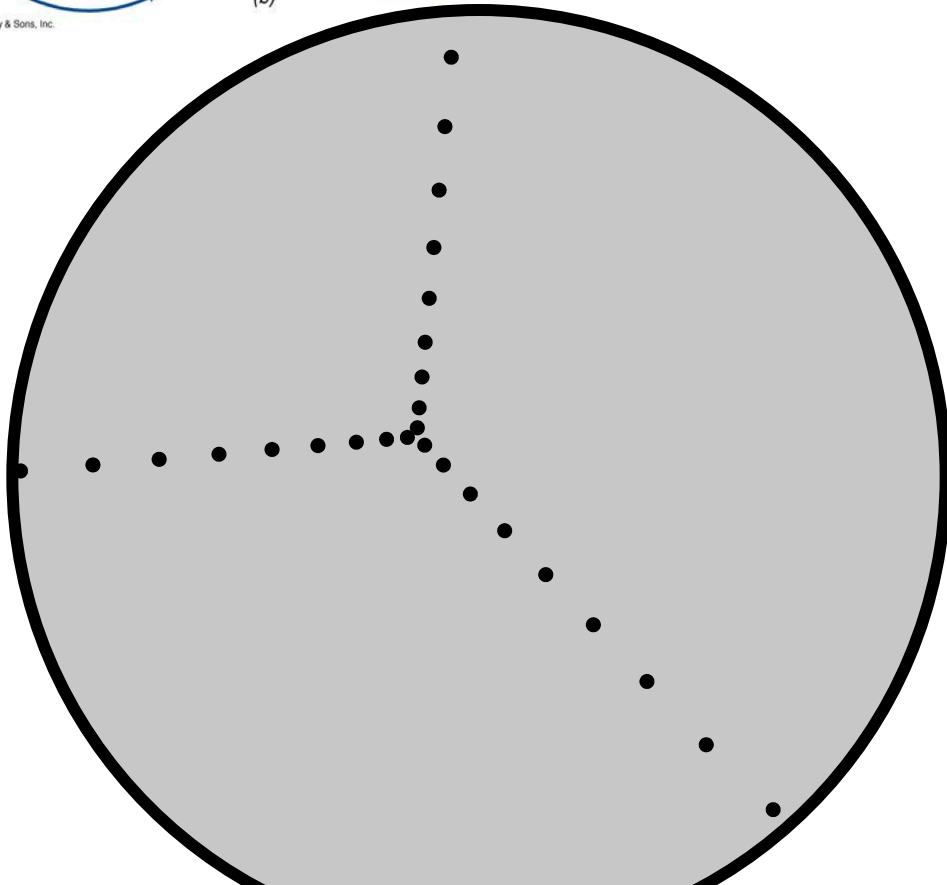
... we can just wait for the Earth to rotate



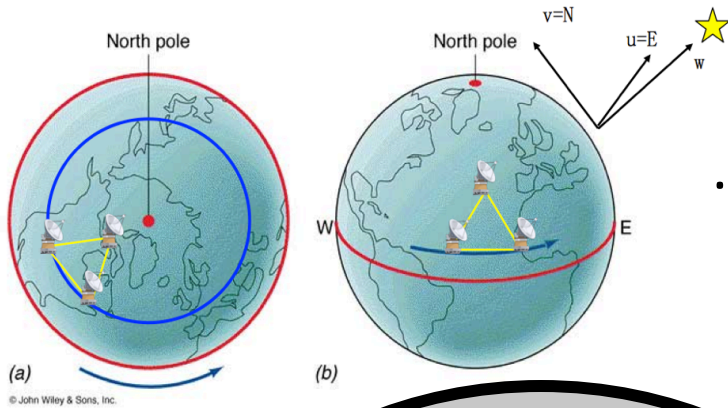
# Interferometry – snapshots vs Earth rotation



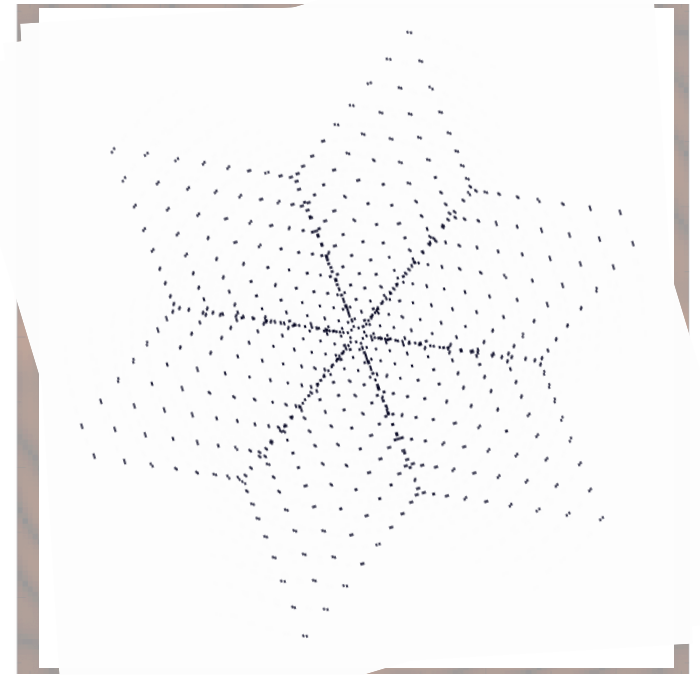
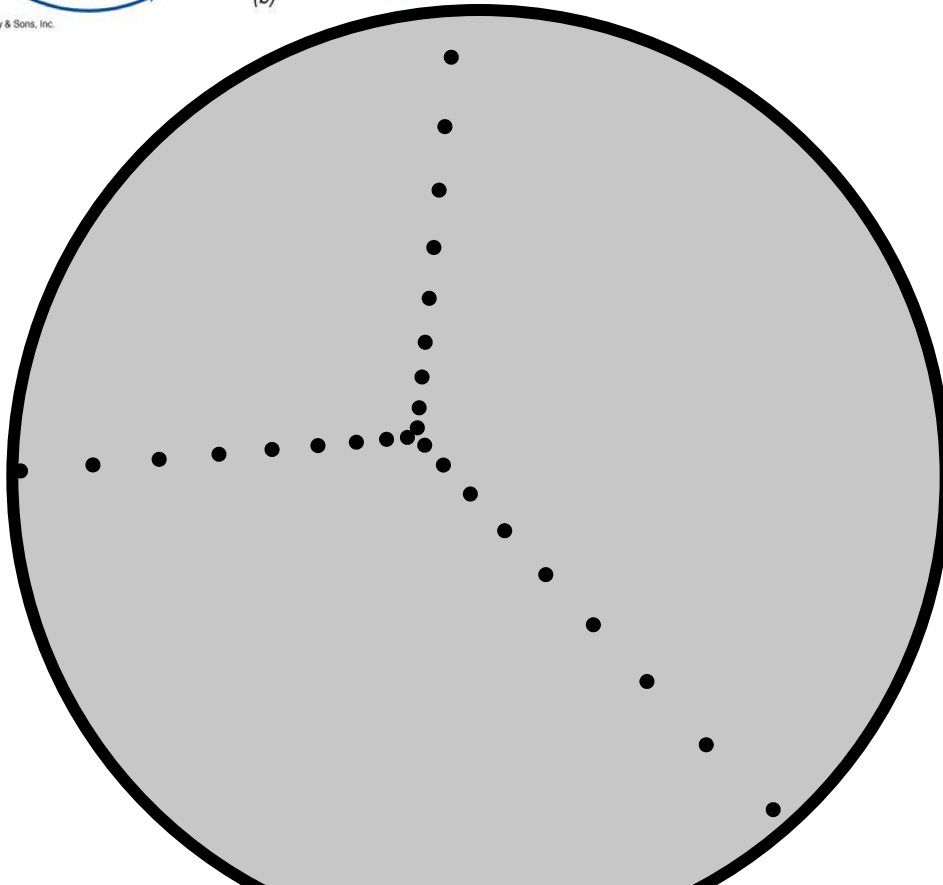
... we can just wait for the Earth to rotate



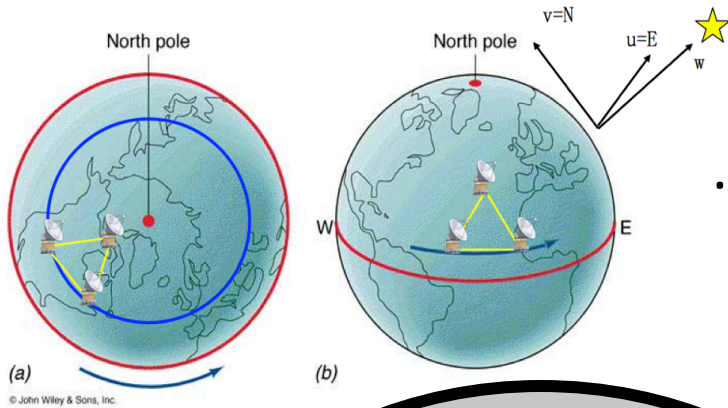
# Interferometry – snapshots vs Earth rotation



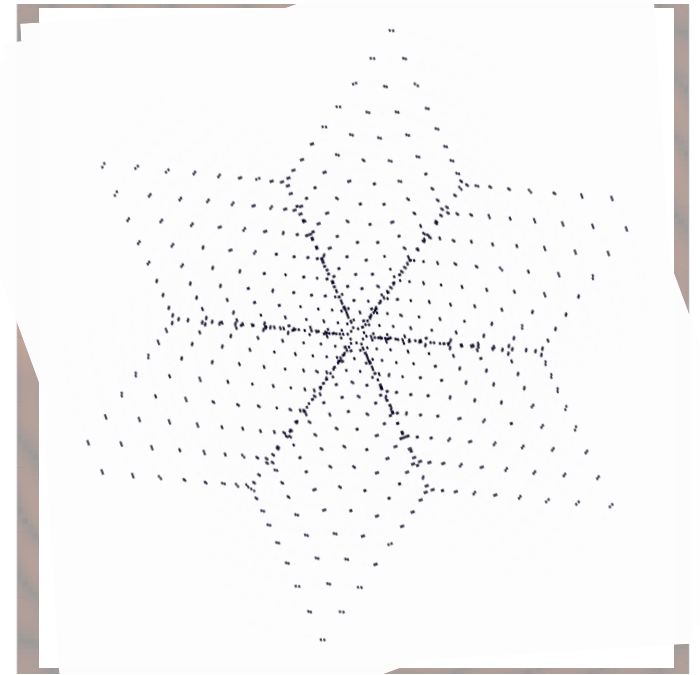
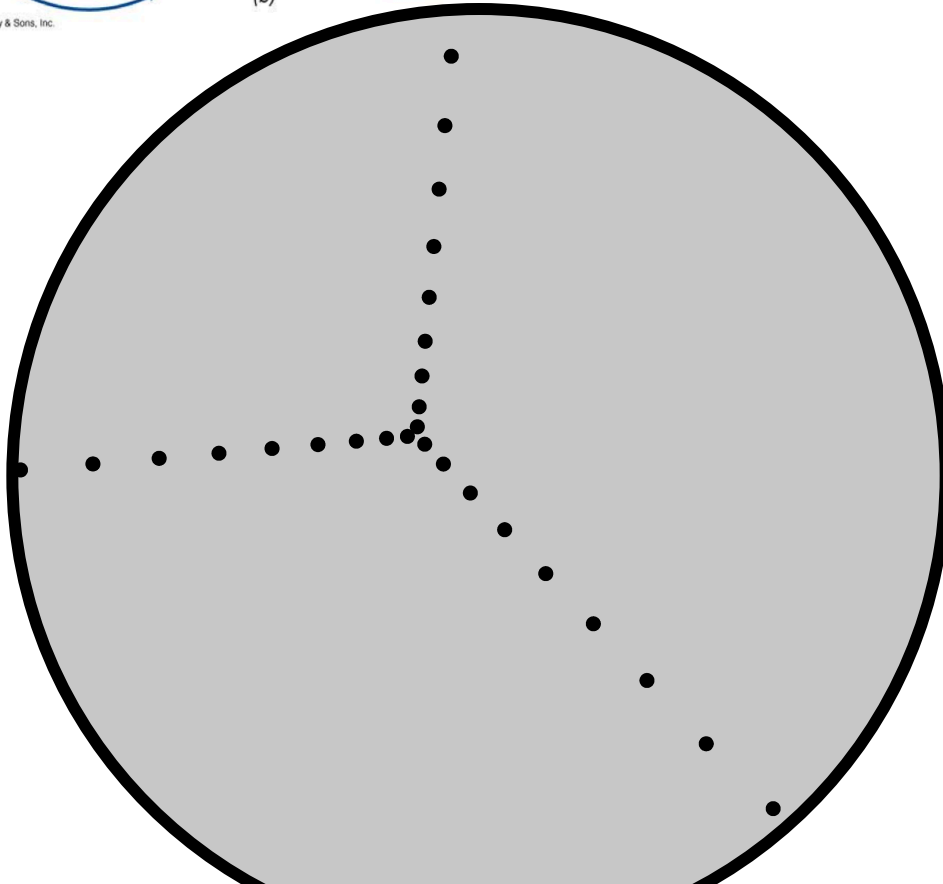
... we can just wait for the Earth to rotate



# Interferometry – snapshots vs Earth rotation

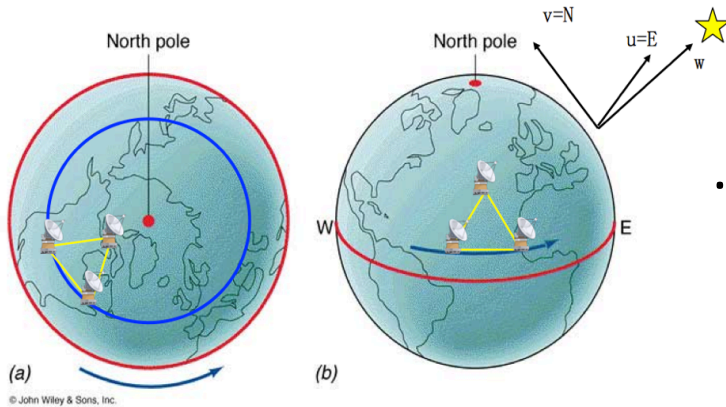


... we can just wait for the Earth to rotate



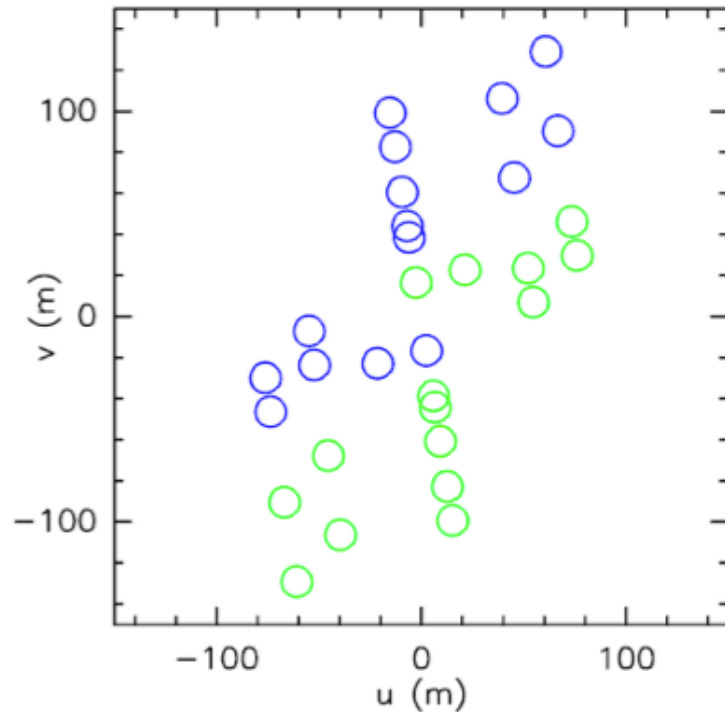


# Interferometry – snapshots vs Earth rotation

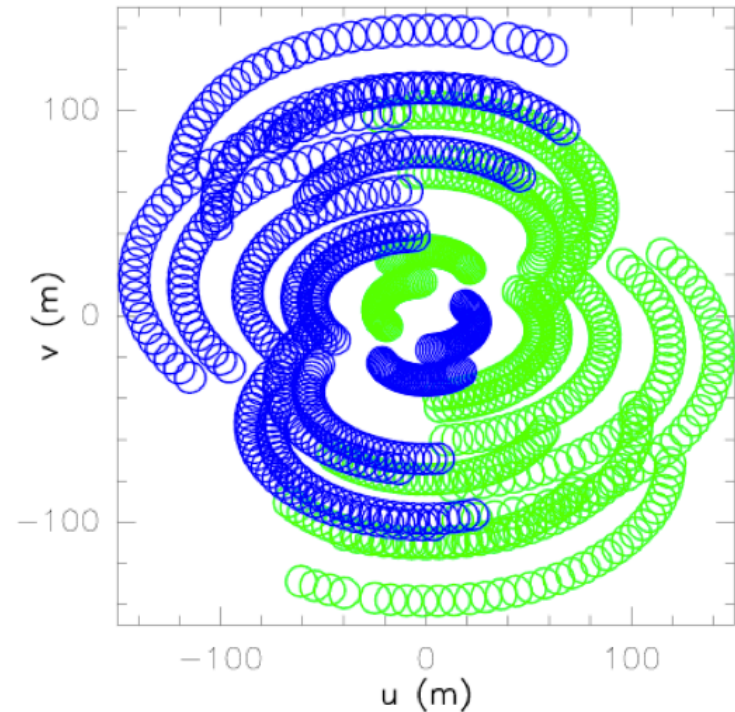


... we can just wait for the Earth to rotate

Sampling in the uv plane

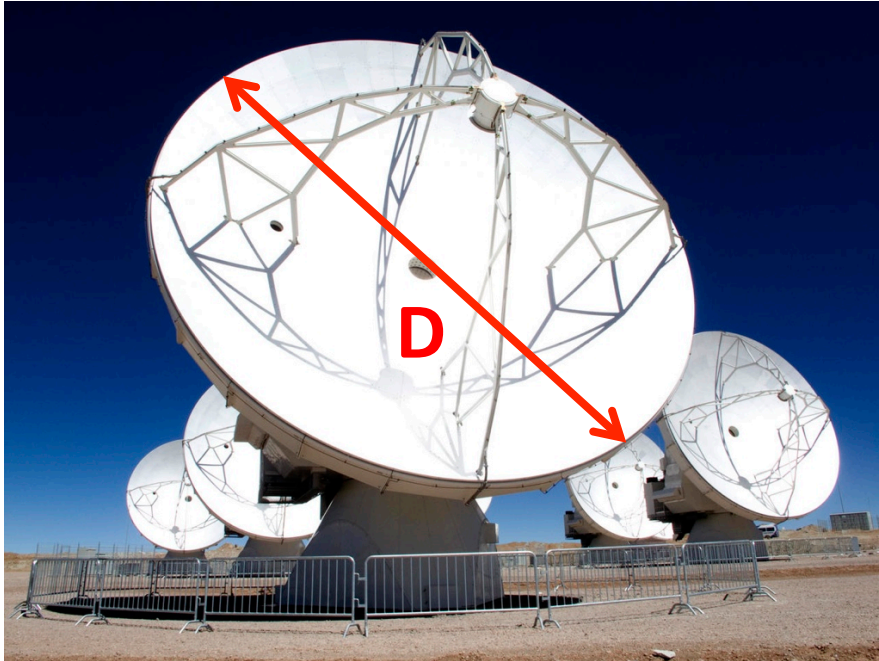


Sampling in the uv plane

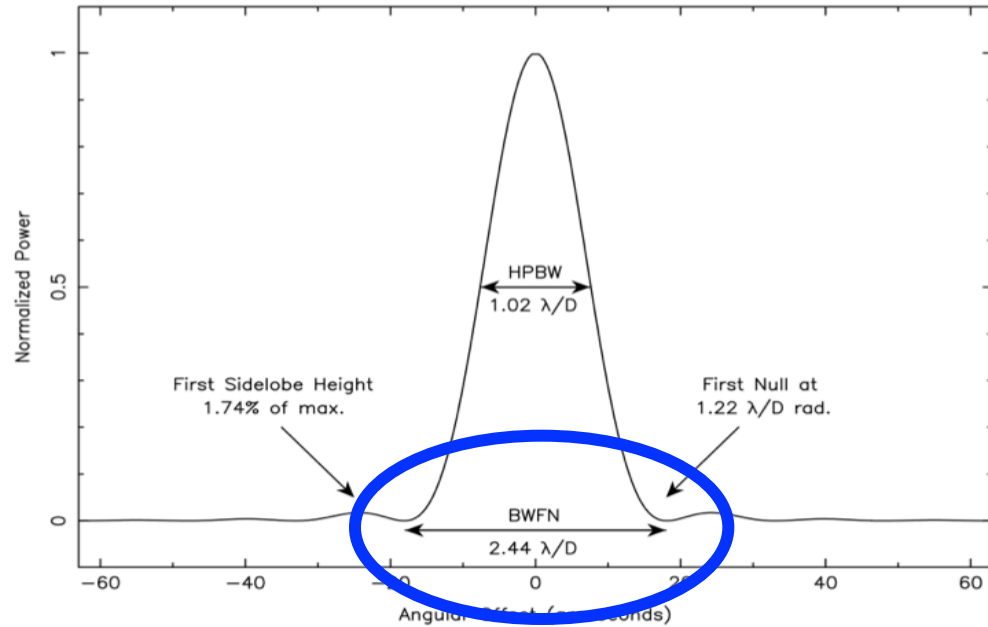


# REMEMBER ... Single-dish response

Single-dish with diameter  $D$



(1D) antenna power response

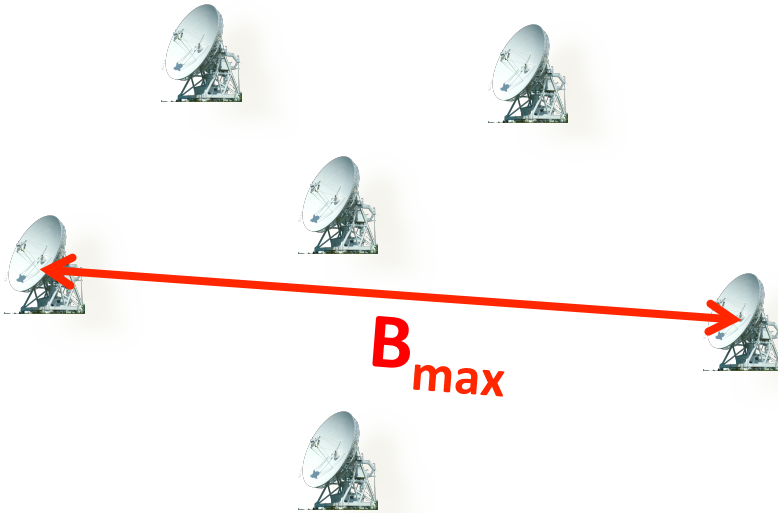


$$PB = 1.22 \frac{\lambda}{D}$$

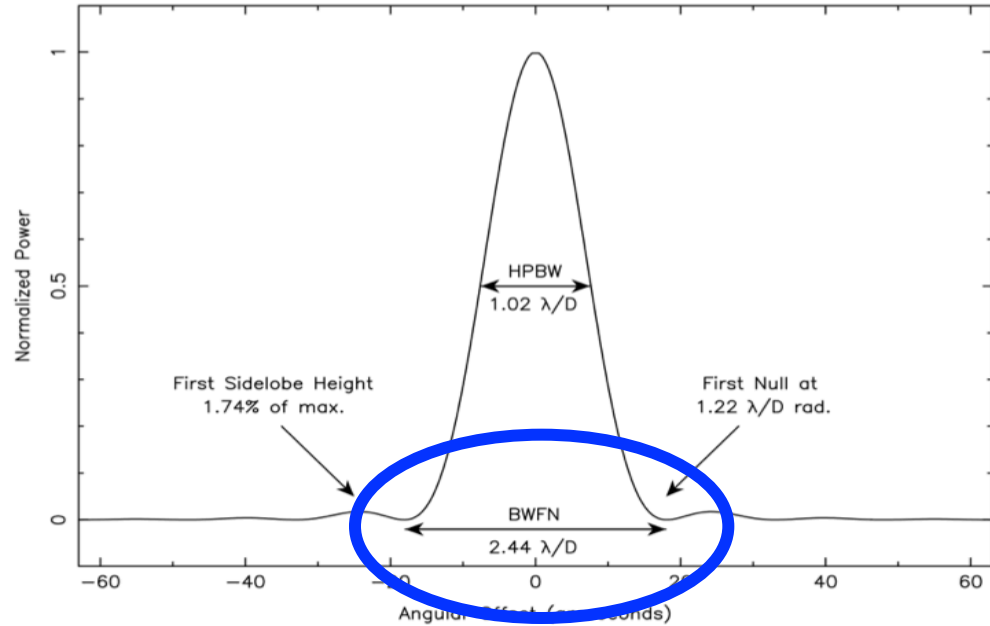
PRIMARY BEAM

# Interferometer “response”

Interferometer with baseline  $B$



interferometer power response



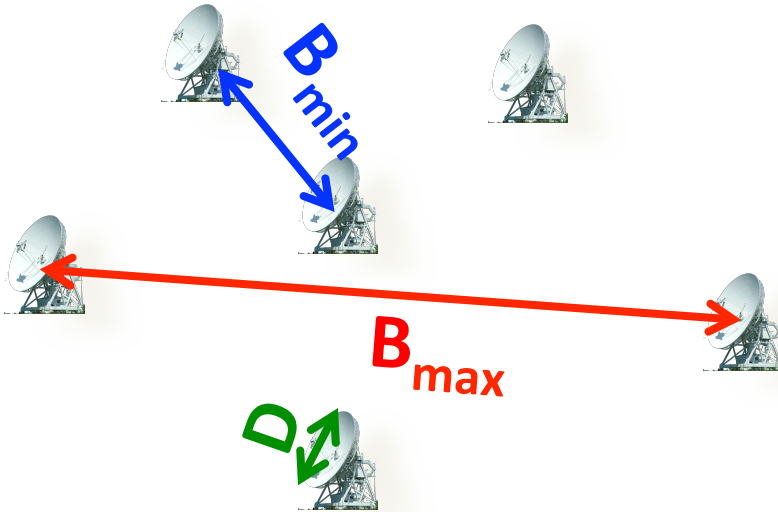
$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$

SYNTHESIZED BEAM

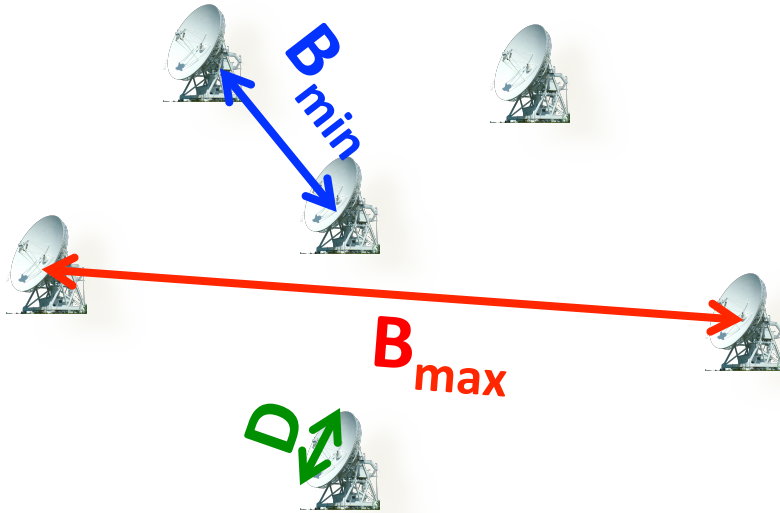
# Synthesized beam, primary beam and LAS

## SYNTHESIZED BEAM

$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$



# Synthesized beam, primary beam and LAS



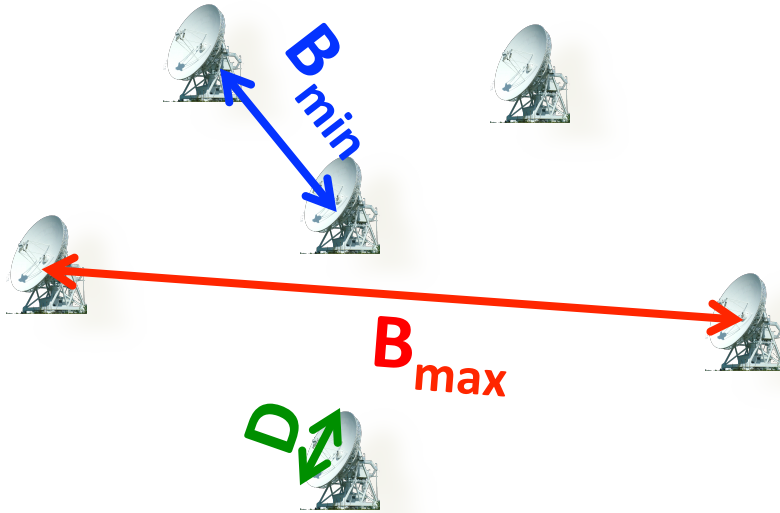
## SYNTHESIZED BEAM

$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$

## LARGEST ANGULAR SCALE

$$LAS = 1.22 \frac{\lambda}{B_{min}}$$

# Synthesized beam, primary beam and LAS



## SYNTHESIZED BEAM

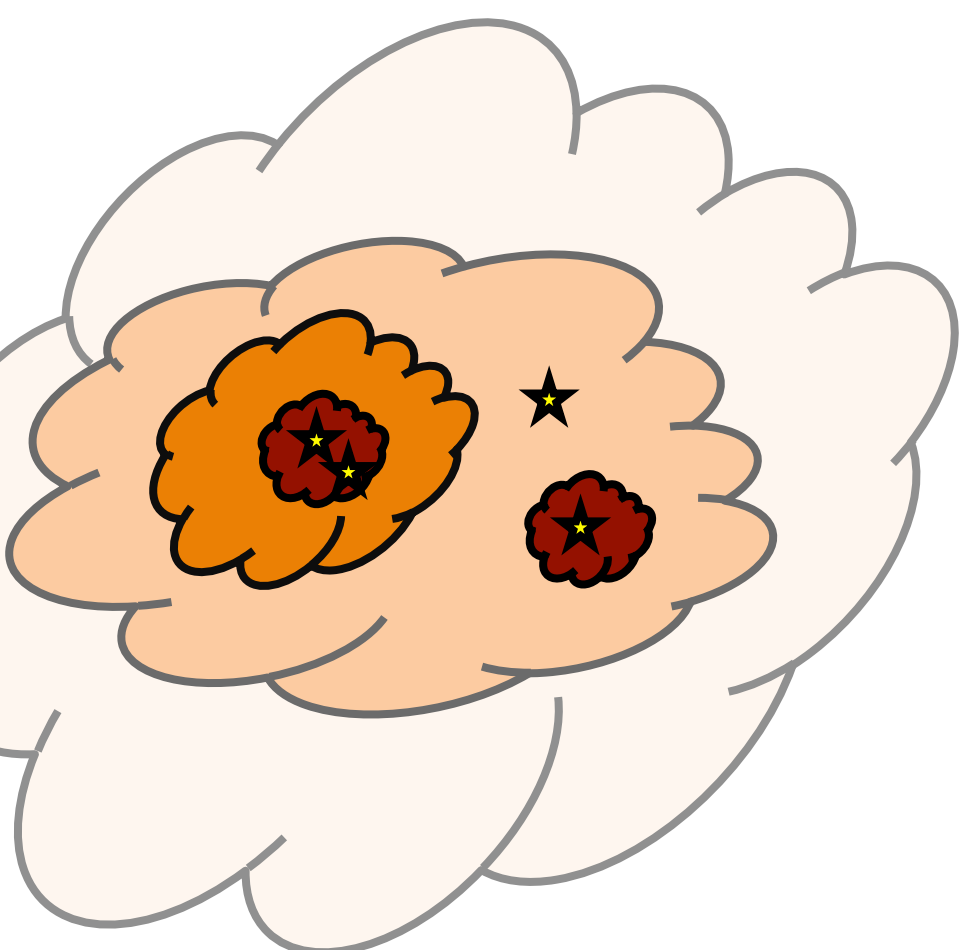
$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$

## LARGEST ANGULAR SCALE

$$LAS = 1.22 \frac{\lambda}{B_{min}}$$

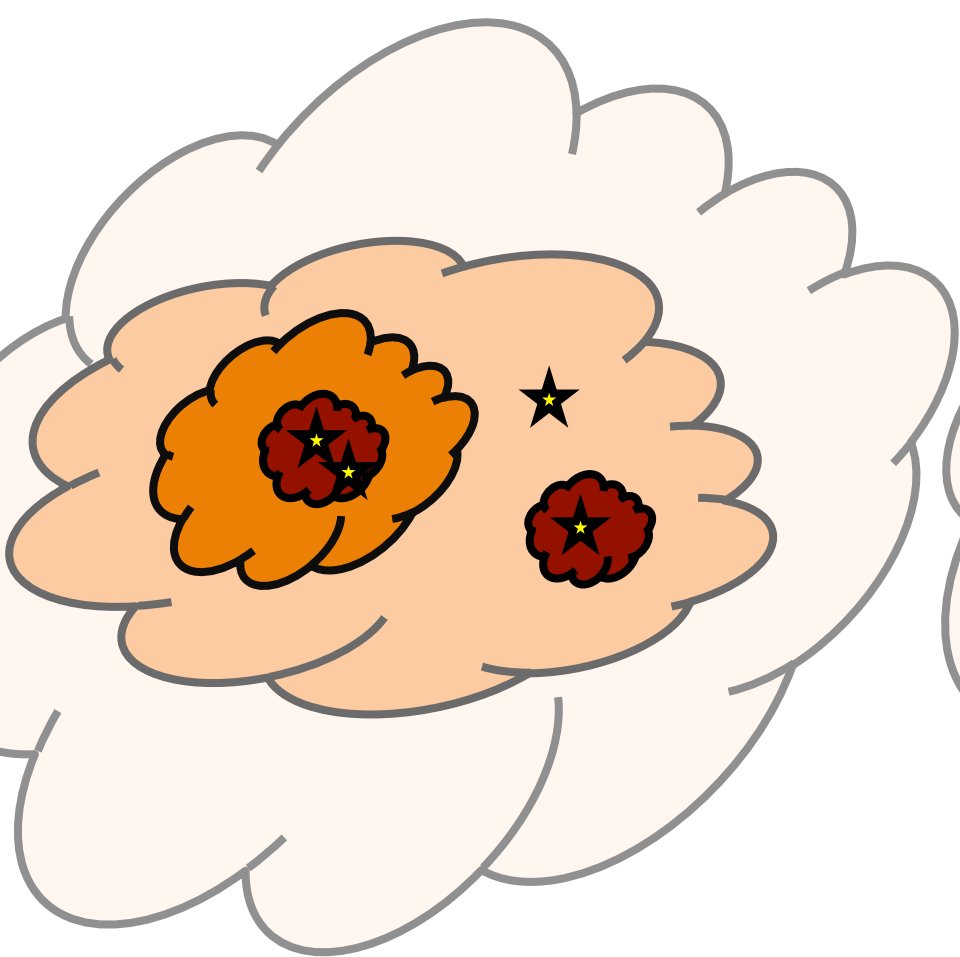
## PRIMARY BEAM

$$PB = 1.22 \frac{\lambda}{D}$$

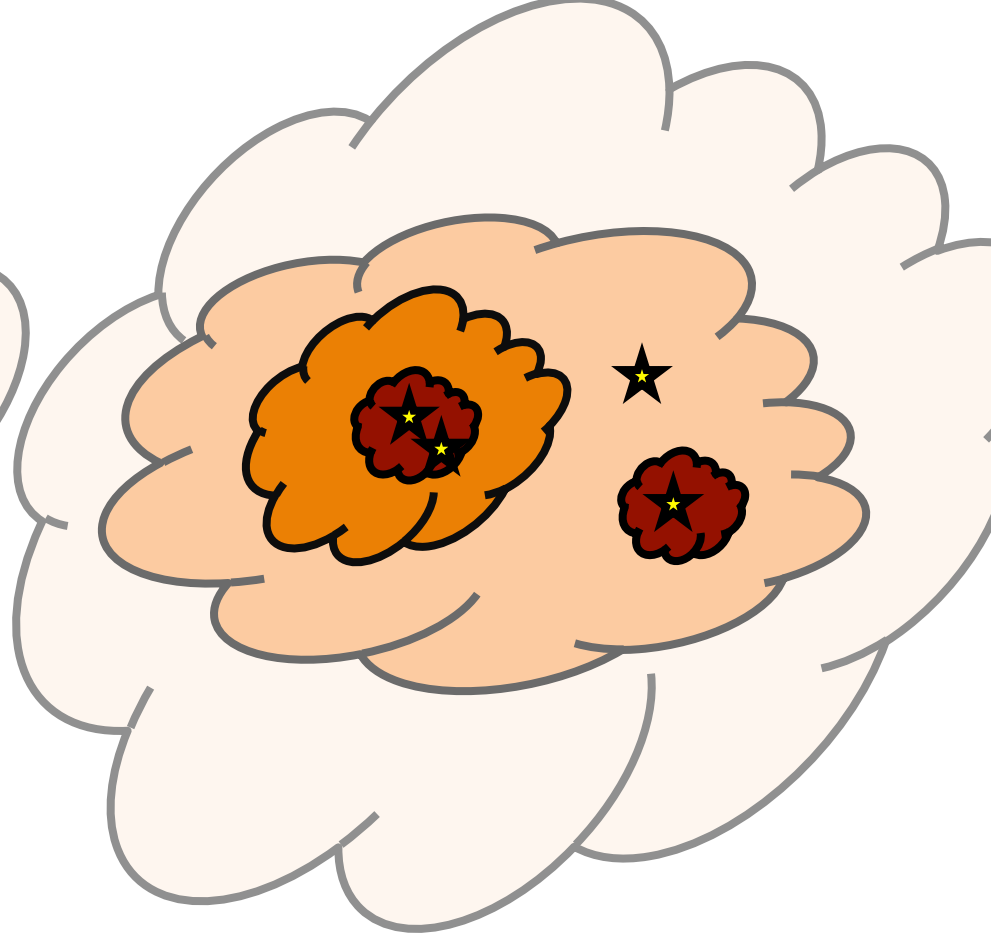


**REAL SKY**





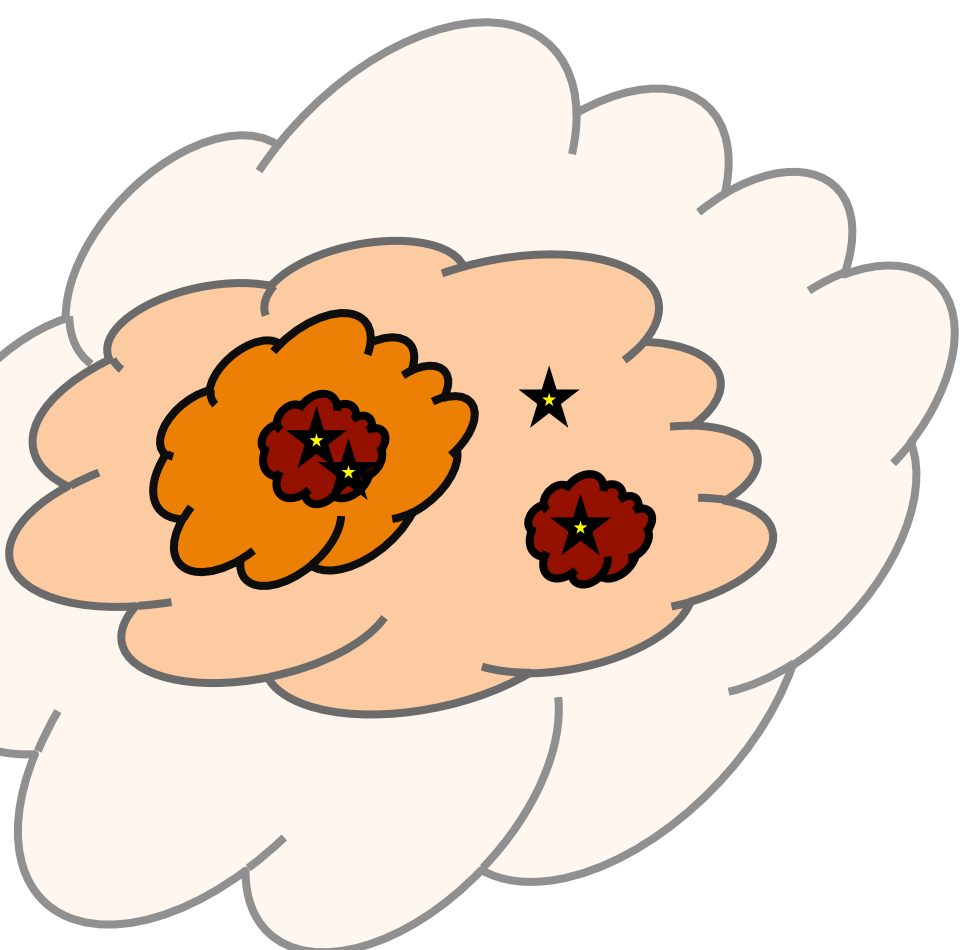
**REAL SKY**



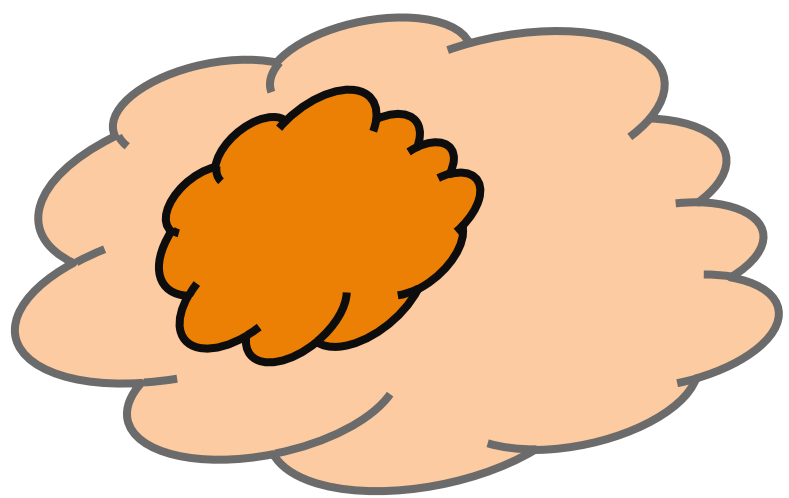
**WHAT WE WANT TO OBTAIN**





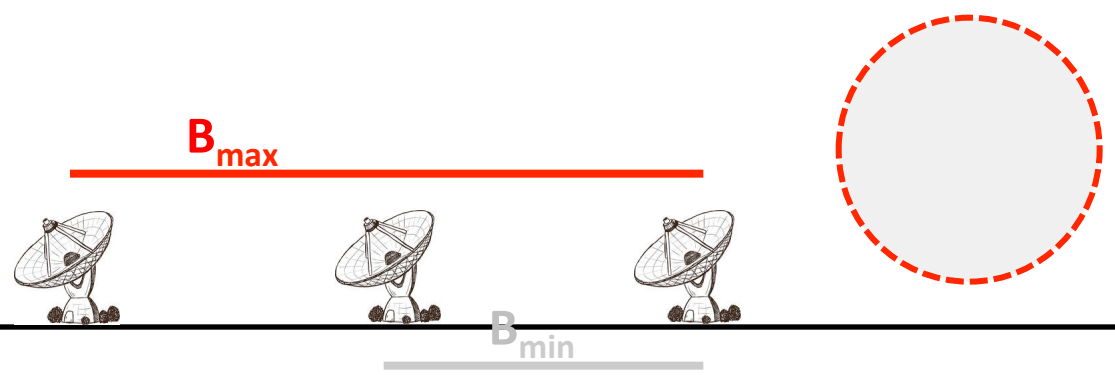


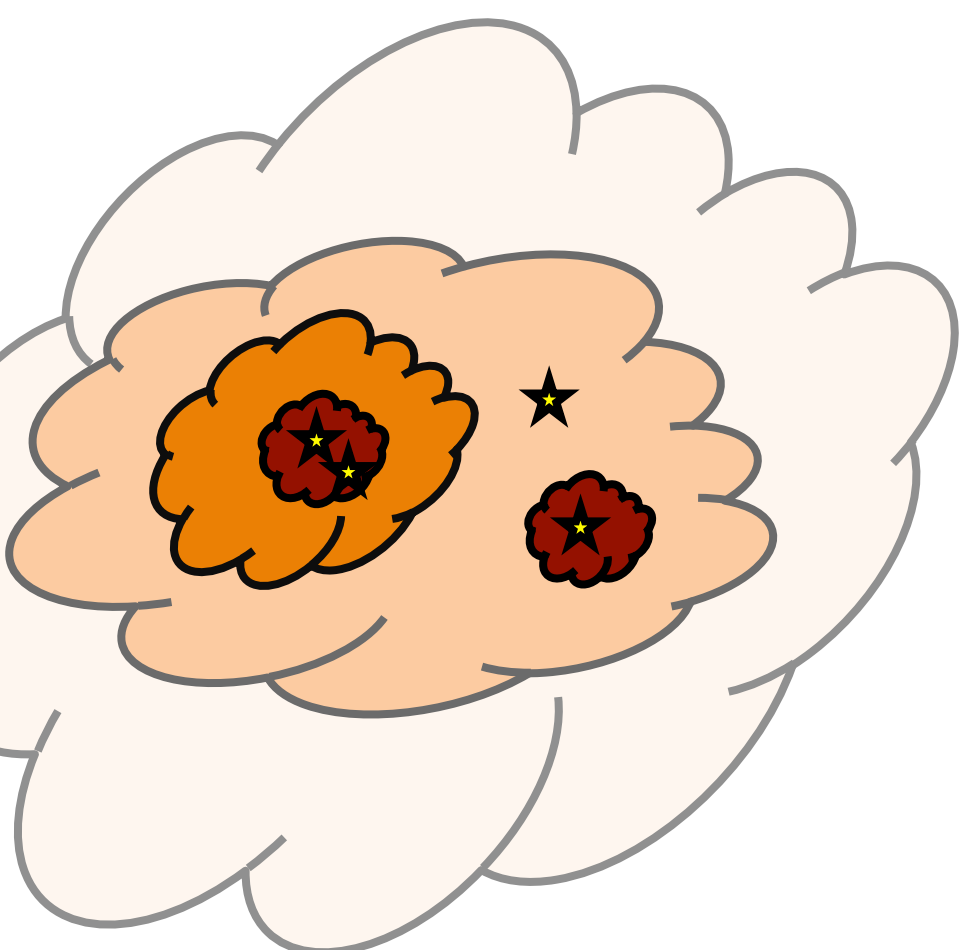
REAL SKY



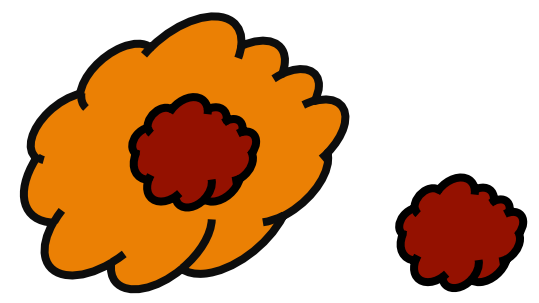
INTERFEROMETER IMAGE

$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$

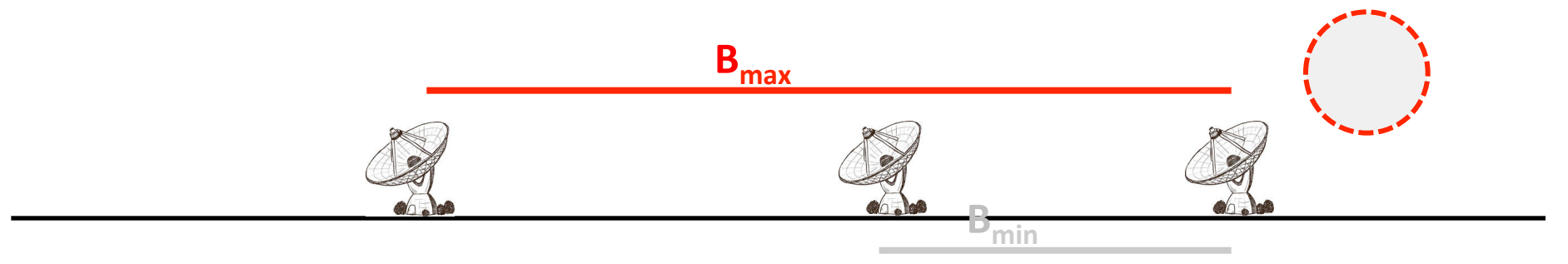


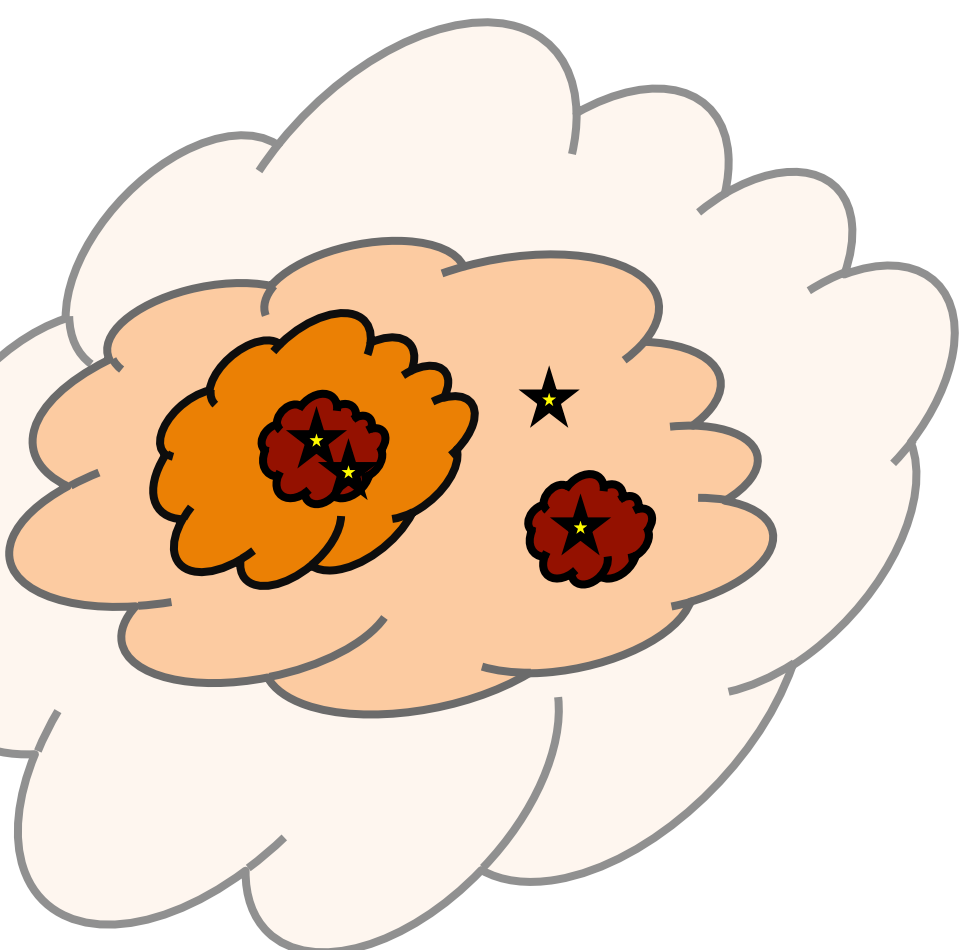


REAL SKY

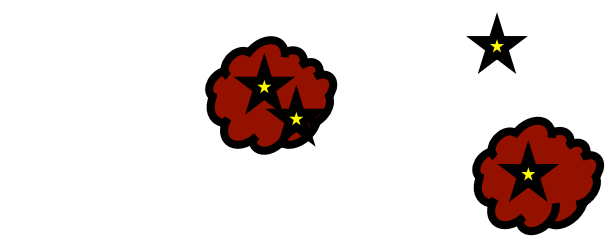


INTERFEROMETER IMAGE

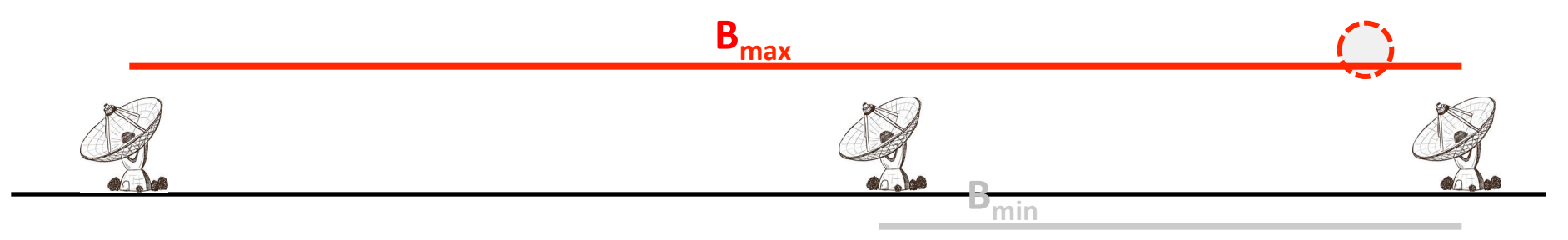


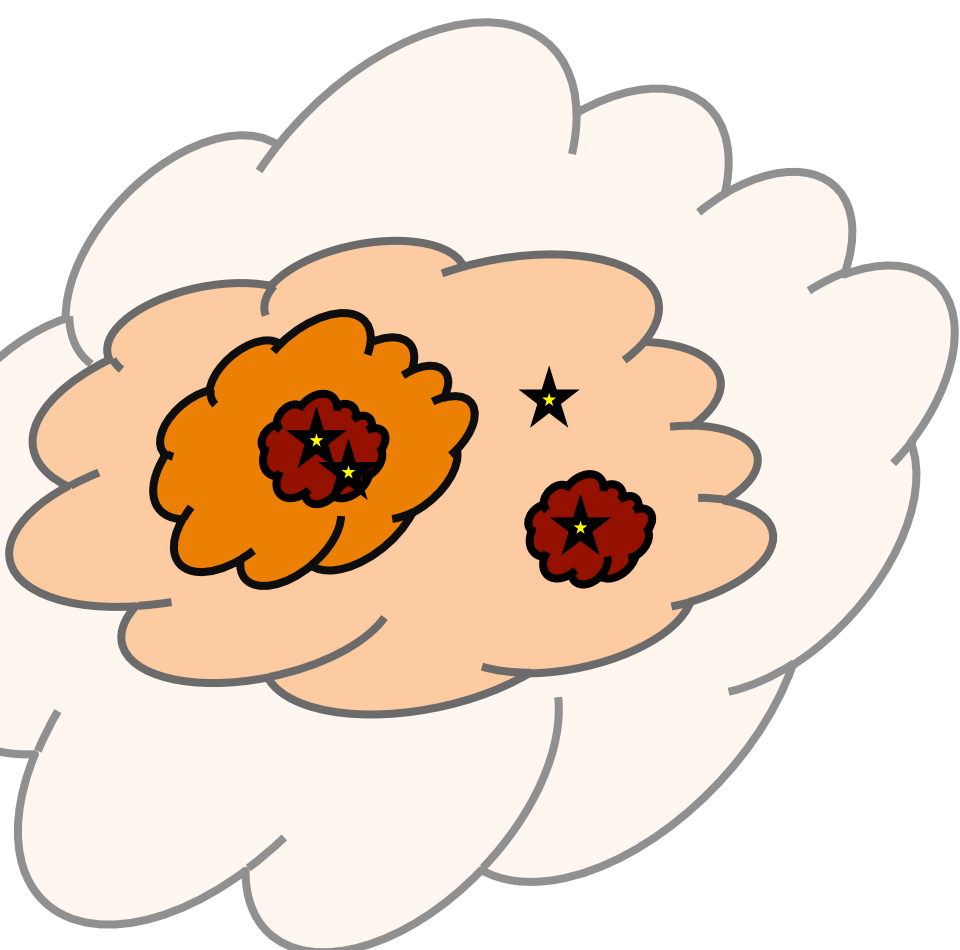


REAL SKY

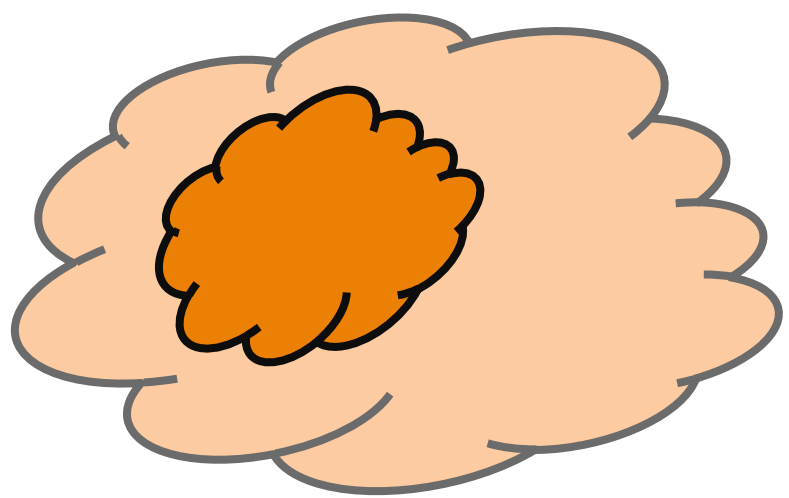


INTERFEROMETER IMAGE



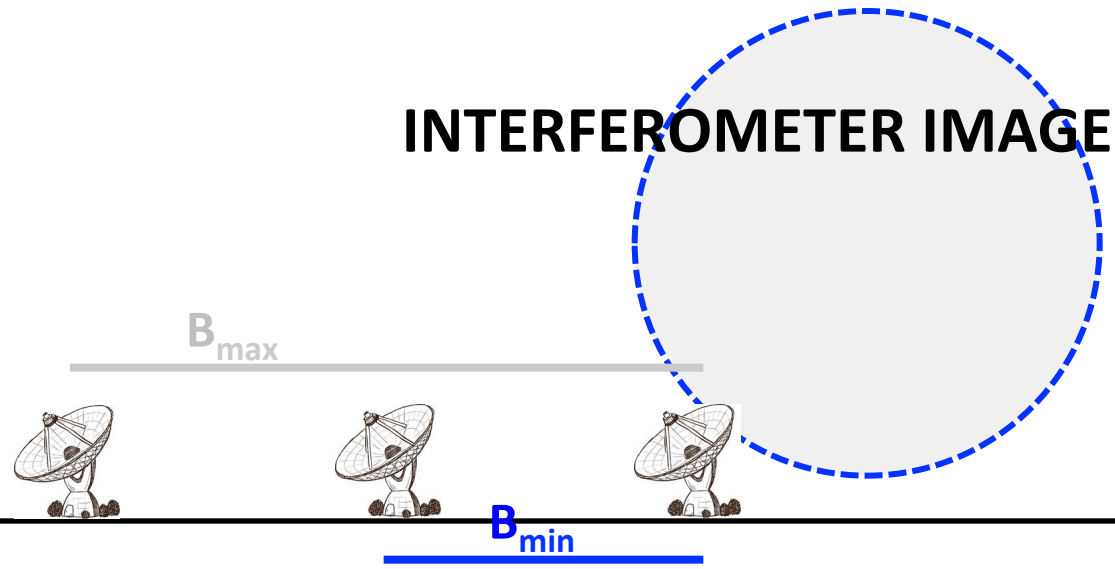


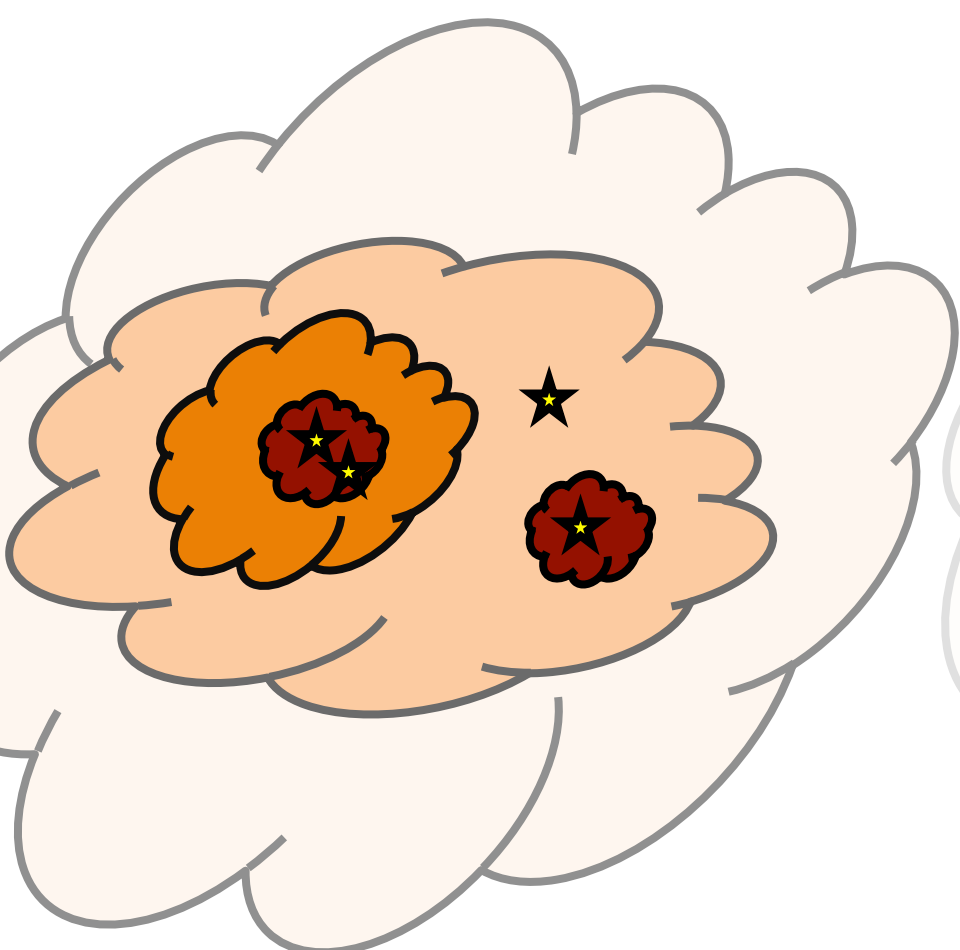
**REAL SKY**



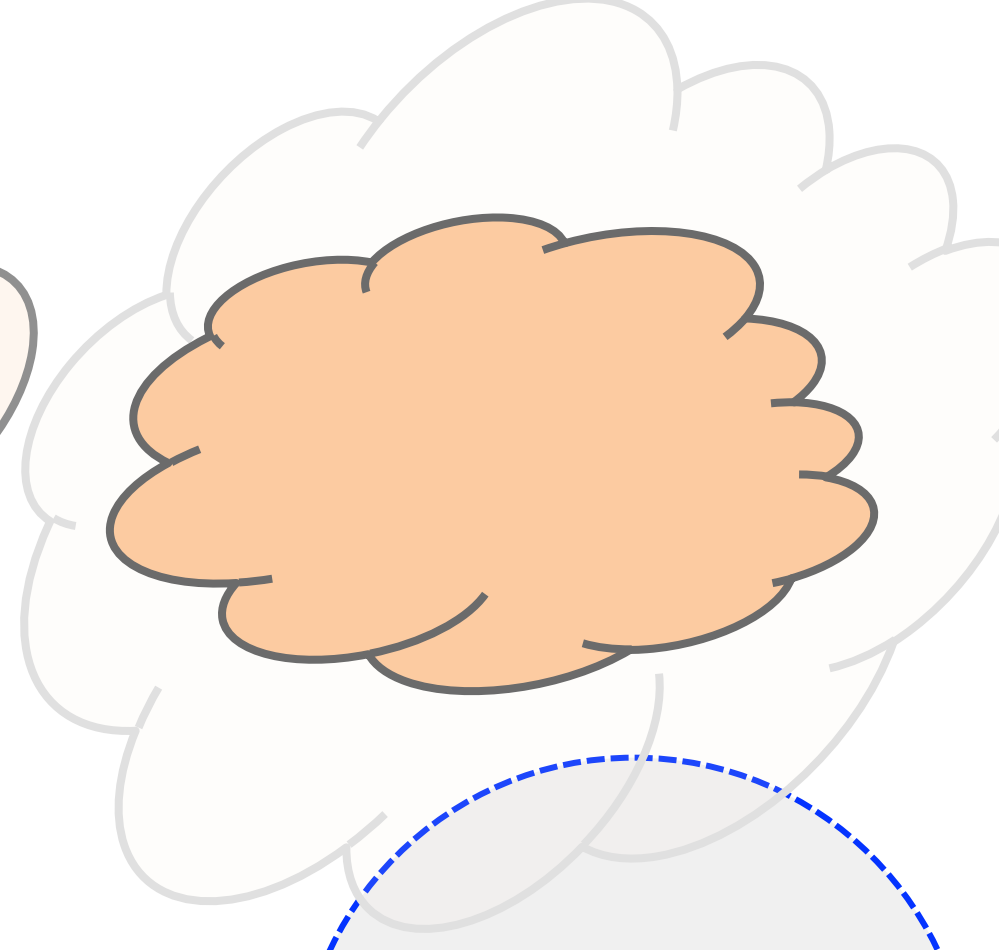
**INTERFEROMETER IMAGE**

$$LAS = 1.22 \frac{\lambda}{B_{\min}}$$

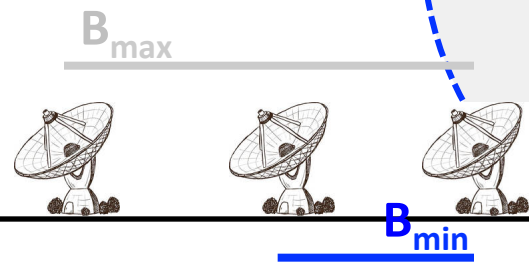




**REAL SKY**

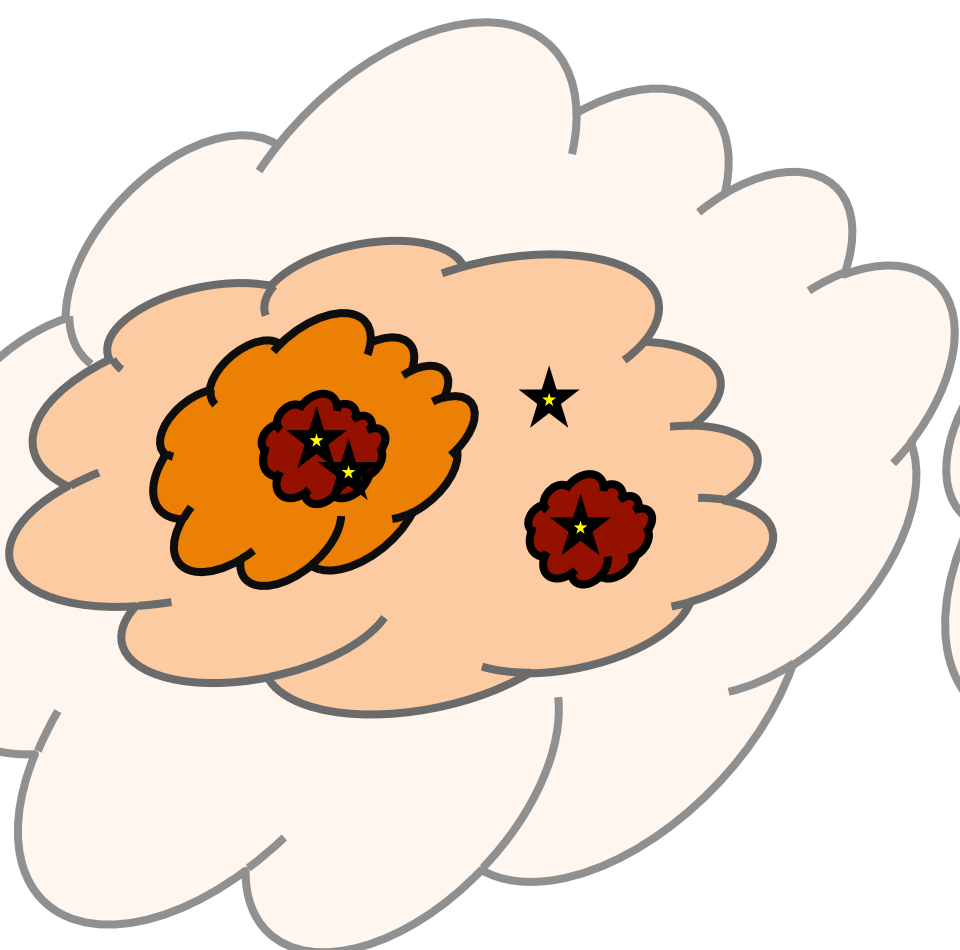


**INTERFEROMETER IMAGE**

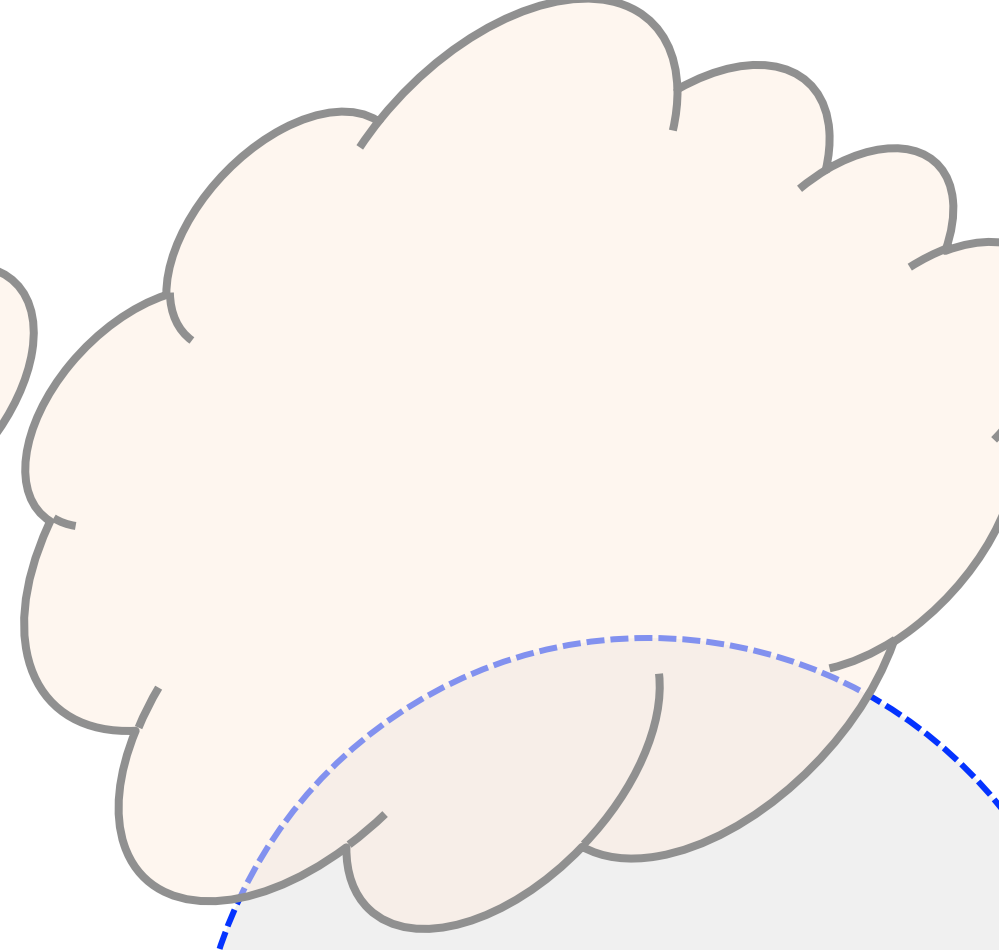


$B_{\max}$

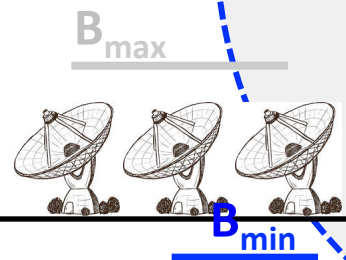
$B_{\min}$



**REAL SKY**

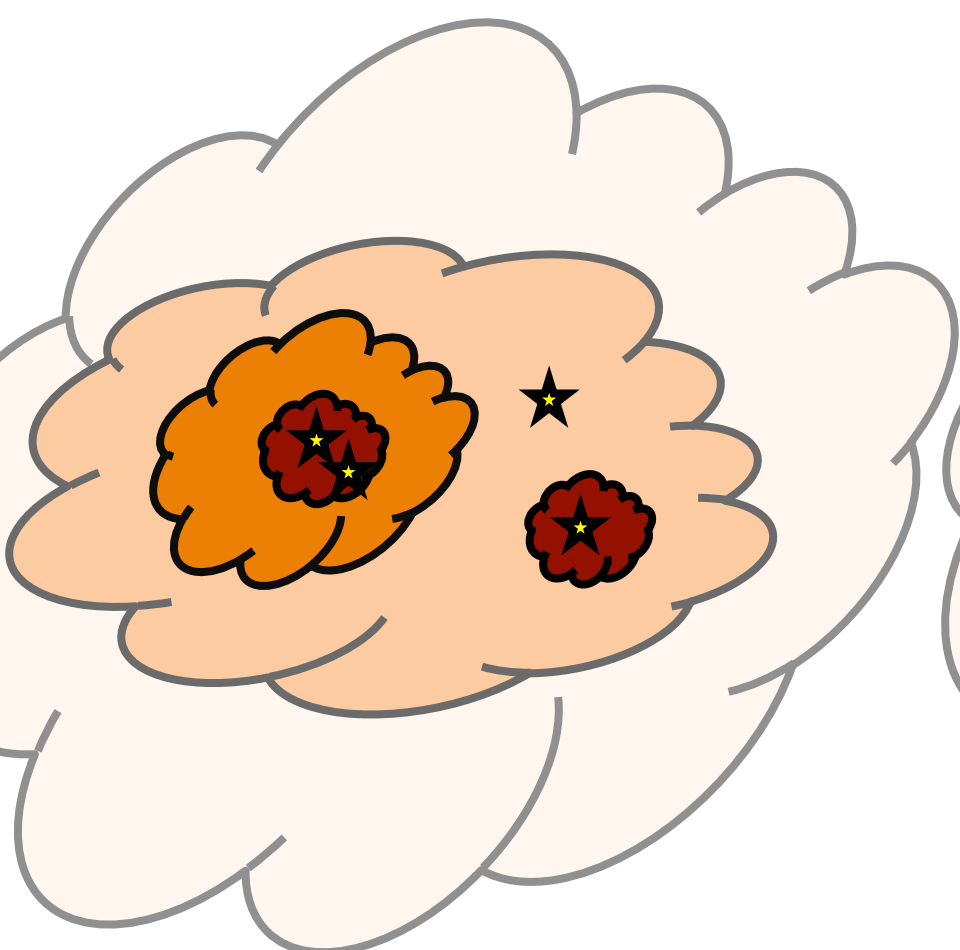


**INTERFEROMETER IMAGE**

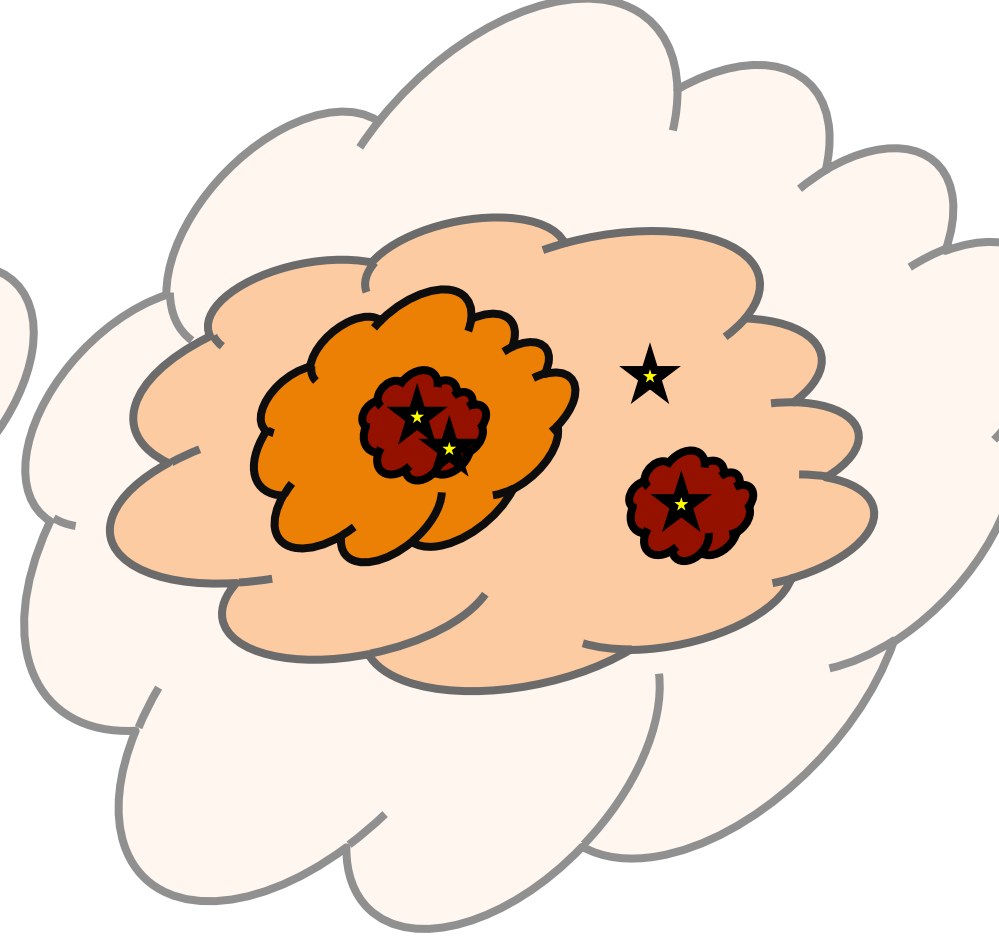


$B_{max}$

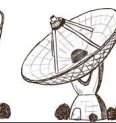
$B_{min}$



**REAL SKY**



**INTERFEROMETER IMAGE**



# Synthesized beam, primary beam and LAS

a.k.a. angular resolution, PSF, ...

it is the size of the object you want to resolve (distinguish)



a.k.a. maximum angular size ...

the largest size of your object

how big it is



a.k.a. field of view (FOV), ...

the area of the sky you want to observe

## SYNTHESIZED BEAM

$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$

## LARGEST ANGULAR SCALE

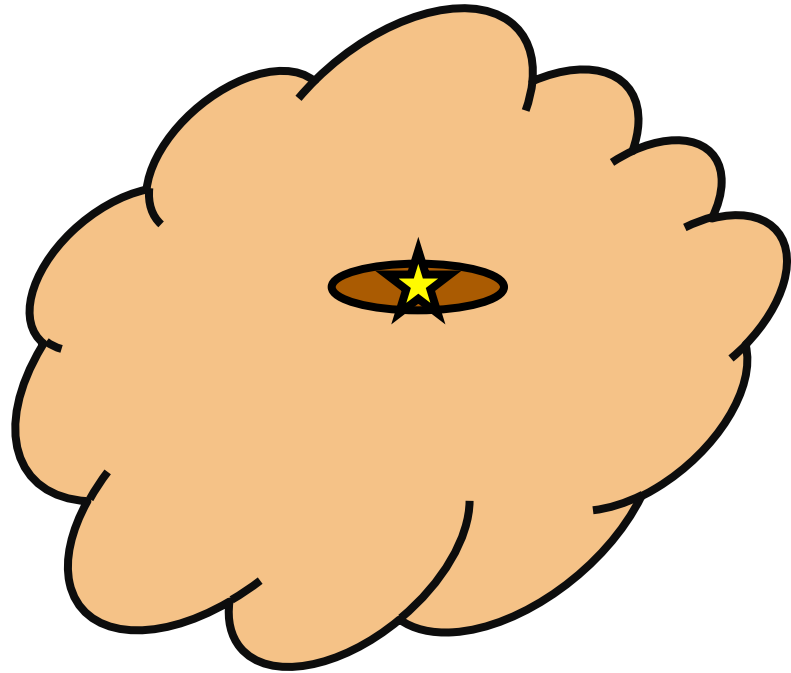
$$LAS = 1.22 \frac{\lambda}{B_{min}}$$

## PRIMARY BEAM

$$PB = 1.22 \frac{\lambda}{D}$$



# Example I: compact protoplanetary disk



## SYNTHESIZED BEAM

$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$

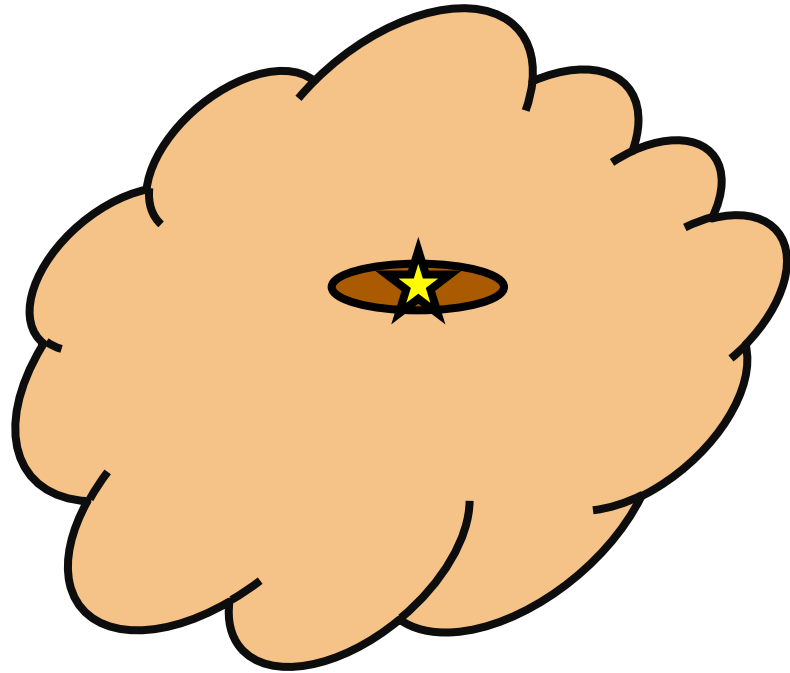
## LARGEST ANGULAR SCALE

$$LAS = 1.22 \frac{\lambda}{B_{min}}$$

## PRIMARY BEAM

$$PB = 1.22 \frac{\lambda}{D}$$

# Example I: compact protoplanetary disk



## SYNTHESIZED BEAM

$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$

## LARGEST ANGULAR SCALE

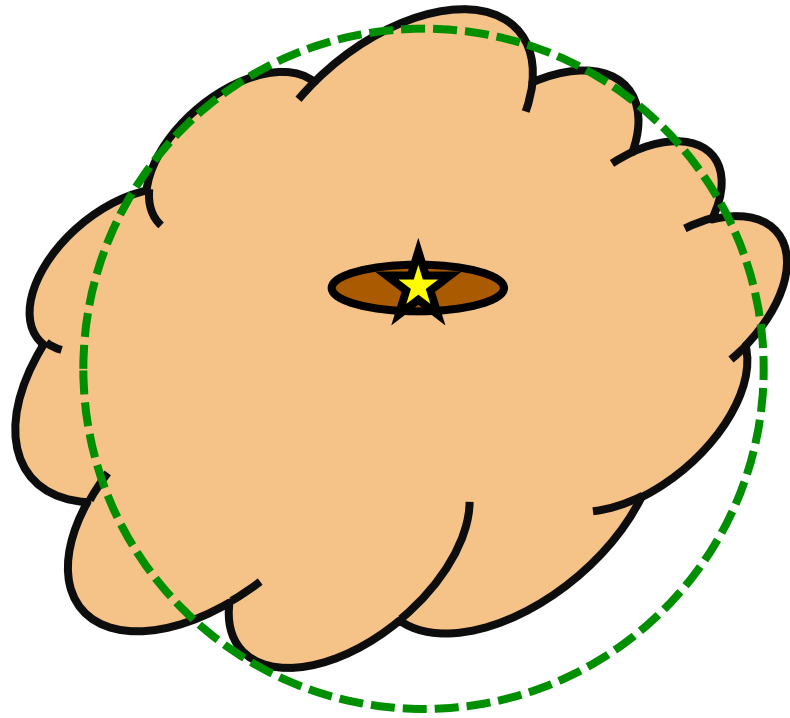
$$LAS = 1.22 \frac{\lambda}{B_{min}}$$

## PRIMARY BEAM

$$PB = 1.22 \frac{\lambda}{D}$$

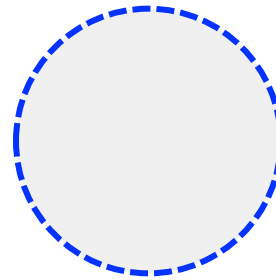


# Example I: compact protoplanetary disk



**SYNTHESIZED BEAM**

$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$



**LARGEST ANGULAR SCALE**

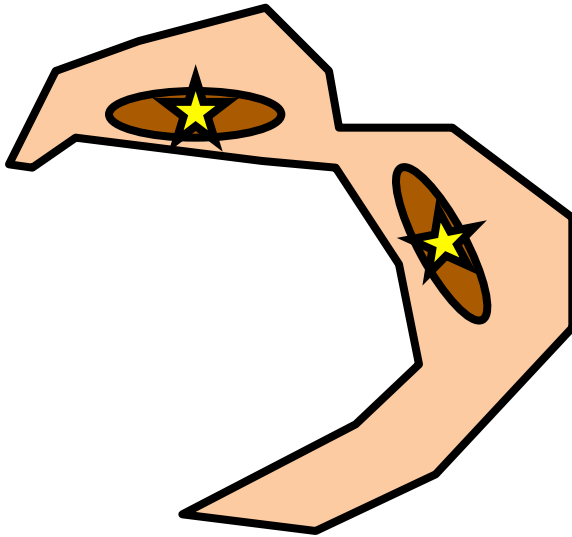
$$LAS = 1.22 \frac{\lambda}{B_{min}}$$

**PRIMARY BEAM**

$$PB = 1.22 \frac{\lambda}{D}$$



# Example II: disks and filament



## SYNTHESIZED BEAM

$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$

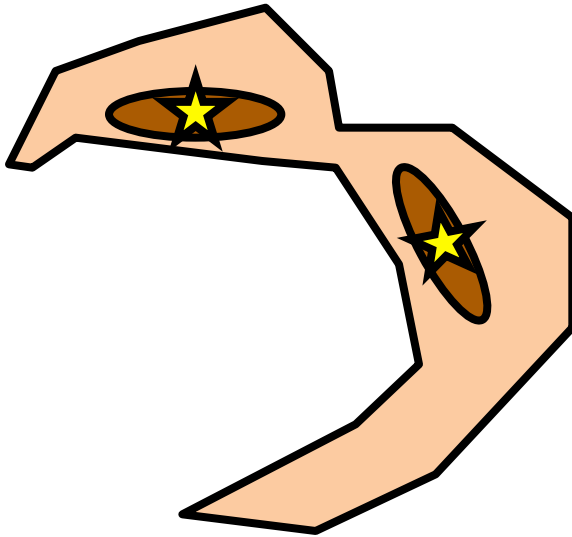
## LARGEST ANGULAR SCALE

$$LAS = 1.22 \frac{\lambda}{B_{min}}$$

## PRIMARY BEAM

$$PB = 1.22 \frac{\lambda}{D}$$

# Example II: disks and filament



## SYNTHESIZED BEAM

$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$

## LARGEST ANGULAR SCALE

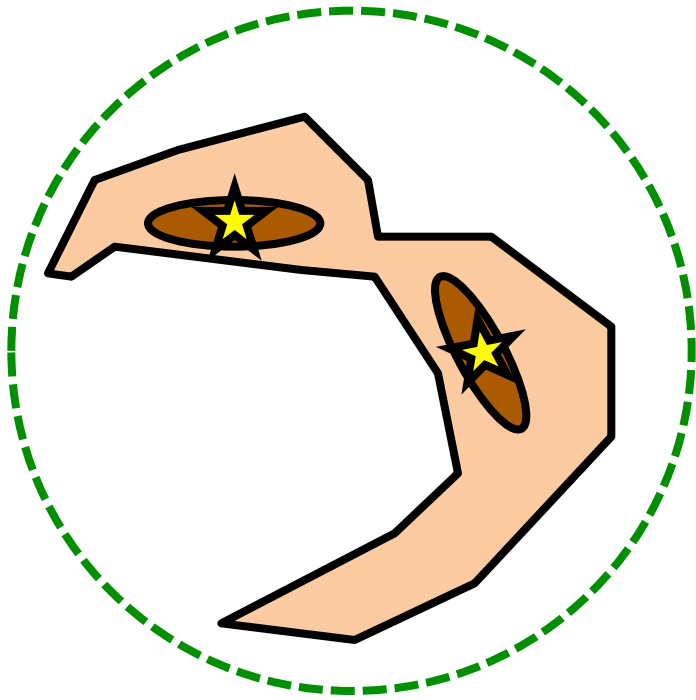
$$LAS = 1.22 \frac{\lambda}{B_{min}}$$

## PRIMARY BEAM

$$PB = 1.22 \frac{\lambda}{D}$$

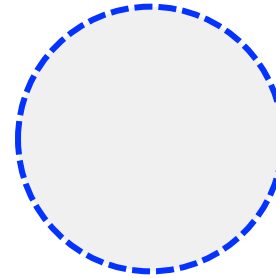


# Example II: disks and filament



**SYNTHESIZED BEAM**

$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$



**LARGEST ANGULAR SCALE**

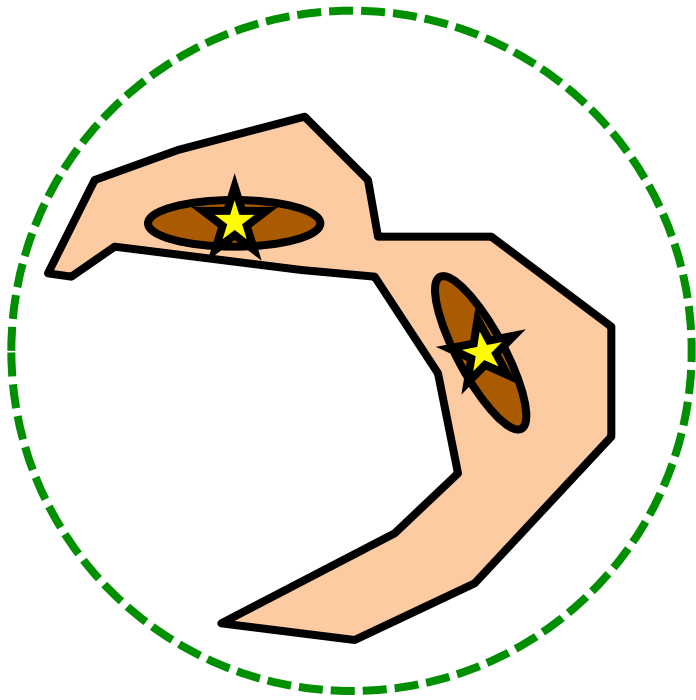
$$LAS = 1.22 \frac{\lambda}{B_{min}}$$

**PRIMARY BEAM**

$$PB = 1.22 \frac{\lambda}{D}$$



# Example II: disks and filament



**SYNTHESIZED BEAM**

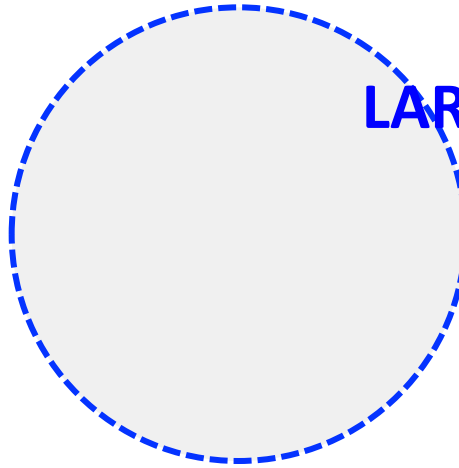
$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$

**LARGEST ANGULAR SCALE**

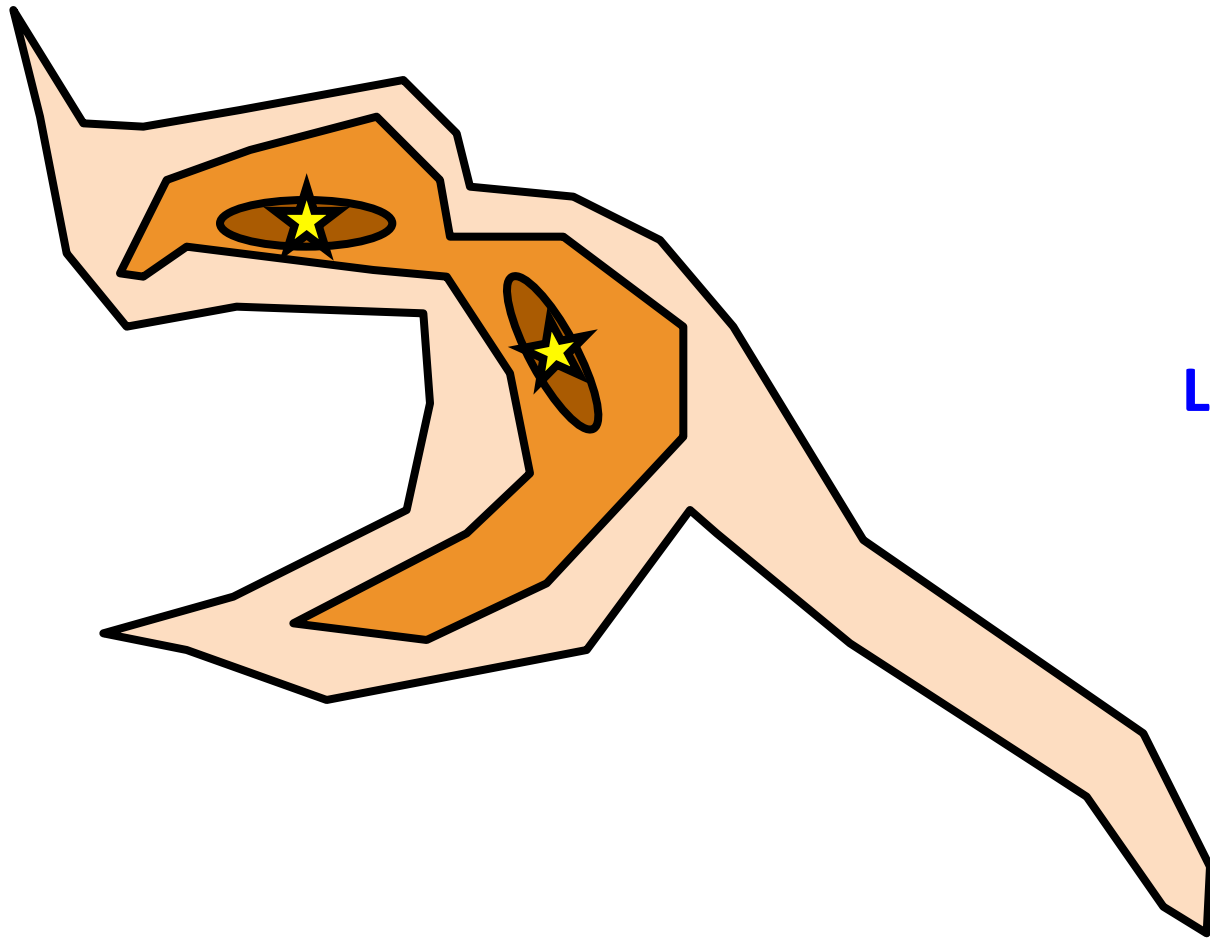
$$LAS = 1.22 \frac{\lambda}{B_{min}}$$

**PRIMARY BEAM**

$$PB = 1.22 \frac{\lambda}{D}$$



# Example III: disks and extended filament



**SYNTHESIZED BEAM**

$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$

**LARGEST ANGULAR SCALE**

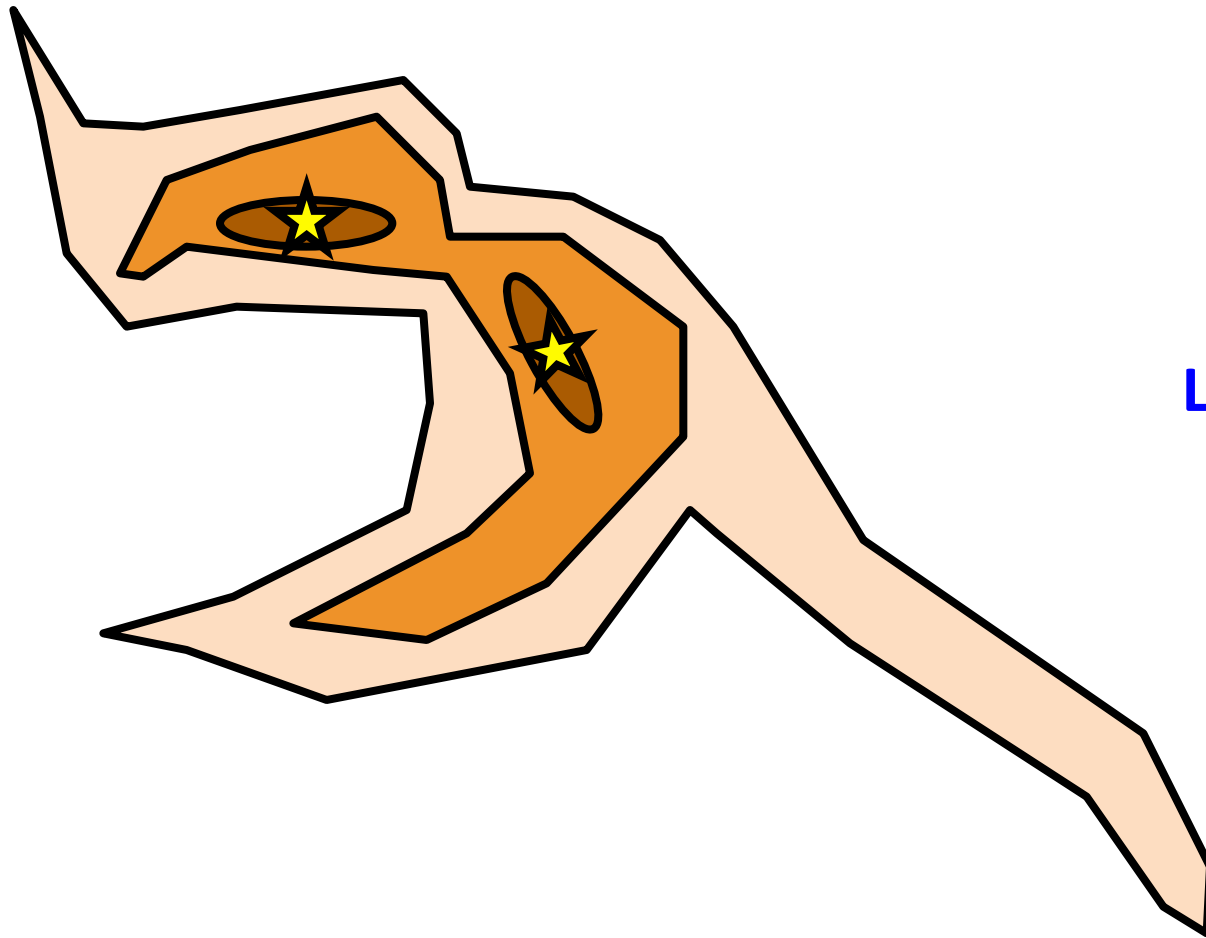
$$LAS = 1.22 \frac{\lambda}{B_{min}}$$

**PRIMARY BEAM**

$$PB = 1.22 \frac{\lambda}{D}$$



# Example III: disks and extended filament



**SYNTHESIZED BEAM**

$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$

**LARGEST ANGULAR SCALE**

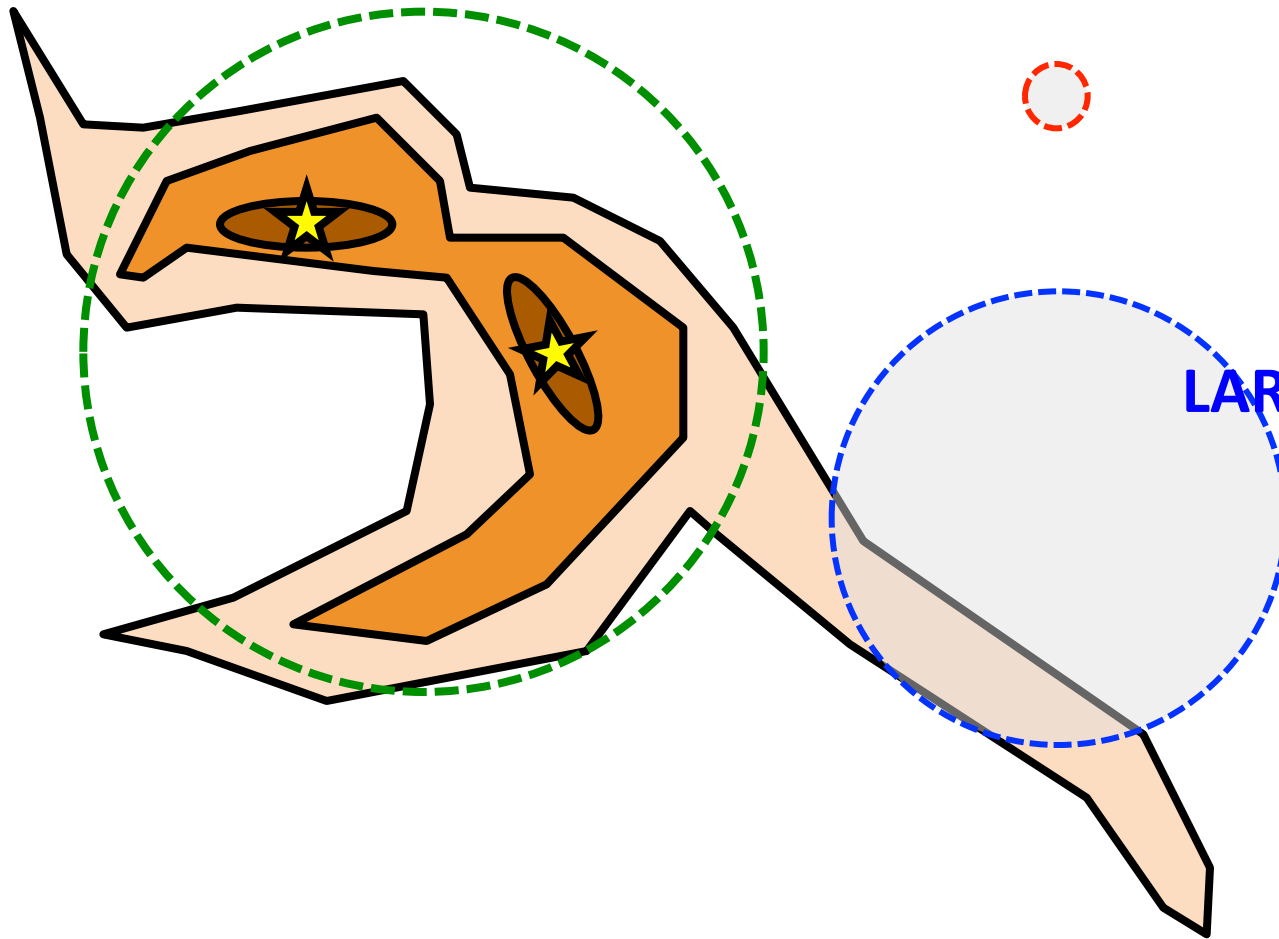
$$LAS = 1.22 \frac{\lambda}{B_{min}}$$

**PRIMARY BEAM**

$$PB = 1.22 \frac{\lambda}{D}$$



# Example III: disks and extended filament



**SYNTHESIZED BEAM**

$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$

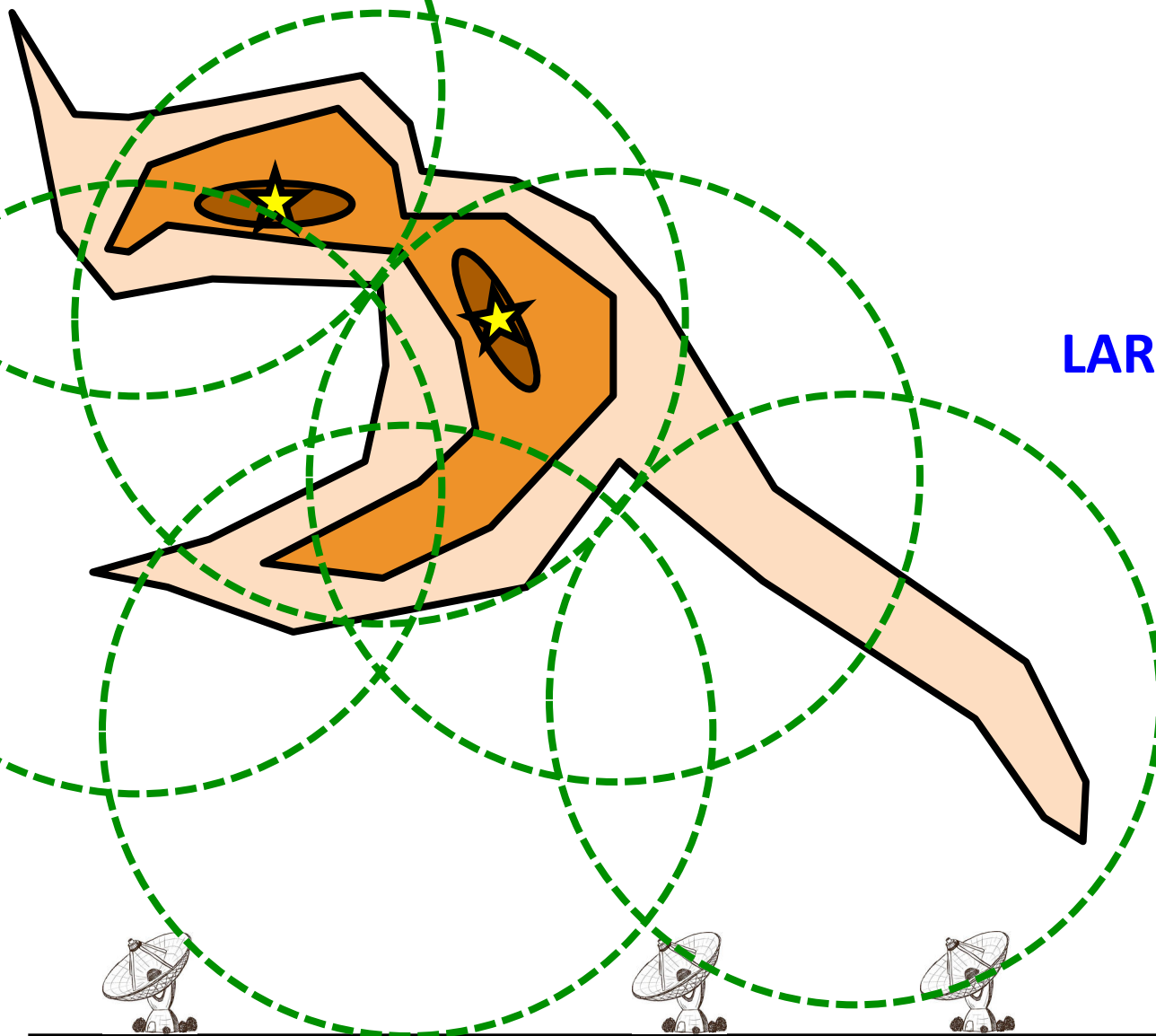
**LARGEST ANGULAR SCALE**

$$LAS = 1.22 \frac{\lambda}{B_{min}}$$

**PRIMARY BEAM**

$$PB = 1.22 \frac{\lambda}{D}$$

# Example III: disks and extended filament



**SYNTHESIZED BEAM**

$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$

**LARGEST ANGULAR SCALE**

$$LAS = 1.22 \frac{\lambda}{B_{min}}$$

**PRIMARY BEAM**

$$PB = 1.22 \frac{\lambda}{D}$$

# Practical work with the almaOT

# Starting the almaOT

The screenshot displays the ALMA Observing Tool (Cycle5) interface. The title bar shows the application name and the current project: "ALMA Observing Tool (Cycle5) - Project". The menu bar includes "File", "Edit", "View", "Tool", "Search", and "Help". The toolbar contains various icons for file operations and navigation.

The interface is divided into several panels:

- Project Structure:** A tree view showing the project hierarchy. The "Project" folder is expanded, revealing a "Proposal" folder, which is further expanded to show "Planned Observing" and "ScienceGoal (Science Goal)". Under "ScienceGoal", there are sub-items: "General", "Field Setup", "Spectral Setup", "Calibration Setup", "Control and Performance", and "Technical Justification".
- Editors:** A panel with tabs for "Spectral", "Spatial", and "Project". The "Project" tab is active, showing a form for "Principal Investigator" with a "Select Pl..." button. Below this is the "Main Project Information" section, which includes fields for "Project", "Assigned Priority", and "Project Code" (currently set to "None Assigned").
- Feedback:** A panel with tabs for "Validation", "Validation History", and "Log". The "Validation" tab is active, showing a table with columns for "Description" and "Suggestion".

# Field setup in the almaOT

The screenshot displays the ALMA Observing Tool (Cycle5) interface. The title bar shows the application name and the current project: "ALMA Observing Tool (Cycle5) - Project". The menu bar includes "File", "Edit", "View", "Tool", "Search", and "Help". The toolbar contains various icons for file operations and navigation.

The interface is divided into several panels:

- Project Structure:** A tree view on the left showing the project hierarchy. The "Field Setup" folder is highlighted with a red circle and a red arrow pointing to the text "FIELD SETUP" below it. The hierarchy includes: Project > Proposal > Planned Observing > ScienceGoal (Science Goal) > General > Field Setup. Other folders under "General" include Spectral Setup, Calibration Setup, Control and Performance, and Technical Justification.
- Editors:** A panel on the right with tabs for "Spectral", "Spatial", and "Project". The "Project" tab is active, showing configuration fields for:
  - Principal Investigator: A text input field with a "Select PI..." button.
  - Main Project Information: Fields for "Project", "Assigned Priority", and "Project Code" (currently set to "None Assigned").
- Feedback:** A panel at the bottom with tabs for "Validation", "Validation History", and "Log". It contains a table with columns for "Description" and "Suggestion".

# Field setup in the almaOT

The screenshot displays the ALMA Observing Tool (Cycle5) interface. The main window is titled "ALMA Observing Tool (Cycle5) - Project" and shows the "Field Setup" configuration panel. The interface includes a menu bar (File, Edit, View, Tool, Search, Help), a toolbar with various icons, and a "Project Structure" tree on the left. The "Field Setup" panel is divided into several sections: "SinglePoint", "Source", "Source Coordinates", "Source Radial Velocity", "Target Type", and "Expected Source Properties".

**Project Structure:**

- Project
  - Proposal
    - Planned Observing
      - ScienceGoal (Science Goal)
        - General
        - Field Setup
        - Spectral Setup
        - Calibration Setup
        - Control and Performance
        - Technical Justification

Input source details and mapping info or use the Visual Editor on the spatial tab.  
You must choose between checking 1 Rectangular Field on all sources or none.  
Check 1 Rectangular Field on the first source before adding others to put rectangular mosaics around multiple sources.

### SinglePoint

Source

Source Name  Resolve

Choose a Solar System Object?  Name of object

System  Sexagesimal display?

Source Coordinates

RA  Parallax

Dec  PM RA

PM DEC

Source Radial Velocity    z  Doppler Type

Target Type  Individual Pointing(s)  1 Rectangular Field

Expected Source Properties

Peak Continuum Flux Density per Synthesized Beam

Continuum Polarization Percentage  per cent

Peak Line Flux Density per Synthesized Beam

Line Width

### Feedback

Validation Validation History Log

Description	Suggestion

# Field setup in the almaOT

The screenshot displays the ALMA Observing Tool (Cycle5) interface. The main window is titled "ALMA Observing Tool (Cycle5) - Project". The interface is divided into several sections:

- Project Structure:** A tree view on the left shows the project hierarchy: Project > Proposal > Planned Observing > ScienceGoal (Science Goal) > Field Setup (highlighted).
- Editors:** A central panel with tabs for "Spectral", "Spatial" (circled in red), and "Field Setup".
- Field Setup Panel:** Contains the following fields:
  - Source Name:** A text input field with a "Resolve" button.
  - Choose a Solar System Object?:** A checkbox.
  - Name of object:** A dropdown menu currently set to "Unspecified".
  - Source Coordinates:** Fields for System (ICRS), Sexagesimal display? (checked), RA (00:00:00.0000), and Dec (00:00:00.000).
  - Parallax:** 0.00000 mas.
  - PM RA:** 0.00000 mas/yr.
  - PM DEC:** 0.00000 mas/yr.
  - Source Radial Velocity:** 0.000 km/s, with a dropdown for "lsrk" and a redshift field "z" set to 0.000000000.
  - Doppler Type:** RADIO.
  - Target Type:** Radio buttons for "Individual Pointing(s)" (selected) and "1 Rectangular Field".
  - Expected Source Properties:** Fields for Peak Continuum Flux Density per Synthesized Beam (0.00000 Jy), Continuum Polarization Percentage (0.0 per cent), Peak Line Flux Density per Synthesized Beam (0.00000 Jy), and Line Width (0.00000 km/s).
- Feedback:** A section at the bottom with tabs for "Validation", "Validation History", and "Log". Below these is a table with columns for "Description" and "Suggestion".



# Field setup in the almaOT

The screenshot displays the ALMA Observing Tool (Cycle5) interface. The title bar shows the application name and the current project: "ALMA Observing Tool (Cycle5) - Project". The system tray includes the date and time: "Mon 27 Mar 09:50" and the user name: "Alvaro Sanchez".

The interface is divided into several panels:

- Project Structure:** A tree view on the left showing the project hierarchy: Project > Proposal > Planned Observing > ScienceGoal (Science Goal) > Field Setup (selected).
- Editors:** A central panel with tabs for "Spectral", "Spatial", and "Field Setup". The "Field Setup" tab is active, showing a "Spatial Image" viewer with a yellow box indicating the field of view. Below the viewer are zoom controls (1x, 320, 306, 0.0) and an "Image Filename" input field.
- FOV Parameters:** A section below the image viewer with the following values:
  - Representative Frequency (Sky): 0.000 GHz
  - Antenna Diameter: 12m
  - Antenna Beamsize (HPBW): 0.000 arcsec
- SinglePoint:** A configuration panel on the right for a single pointing. It includes:
  - Source:** Source Name, Choose a Solar System Object?, Name of object.
  - Source Coordinates:** System (ICRS), Sexagesimal display? (checked), RA (00:00:00.0000), Dec (00:00:00.000).
  - Source Radial Velocity:** 0.000 km/s, lsrk.
  - Target Type:** Individual Pointing(s) (selected), 1 Rectangular.
  - Expected Source Properties:** Peak Continuum Flux Density per Synthesized Beam, Continuum Polarization Percentage, Peak Line Flux Density per Synthesized Beam, Line Width, Line Polarization Percentage.
  - Field Center Coordinates:** Coord Type (Relative selected), Absolute, Offset Unit (arcsec), #Pointings (1), RA [arcsec] (0.00000).

# Field setup in the almaOT

The screenshot displays the ALMA Observing Tool (Cycle5) interface. The main window is titled "ALMA Observing Tool (Cycle5) - Project" and shows a menu bar (File, Edit, View, Tool, Search, Help) and a toolbar with various icons. The interface is divided into two main panes: "Project Structure" on the left and "Editors" on the right.

**Project Structure:** A tree view showing the project hierarchy. The "Field Setup" option is highlighted under the "ScienceGoal (Science Goal)" folder.

**Editors:** The "Field Setup" tab is active. It contains the following configuration options:

- Source:** A text input field for the source name, with a "Resolve" button to the right.
- Choose a Solar System Object?:** A checkbox, currently unchecked. The "Name of object" dropdown is set to "Unspecified".
- Source Coordinates:** Fields for RA (00:00:00.0000) and Dec (00:00:00.000). The "System" is set to "ICRS". A "Sexagesimal display?" checkbox is checked. "Parallax" is 0.00000 mas, "PM RA" is 0.00000 mas/yr, and "PM DEC" is 0.00000 mas/yr.
- Source Radial Velocity:** A field for velocity (0.000 km/s) with a "lsrk" dropdown, and a redshift field (z = 0.000000000) with a "Doppler Type" dropdown set to "RADIO".
- Target Type:** Radio buttons for "Individual Pointing(s)" (selected) and "1 Rectangular Field".
- Expected Source Properties:** Fields for "Peak Continuum Flux Density per Synthesized Beam" (0.00000 Jy), "Continuum Polarization Percentage" (0.0 per cent), "Peak Line Flux Density per Synthesized Beam" (0.00000 Jy), "Line Width" (0.00000 km/s), and "Line Polarization Percentage" (0.0 per cent).
- Field Center Coordinates:** Radio buttons for "Coord Type" (Relative selected, Absolute unselected), a dropdown for "Offset Unit" (arcsec), and a field for "#Pointings" (1).

# Field setup in the almaOT

The screenshot displays the ALMA Observing Tool (Cycle5) interface. The main window is titled "ALMA Observing Tool (Cycle5) - Project" and shows a menu bar (File, Edit, View, Tool, Search, Help) and a toolbar. The "Project Structure" pane on the left shows a tree view with "Project" expanded to "Planned Observing" and "ScienceGoal (Science Goal)", with "Field Setup" selected. The "Editors" pane on the right has tabs for "Spectral", "Spatial", and "Field Setup". The "Field Setup" tab is active, showing a "Source" configuration panel. A red box highlights the "Source Name" input field, which is currently empty, with the text "Name of the source" written in red next to it. The "Source Name" field is followed by a "Resolve" button. Below the "Source Name" field, there is a "Choose a Solar System Object?" checkbox and a "Name of object" dropdown menu set to "Unspecified". The "Source Coordinates" section includes "System" (ICRS), "Sexagesimal display?" (checked), "RA" (00:00:00.0000), "Dec" (00:00:00.0000), "Parallax" (0.00000 mas), "PM RA" (0.00000 mas/yr), and "PM DEC" (0.00000 mas/yr). The "Source Radial Velocity" section includes "Source Radial Velocity" (0.000 km/s), "lsrk" checkbox, "z" (0.000000000), and "Doppler Type" (RADIO). The "Target Type" section has radio buttons for "Individual Pointing(s)" (selected) and "1 Rectangular Field". The "Expected Source Properties" section includes "Peak Continuum Flux Density per Synthesized Beam" (0.00000 Jy), "Continuum Polarization Percentage" (0.0 per cent), "Peak Line Flux Density per Synthesized Beam" (0.00000 Jy), "Line Width" (0.00000 km/s), and "Line Polarization Percentage" (0.0 per cent). The "Field Center Coordinates" section includes "Coord Type" (Relative), "Offset Unit" (arcsec), and "#Pointings" (1).

ALMA Observing Tool (Cycle5) - Project

File Edit View Tool Search Help

Project Structure

Proposal Program

Unsubmitted Proposal

Project

Proposal

Planned Observing

ScienceGoal (Science Goal)

General

Field Setup

Spectral Setup

Calibration Setup

Control and Performance

Technical Justification

Editors

Spectral Spatial Field Setup

Input source details and mapping info or use the Visual Editor on the spatial tab.  
You must choose between checking 1 Rectangular Field on all sources or none.  
Check 1 Rectangular Field on the first source before adding others to put rectangular mosaics around multiple sources.

SinglePoint

Source

Source Name  **Name of the source** Resolve

Choose a Solar System Object?  Name of object Unspecified

System ICRS Sexagesimal display?  Parallax 0.00000 mas

Source Coordinates RA 00:00:00.0000 PM RA 0.00000 mas/yr

Dec 00:00:00.0000 PM DEC 0.00000 mas/yr

Source Radial Velocity 0.000 km/s lsrk z 0.000000000 Doppler Type RADIO

Target Type  Individual Pointing(s)  1 Rectangular Field

Expected Source Properties

Peak Continuum Flux Density per Synthesized Beam 0.00000 Jy

Continuum Polarization Percentage 0.0 per cent

Peak Line Flux Density per Synthesized Beam 0.00000 Jy

Line Width 0.00000 km/s

Line Polarization Percentage 0.0 per cent

Field Center Coordinates

Coord Type  Relative  Absolute

Offset Unit arcsec

#Pointings 1

# Field setup in the almaOT

**Project Structure**

- Project
  - Proposal
    - Planned Observing
      - ScienceGoal (Science Goal)
        - General
        - Field Setup**
        - Spectral Setup
        - Calibration Setup
        - Control and Performance
        - Technical Justification

**Editors**

Spectral | Spatial | **Field Setup**

Input source details and mapping info or use the Visual Editor on the spatial tab.  
You must choose between checking 1 Rectangular Field on all sources or none.  
Check 1 Rectangular Field on the first source before adding others to put rectangular mosaics around multiple sources.

**SinglePoint**

Source

Source Name  **Name of the source** Resolve

Choose a Solar System Object?  Name of object

System  Sexagesimal

Source Coordinates

RA  **Coordinates of the source**

Dec

Parallax

PM RA

PM DEC

Source Radial Velocity    z  Doppler Type

Target Type  Individual Pointing(s)  1 Rectangular Field

Expected Source Properties

Peak Continuum Flux Density per Synthesized Beam

Continuum Polarization Percentage  per cent

Peak Line Flux Density per Synthesized Beam

Line Width

Line Polarization Percentage  per cent

Field Center Coordinates

Coord Type  Relative  Absolute

Offset Unit

#Pointings

# Field setup in the almaOT

**Project Structure**

- Project
  - Proposal
    - Planned Observing
      - ScienceGoal (Science Goal)
        - General
        - Field Setup**
        - Spectral Setup
        - Calibration Setup
        - Control and Performance
        - Technical Justification

**Editors**

Spectral | Spatial | **Field Setup**

Input source details and mapping info or use the Visual Editor on the spatial tab.  
You must choose between checking 1 Rectangular Field on all sources or none.  
Check 1 Rectangular Field on the first source before adding others to put rectangular mosaics around multiple sources.

**SinglePoint**

Source

Source Name  **Name of the source** Resolve

Choose a Solar System Object?  Name of object: Unspecified

System: ICRS Sexagesimal

Source Coordinates

RA:  **Coordinates of the source**

Dec:  **Coordinates of the source**

Source Radial Velocity:  km/s **Velocity / redshift**  z:  Doppler Type: RADIO

Target Type:  Individual Pointing(s)  1 Rectangular Field

Expected Source Properties

Peak Continuum Flux Density per Synthesized Beam:  Jy

Continuum Polarization Percentage:  per cent

Peak Line Flux Density per Synthesized Beam:  Jy

Line Width:  km/s

Line Polarization Percentage:  per cent

Field Center Coordinates

Coord Type:  Relative  Absolute

Offset Unit:

#Pointings:

# Field setup in the almaOT

**Project Structure**

- Project
  - Proposal
    - Planned Observing
      - ScienceGoal (Science Goal)
        - General
        - Field Setup**
        - Spectral Setup
        - Calibration Setup
        - Control and Performance
        - Technical Justification

**Editors**

Spectral | Spatial | **Field Setup**

Input source details and mapping info or use the Visual Editor on the spatial tab.  
You must choose between checking 1 Rectangular Field on all sources or none.  
Check 1 Rectangular Field on the first source before adding others to put rectangular mosaics around multiple sources.

**SinglePoint**

Source

Source Name  **Name of the source** Resolve

Choose a Solar System Object?  Name of object: Unspecified

System: ICRS Sexagesimal

Source Coordinates

RA:  **Coordinates of the source**

Dec:  **Coordinates of the source**

Parallax: 0.00000 mas

PM RA: 0.00000 mas/yr

PM DEC: 0.00000 mas/yr

Source Radial Velocity:  km/s **Velocity / redshift**

Target Type:  Individual Pointing(s)  1 Rectangular Field

Expected Source Properties

Peak Continuum Flux Density per Synthesized Beam:  Jy **Expected intensity of the source**

Continuum Polarization Percentage:  per cent

Peak Line Flux Density per Synthesized Beam:  Jy **Expected intensity of the source**

Line Width:  km/s **Expected intensity of the source**

Line Polarization Percentage:  per cent

Field Center Coordinates

Coord Type:  Relative  Absolute

Offset Unit: arcsec

#Pointings: 1

# Field setup in the almaOT

**Project Structure**

- Project
  - Proposal
    - Planned Observing
      - ScienceGoal (Science Goal)
        - General
        - Field Setup**
        - Spectral Setup
        - Calibration Setup
        - Control and Performance
        - Technical Justification

**Editors**

Spectral | Spatial | **Field Setup**

Input source details and mapping info or use the Visual Editor on the spatial tab.  
You must choose between checking 1 Rectangular Field on all sources or none.  
Check 1 Rectangular Field on the first source before adding others to put rectangular mosaics around multiple sources.

**SinglePoint**

Source

Source Name:  **Name of the source** Resolve

Choose a Solar System Object?  Name of object: Unspecified

System: ICRS Sexagesimal

Source Coordinates

RA:  **Coordinates of the source**

Dec:  **Coordinates of the source**

Source Radial Velocity:  km/s **Velocity / redshift**

Target Type:  Individual Pointing(s)  1 Rectangular Field

Expected Source Properties

Peak Continuum Flux Density per Synthesized Beam:  Jy

Continuum Polarization Percentage:  per cent

Peak Line Flux Density per Synthesized Beam:  Jy **Expected intensity of the source**

Line Width:  km/s

Line Polarization Percentage:  per cent

Field Center Coordinates

Coord Type:  Relative  Absolute

Offset Unit: arcsec

#Pointings: 1

# Field setup in the almaOT

The screenshot displays the ALMA Observing Tool (Cycle5) interface. The main window is titled "ALMA Observing Tool (Cycle5) - Project" and shows the "Field Setup" configuration panel. The interface includes a menu bar (File, Edit, View, Tool, Search, Help), a toolbar with various icons, and a "Project Structure" tree on the left. The "Field Setup" panel is divided into several sections: "SinglePoint", "Source", "Source Coordinates", "Source Radial Velocity", "Target Type", "Expected Source Properties", and "Field Center Coordinates".

**Project Structure:**

- Project
  - Proposal
    - Planned Observing
      - ScienceGoal (Science Goal)
        - General
        - Field Setup**
        - Spectral Setup
        - Calibration Setup
        - Control and Performance**
        - Technical Justification

**CONTROL and PERFORMANCE**

**Editors**

Spectral | Spatial | **Field Setup**

Input source details and mapping info or use the Visual Editor on the spatial tab.  
You must choose between checking 1 Rectangular Field on all sources or none.  
Check 1 Rectangular Field on the first source before adding others to put rectangular mosaics around multiple sources.

**SinglePoint**

Source

Source Name  Resolve

Choose a Solar System Object?  Name of object

System  Sexagesimal display?

Parallax

Source Coordinates

RA  PM RA

Dec  PM DEC

Source Radial Velocity    z  Doppler Type

Target Type  Individual Pointing(s)  1 Rectangular Field

Expected Source Properties

Peak Continuum Flux Density per Synthesized Beam

Continuum Polarization Percentage  per cent

Peak Line Flux Density per Synthesized Beam

Line Width

Line Polarization Percentage  per cent

Field Center Coordinates

Coord Type  Relative  Absolute

Offset Unit

#Pointings



# Control and Performance in the almaOT

The screenshot displays the ALMA Observing Tool (Cycle5) interface. The main window is titled "ALMA Observing Tool (Cycle5) - Project" and shows the "Control and Performance" configuration panel. The interface includes a menu bar (File, Edit, View, Tool, Search, Help), a toolbar with various icons, and a "Project Structure" pane on the left. The "Control and Performance" panel is divided into several sections: "Configuration Information", "Desired Performance", and "Override OT's sensitivity-based time estimate (must be justified)".

**Project Structure:**

- Project
  - Proposal
    - Planned Observing
      - ScienceGoal (Science Goal)
        - General
        - Field Setup
        - Spectral Setup
        - Calibration Setup
        - Control and Performance
        - Technical Justification

ALMA Observing Tool (Cycle5) - Project

File Edit View Tool Search Help

ALMA Observing Tool (Cycle5) - Project

Perspective 1

Project Structure

Proposal Program

Unsubmitted Proposal

- Project
  - Proposal
    - Planned Observing
      - ScienceGoal (Science Goal)
        - General
        - Field Setup
        - Spectral Setup
        - Calibration Setup
        - Control and Performance
        - Technical Justification

Editors

Spectral Spatial Control and Performance

These parameters are used to control various aspects of the observations, including the required antenna configurations and integration time.

Control and Performance

Configuration Information

Antenna Beamsize ( $1.13 * \lambda / D$ )	12m	0.000 arcsec	7m	0.000 arcsec		
Number of Antennas	12m	43	7m	10	TP	3
	ACA 7m configuration		Most compact 12m configuration		Most extended 12m configuration	
Longest baseline	0.049 km	0.161 km	16.197 km			
Synthesized beamsize	0.000 arcsec	0.000 arcsec	0.000 arcsec			
Shortest baseline	0.009 km	0.015 km	0.256 km			
Maximum recoverable scale	0.000 arcsec	0.000 arcsec	0.000 arcsec			

Desired Performance

Desired Angular Resolution (Synthesized Beam)  Single  Range  Any  Standalone ACA

0.00000 arcsec

Largest Angular Structure in source Undefined arcsec

Desired sensitivity per pointing 0.00000 Jy equivalent to Infinity K

Bandwidth used for Sensitivity RepresentativeWindowResolution Frequency Width 0.000000 GHz

Science goal integration time estimate Time Estimate

Override OT's sensitivity-based time estimate (must be justified)  Yes  No

Are the observations time constrained?  Yes  No

# Control and Performance in the almaOT

The screenshot displays the ALMA Observing Tool (Cycle5) interface. The main window is titled "ALMA Observing Tool (Cycle5) - Project" and shows a "Control and Performance" configuration panel. The left sidebar shows the "Project Structure" with a tree view including "Project", "Proposal", "Planned Observing", "ScienceGoal (Science Goal)", "General", "Field Setup", "Spectral Setup", "Calibration Setup", "Control and Performance", and "Technical Justification". The "Control and Performance" panel is highlighted with a red rounded rectangle and contains the following configuration options:

These parameters are used to control various aspects of the observations, including the required antenna configurations and integration time.

Configuration Information

Antenna Beamsize ( $1.13 * \lambda / D$ )	12m 0.000 arcsec	7m 0.000 arcsec	
Number of Antennas	12m 43	7m 10 TP 3	
	ACA 7m configuration	Most compact 12m configuration	Most extended 12m configuration
Longest baseline	0.049 km	0.161 km	16.197 km
Synthesized beamsize	0.000 arcsec	0.000 arcsec	0.000 arcsec
Shortest baseline	0.009 km	0.015 km	0.256 km
Maximum recoverable scale	0.000 arcsec	0.000 arcsec	0.000 arcsec

Desired Performance

Desired Angular Resolution (Synthesized Beam)  Single  Range  Any  Standalone ACA

0.00000 arcsec

Largest Angular Structure in source Undefined arcsec

Desired sensitivity per pointing 0.00000 Jy equivalent to Infinity K

Bandwidth used for Sensitivity RepresentativeWindowResolution Frequency Width 0.000000 GHz

Science goal integration time estimate Time Estimate

Override OT's sensitivity-based time estimate (must be justified)  Yes  No

Are the observations time constrained?  Yes  No

# Control and Performance in the almaOT

## Control and Performance

### Configuration Information

Antenna Beamsize ( $1.13 * \lambda / D$ )	12m	<input type="text" value="0.000 arcsec"/>	7m	<input type="text" value="0.000 arcsec"/>	
Number of Antennas	12m	<input type="text" value="43"/>	7m	<input type="text" value="10"/>	TP <input type="text" value="3"/>
	ACA 7m configuration		Most compact 12m configuration		Most extended 12m configuration
Longest baseline	<input type="text" value="0.049 km"/>	<input type="text" value="0.161 km"/>	<input type="text" value="16.197 km"/>		
Synthesized beamsize	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>		
Shortest baseline	<input type="text" value="0.009 km"/>	<input type="text" value="0.015 km"/>	<input type="text" value="0.256 km"/>		
Maximum recoverable scale	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>		

### Desired Performance

Desired Angular Resolution (Synthesized Beam)  Single  Range  Any  Standalone ACA

▼

Largest Angular Structure in source

▼

# Control and Performance in the almaOT

Control and Performance

Configuration Information

Antenna Beamsize ( $1.13 * \lambda / D$ )	12m	<input type="text" value="0.000 arcsec"/>	7m	<input type="text" value="0.000 arcsec"/>	
Number of Antennas	12m	<input type="text" value="43"/>	7m	<input type="text" value="10"/>	TP <input type="text" value="3"/>

ACA 7m configuration      Most compact 12m configuration      Most extended 12m configuration

Longest baseline	<input type="text" value="0.049 km"/>	<input type="text" value="0.161 km"/>	<input type="text" value="16.197 km"/>
Synthesized beamsize	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>
Shortest baseline	<input type="text" value="0.009 km"/>	<input type="text" value="0.015 km"/>	<input type="text" value="0.256 km"/>
Maximum recoverable scale	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>

Desired Performance

Desired Angular Resolution (Synthesized Beam)  Single  Range  Any  Standalone ACA

**Synthesized beam**

Largest Angular Structure in source

# Control and Performance in the almaOT

Control and Performance

Configuration Information

Antenna Beamsize ( $1.13 * \lambda / D$ )	12m	<input type="text" value="0.000 arcsec"/>	7m	<input type="text" value="0.000 arcsec"/>	
Number of Antennas	12m	<input type="text" value="43"/>	7m	<input type="text" value="10"/>	TP <input type="text" value="3"/>

ACA 7m configuration      Most compact 12m configuration      Most extended 12m configuration

Longest baseline	<input type="text" value="0.049 km"/>	<input type="text" value="0.161 km"/>	<input type="text" value="16.197 km"/>
Synthesized beamsize	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>
Shortest baseline	<input type="text" value="0.009 km"/>	<input type="text" value="0.015 km"/>	<input type="text" value="0.256 km"/>
Maximum recoverable scale	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>

Desired Performance

Desired Angular Resolution (Synthesized Beam)  Single  Range  Any  Standalone ACA

	<input type="text" value="0.00000"/>	arcsec	<b>Synthesized beam</b>
Largest Angular Structure in source	<input type="text" value="Undefined"/>	arcsec	<b>Largest angular scale</b>

# Control and Performance in the almaOT

Control and Performance

Configuration Information

Antenna Beamsize ( $1.13 * \lambda / D$ )	12m	<input type="text" value="0.000 arcsec"/>	7m	<input type="text" value="0.000 arcsec"/>	
Number of Antennas	12m	<input type="text" value="43"/>	7m	<input type="text" value="10"/>	TP <input type="text" value="3"/>
	ACA 7m configuration	Most compact 12m configuration	Most extended 12m configuration		
Longest baseline	<input type="text" value="0.049 km"/>	<input type="text" value="0.161 km"/>	<input type="text" value="16.197 km"/>		
Synthesized beamsize	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>		
Shortest baseline	<input type="text" value="0.009 km"/>	<input type="text" value="0.015 km"/>	<input type="text" value="0.256 km"/>		
Maximum recoverable scale	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>		

Desired Performance

Desired Angular Resolution (Synthesized Beam)  Single  Range  Any  Standalone ACA

arcsec **Synthesized beam**

Largest Angular Structure in source  arcsec **Largest angular scale**

## SYNTHESIZED BEAM

a.k.a. angular resolution, PSF, ...  
it is the size of the object you want  
to resolve (distinguish)

$$\theta_{beam} = 1.22 \frac{\lambda}{B_{max}}$$

# Control and Performance in the almaOT

Control and Performance

Configuration Information

Antenna Beamsize ( $1.13 * \lambda / D$ )	12m	<input type="text" value="0.000 arcsec"/>	7m	<input type="text" value="0.000 arcsec"/>	
Number of Antennas	12m	<input type="text" value="43"/>	7m	<input type="text" value="10"/>	TP <input type="text" value="3"/>

ACA 7m configuration      Most compact 12m configuration      Most extended 12m configuration

Longest baseline	<input type="text" value="0.049 km"/>	<input type="text" value="0.161 km"/>	<input type="text" value="16.197 km"/>
Synthesized beamsize	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>
Shortest baseline	<input type="text" value="0.009 km"/>	<input type="text" value="0.015 km"/>	<input type="text" value="0.256 km"/>
Maximum recoverable scale	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>	<input type="text" value="0.000 arcsec"/>

Desired Performance

Desired Angular Resolution (Synthesized Beam)  Single  Range  Any  Standalone ACA

arcsec **Synthesized beam**

Largest Angular Structure in source  arcsec **Largest angular scale**

## LARGEST ANGULAR SCALE

a.k.a. maximum angular size, ...  
the largest size of your object  
how big it is?

$$LAS = 1.22 \frac{\lambda}{B_{\min}}$$

# Mosaics in the almaOT

The screenshot displays the ALMA Observing Tool (Cycle5) interface. The title bar shows the application name and the current project: "ALMA Observing Tool (Cycle5) - Project". The system tray indicates the date and time as "Mon 27 Mar 09:50" and the user as "Alvaro Sanchez".

The interface is divided into several panels:

- Project Structure:** A tree view on the left showing the project hierarchy: Project > Proposal > Planned Observing > ScienceGoal (Science Goal) > Field Setup (selected).
- Editors:** A central panel with tabs for "Spectral", "Spatial", and "Field Setup". The "Spatial" tab is active, showing a "Spatial Image" with a yellow box indicating a region of interest. Below the image are zoom controls (1x, 320, 306, 0.0) and an "Image Filename" field.
- FOV Parameters:** A section at the bottom of the Spatial Image panel containing:
  - Representative Frequency (Sky): 0.000 GHz
  - Antenna Diameter: 12m
  - Antenna Beamsize (HPBW): 0.000 arcsec
- SinglePoint:** A panel on the right for configuring source parameters:
  - Source Name: (empty field)
  - Choose a Solar System Object?:
  - System: ICRS (dropdown), Sexagesimal display?:
  - Source Coordinates: RA: 00:00:00.0000, Dec: 00:00:00.000
  - Source Radial Velocity: 0.000 km/s, lsrk (dropdown)
  - Target Type:  Individual Pointing(s),  1 Rectangular
  - Expected Source Properties: Peak Continuum Flux Density per Synthesized Beam, Continuum Polarization Percentage, Peak Line Flux Density per Synthesized Beam, Line Width, Line Polarization Percentage
  - Field Center Coordinates: Coord Type:  Relative,  Absolute; Offset Unit: arcsec; #Pointings: 1; RA [arcsec]: 0.00000



# Mosaics in the almaOT

Spectral Spatial Field Setup

Spatial Image

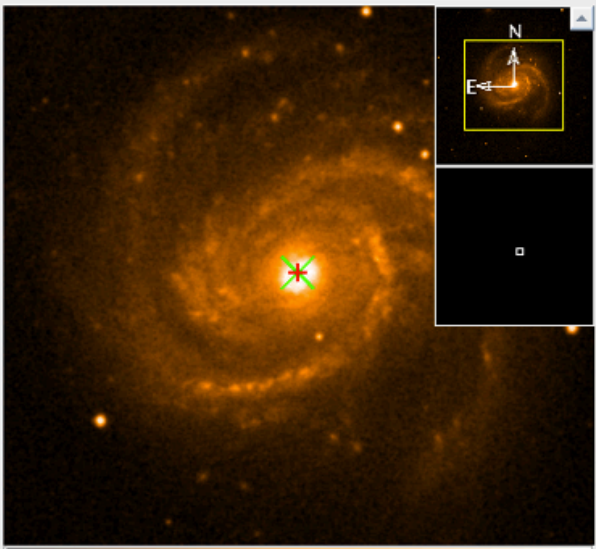


Image Filename `l/.jsky3/cache/jsky1814992724433392157.fits`

FOV Parameters

Representative Frequency (Sky)

Antenna Diameter

Antenna Beamsize (HPBW)

Show Antenna Beamsize

Image Query

Image Server

Image Size(arcmin)

M100

Source

Source Name

Choose a Solar System Object?  Name of object

System  Sexagesimal display?

Parallax

Source Coordinates

RA  PM RA

Dec  PM DEC

Resolved by cdsws.u-strasbg.fr (SIMBAD)

Source Radial Velocity    z  Doppler Type

Target Type  Individual Pointing(s)  1 Rectangular Field

Expected Source Properties

Peak Continuum Flux Density per Synthesized Beam

Continuum Polarization Percentage  %

Peak Line Flux Density per Synthesized Beam

Line Width

Line Polarization Percentage  %

Field Center Coordinates

Custom Mosaic:

PointingPattern:  Offset

Offset Unit

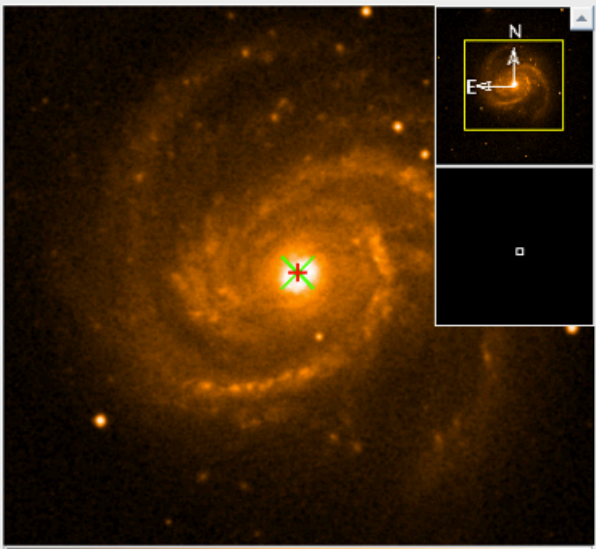
#Pointings

RA [arcsec]	Dec [arcsec]
0.00000	0.00000

# Mosaics in the almaOT

Spectral Spatial Field Setup

Spatial Image



M100

Source

Source Name M100 Resolve

Choose a Solar System Object?  Name of object Unspecified

System FK5 J2000 Sexagesimal display?  Parallax 0.00000 mas

Source Coordinates RA 12:22:54.8989 PM RA 0.00000 mas/yr  
Dec 15:49:20.570 PM DEC 0.00000 mas/yr  
Resolved by cdsws.u-strasbg.fr (SIMBAD)

Source Radial Velocity 1569.779 km/s hel z 0.005250000 Doppler Type RELATIVISTIC

Target Type  Individual Pointing(s)  1 Rectangular Field

Expected Source Properties

Peak Continuum Flux Density per Synthesized Beam 0.00000 Jy

Continuum Polarization Percentage 0.0 %

Peak Line Flux Density per Synthesized Beam 0.00000 Jy

Line Width 0.00000 km/s

Line Polarization Percentage 0.0 %

Field Center Coordinates

Custom Mosaic:

PointingPattern : Offset

Offset Unit arcsec

#Pointings 1

RA [arcsec]	Dec [arcsec]
0.00000	0.00000

**Pointings by hand**

Image Filename i/.jsky3/cache/jsky1814992724433392157.fits

FOV Parameters

Representative Frequency (Sky) 0.000 GHz

Antenna Diameter 12m

Antenna Beamsize (HPBW) 0.000 arcsec

Show Antenna Beamsize

Image Query

Image Server Digitized Sky (Version II) at ESO

Image Size(arcmin) 10.0 Query

Add Source Load from File... Export to File... Delete Source Delete All Sources

# Mosaics in the almaOT

Interactive mosaic

The screenshot displays the almaOT interface with the following components:

- Spatial Image Panel:** Shows a spatial image of M100. A toolbar at the top includes icons for file operations and a red circle highlights the mosaic tool (a grid icon).
- M100 Source Configuration Panel:** Contains fields for Source Name (M100), Source Coordinates (RA: 12:22:54.8989, Dec: 15:49:20.570), and Source Radial Velocity (1569.779 km/s). It also includes a 'Field Center Coordinates' section with a table for manual pointing entries.

RA [arcsec]	Dec [arcsec]
0.00000	0.00000

**Pointings by hand**

# Break #1

German ARC: ALMA community days (March 2017)