Measuring of Magnetic field in the Star-forming Region: G351.775 by Zeeman splitting of 1665 MHz OH Masers

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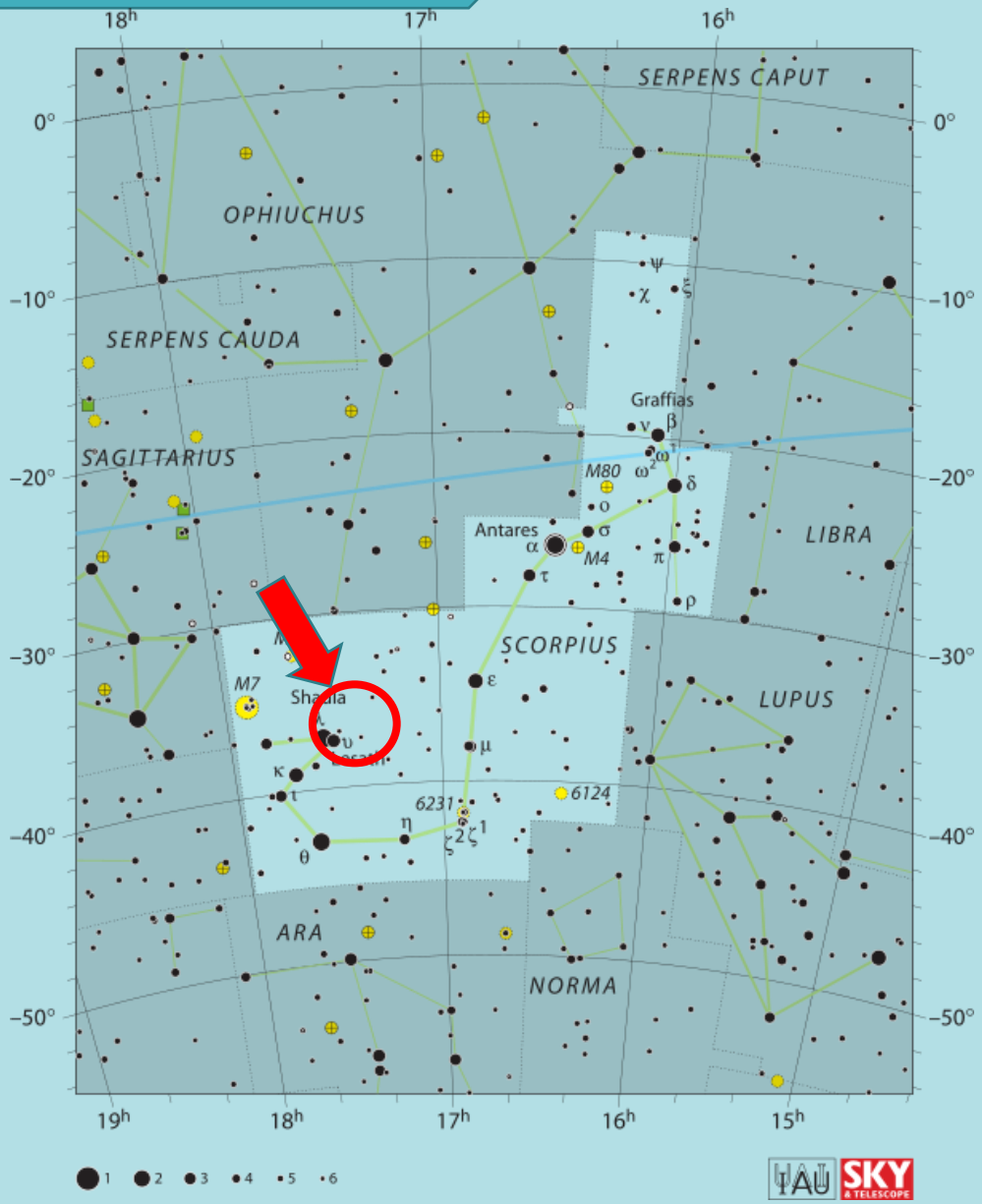
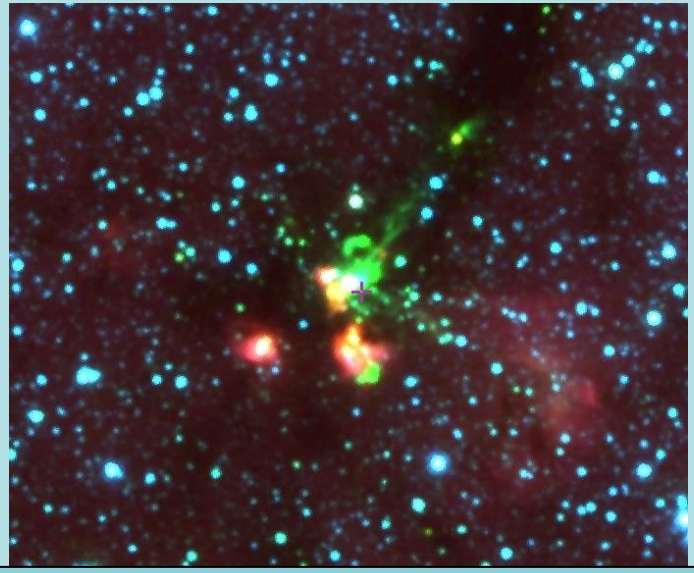
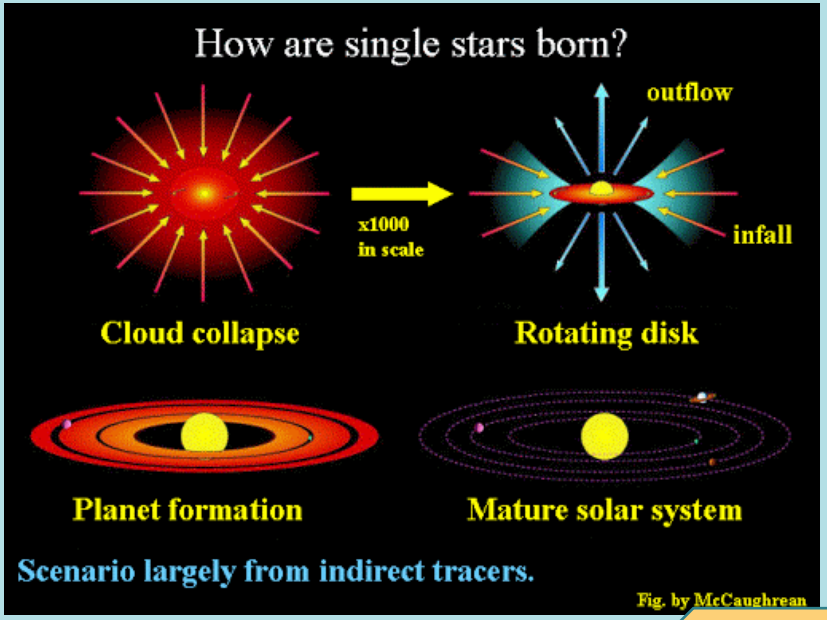
G351.775



https://upload.wikimedia.org/wikipedia/commons/3/38/



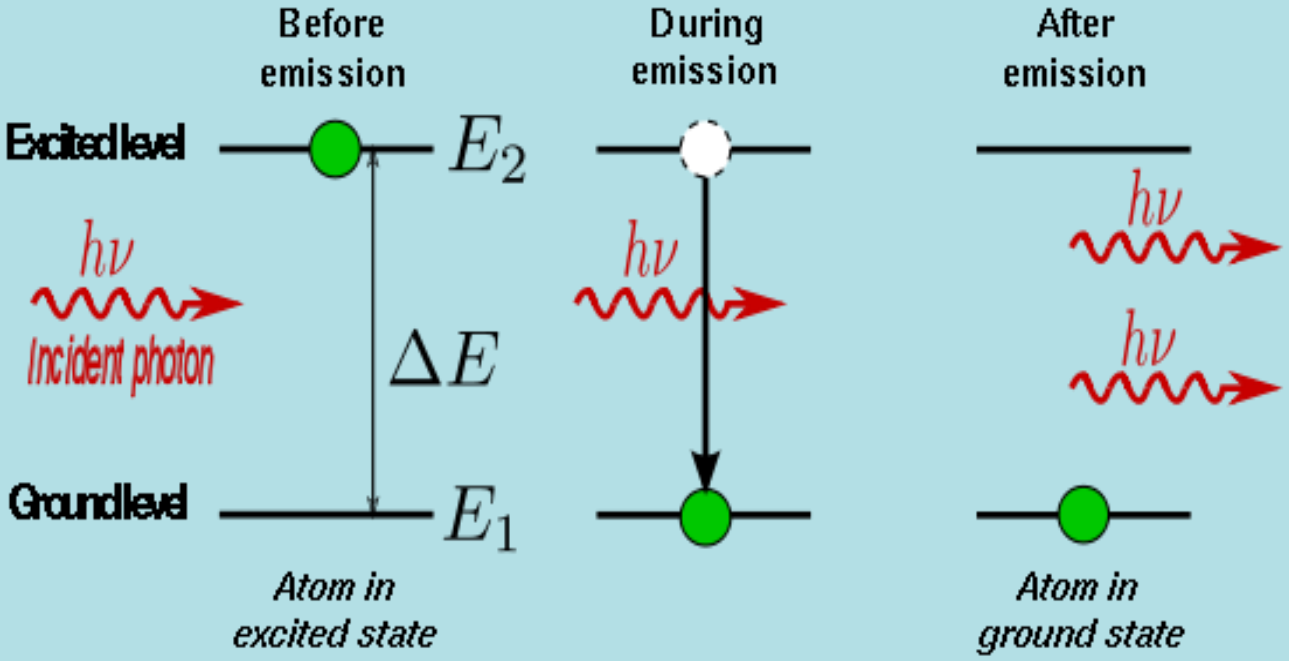
IRAC, 8 μm(r) & 4.5 μm(g)



https://lh3.googleusercontent.com/proxy/

MASER

Maser: Microwave Amplification by Stimulated Emission of Radiation



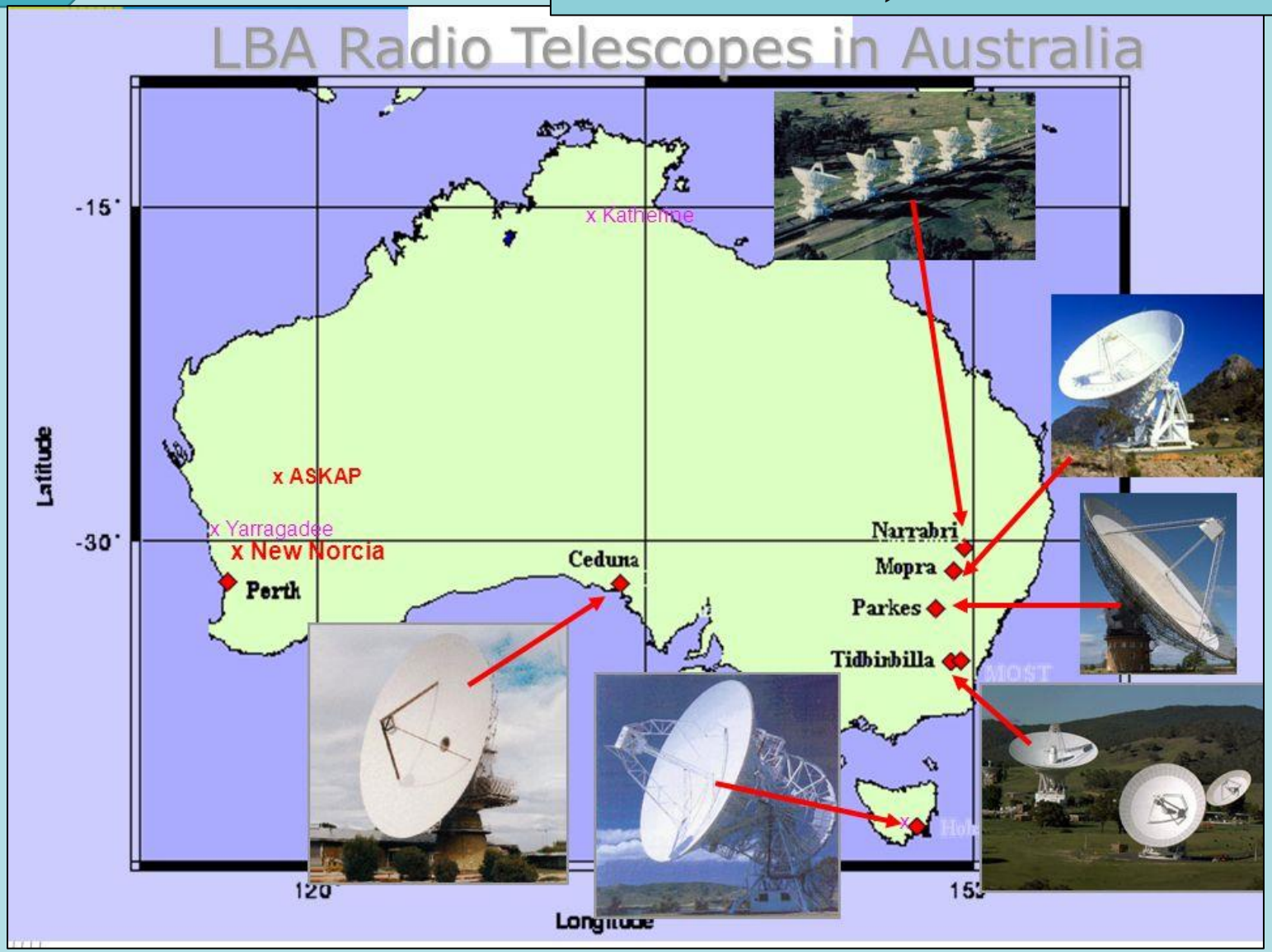
$$E_2 - E_1 = \Delta E = h\nu$$

https://en.wikipedia.org/wiki/Megamaser#/media/File:Stimulated_Emission.svg

OH, CH, H_2CO, H_2O, NH_3, CH_3OH

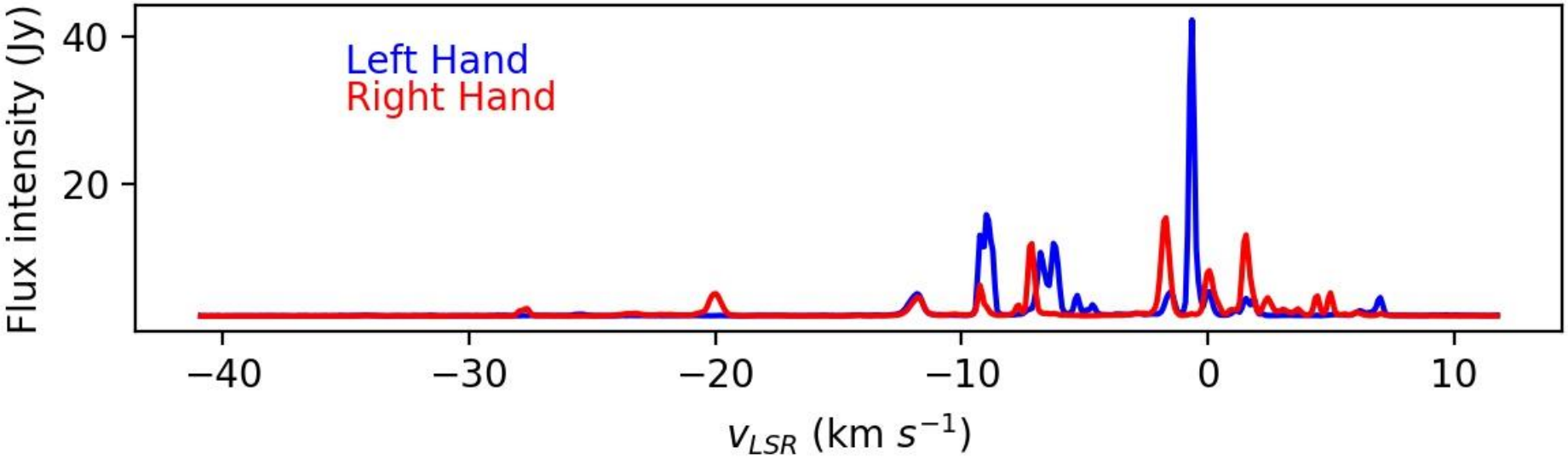
LBA

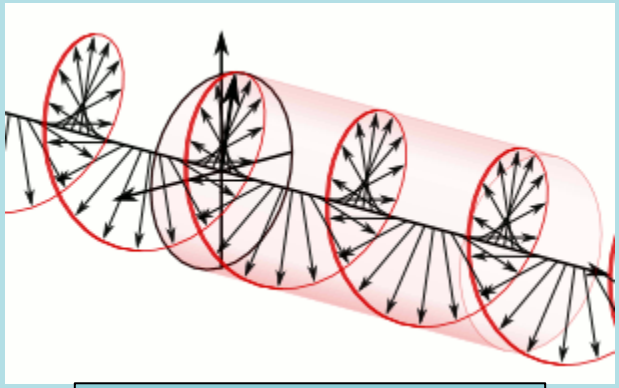
OH 1665 MHz, 10 Mar 2012



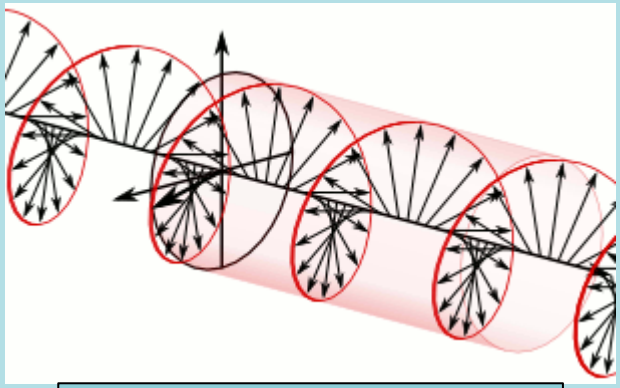
https://images.slideplayer.com/24/7356434/slides/slide_3.jpg

OH spectra





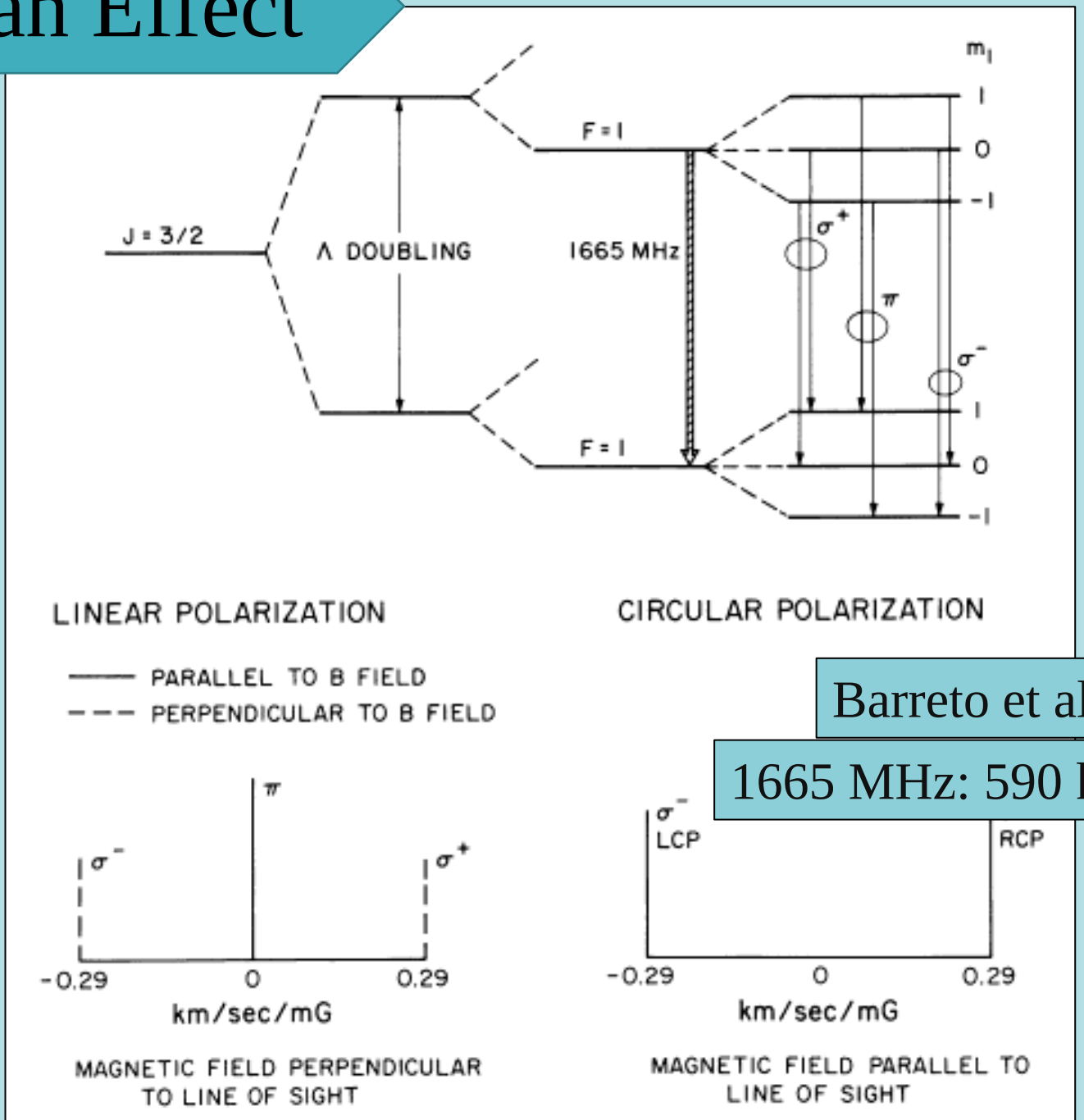
left-hand circularly



right-hand circularly

https://en.wikipedia.org/wiki/Circular_polarization

Zeeman Effect

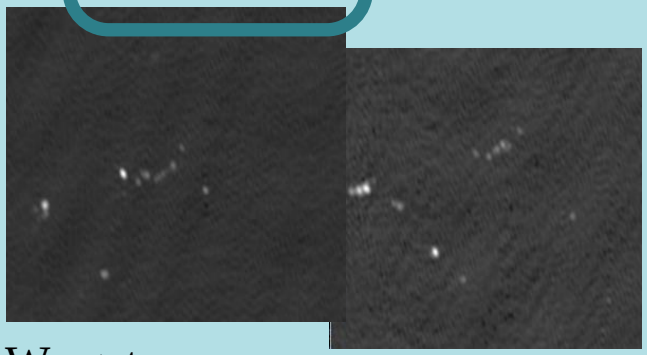


Barreto et al, 1988

1665 MHz: 590 km/s /G

Image Processing

Raw data of H_2O masers in W49N



AIPS

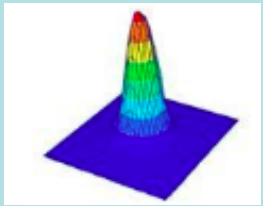
Calculated from Gaussian fitting Asanok et al. (in preparation).

output files consist of texts and numerical

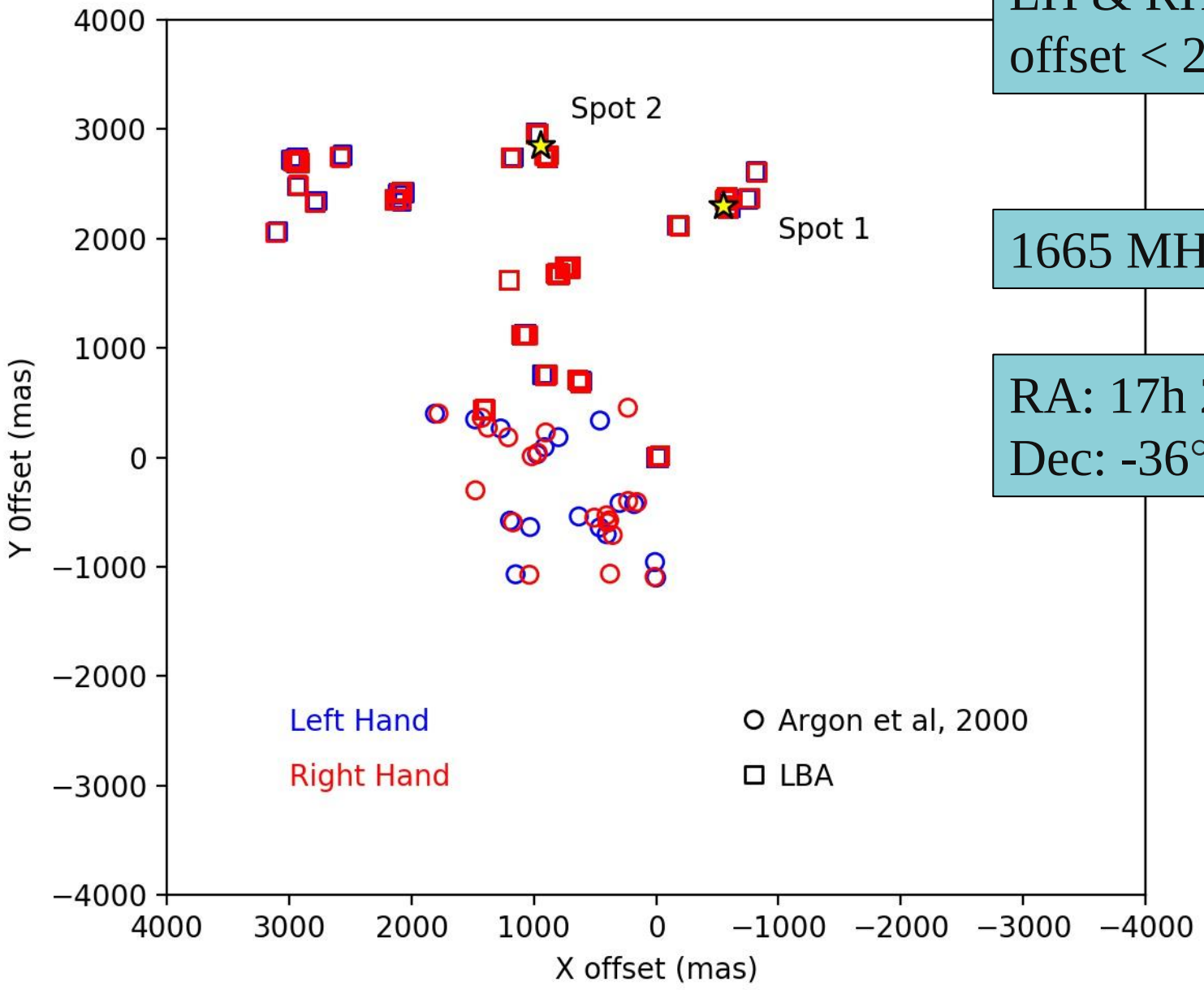
```
Window BLC    1    1    1    1  1  1  1 TRC  512  512    1    1  1  1  1
Sources found down to 10.471703 in JY/BEAM
Retry level  0.080000 (JY/BEAM ) plus gain 0.100
Reject components peak <   0.00000 in JY/BEAM
Reject components flux <   0.00000
Reject components width >  20.0 cells
Reject components outside window >    0.0 cells
Reject components outside image >     0.0 cells
Reject residual flux >    0.00000 with gain 0.100
Fluxes expressed in units of       JY/BEAM
NOTE: Fluxes marked by * have been divided by 1000.
Errors determined by theory from RMS  2.08310
Reference Center: 19 10 13.3020  09 06 14.200
All source widths and coordinates and their errors are in arc seconds
NO corrections for bandwidth smearing have been made
Source peaks and fluxes NOT corrected for primary beam

    #       Peak    Dpeak      Flux    Dflux     RA---SIN    DEC--SIN    Dx       Dy
Dpa
    1     35.892(  2.083)    34.913(  3.542)    -0.03920     0.01589( 0.00002 0.00003) (
9.8)

Component widths & PA: fit, deconvolved at fit and  1.30 sigma low and high from fit
   #  MAJ-fit MIN-fit PA-fit    MAJ-dec MIN-dec PA-dec  R  MAJ-low MIN-low PA-low
MAXresid

    1 0.00119 0.00094  178.6    0.00040 0.00000   11.6  U  ---     ---         ---     (
4.38848
      localhos   SAD  (31DEC18)     123               18-MAR-2019   12:25:51
R17058B-MF1 .ICL001.      1     Disk  1     Plane    2     User     123
```

We get;

- Offset position (x, y)
- LSR (Local Standard of Rest) Velocities
- Peak flux intensity



Distribution

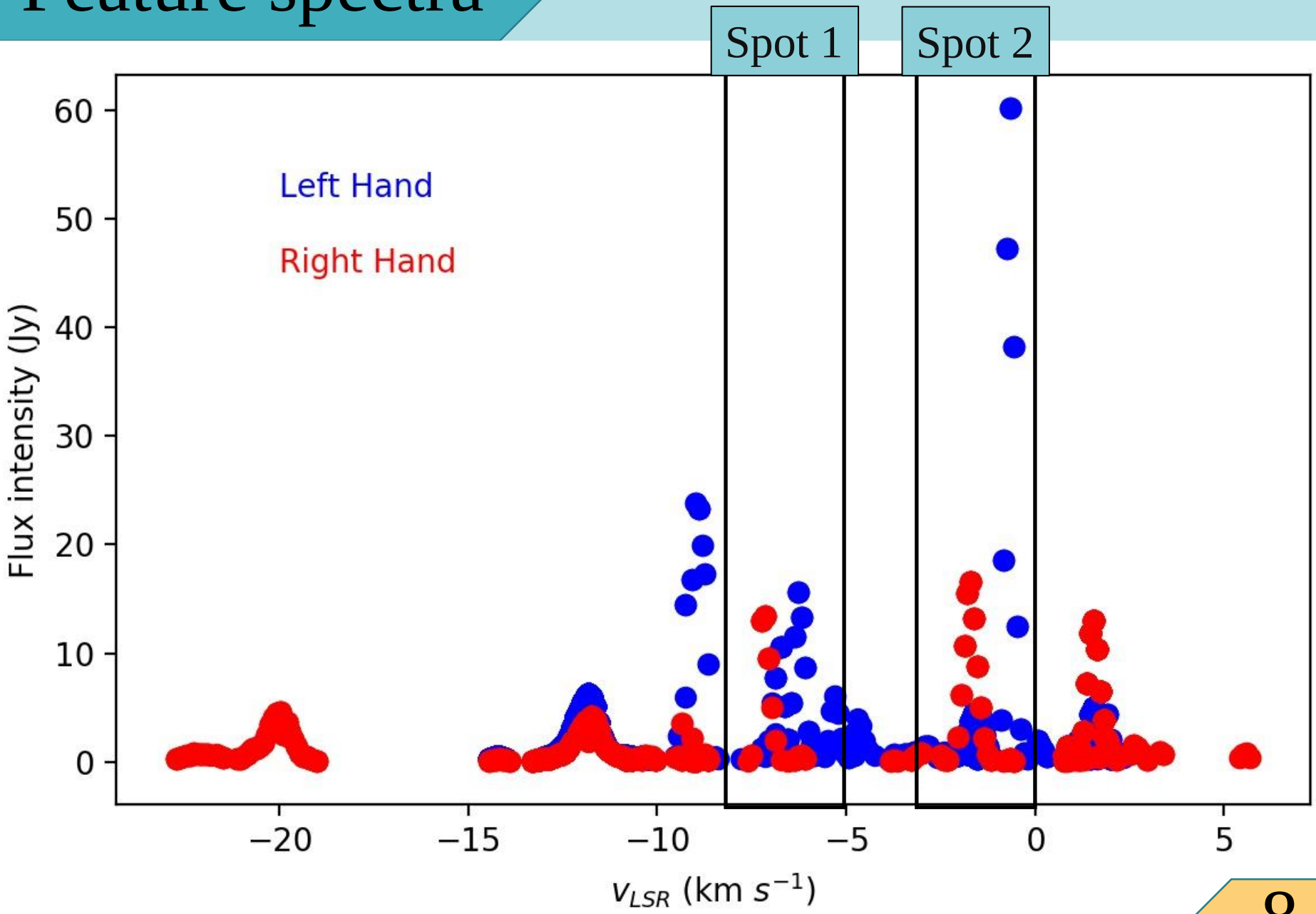


LH & RH
offset < 20 mas

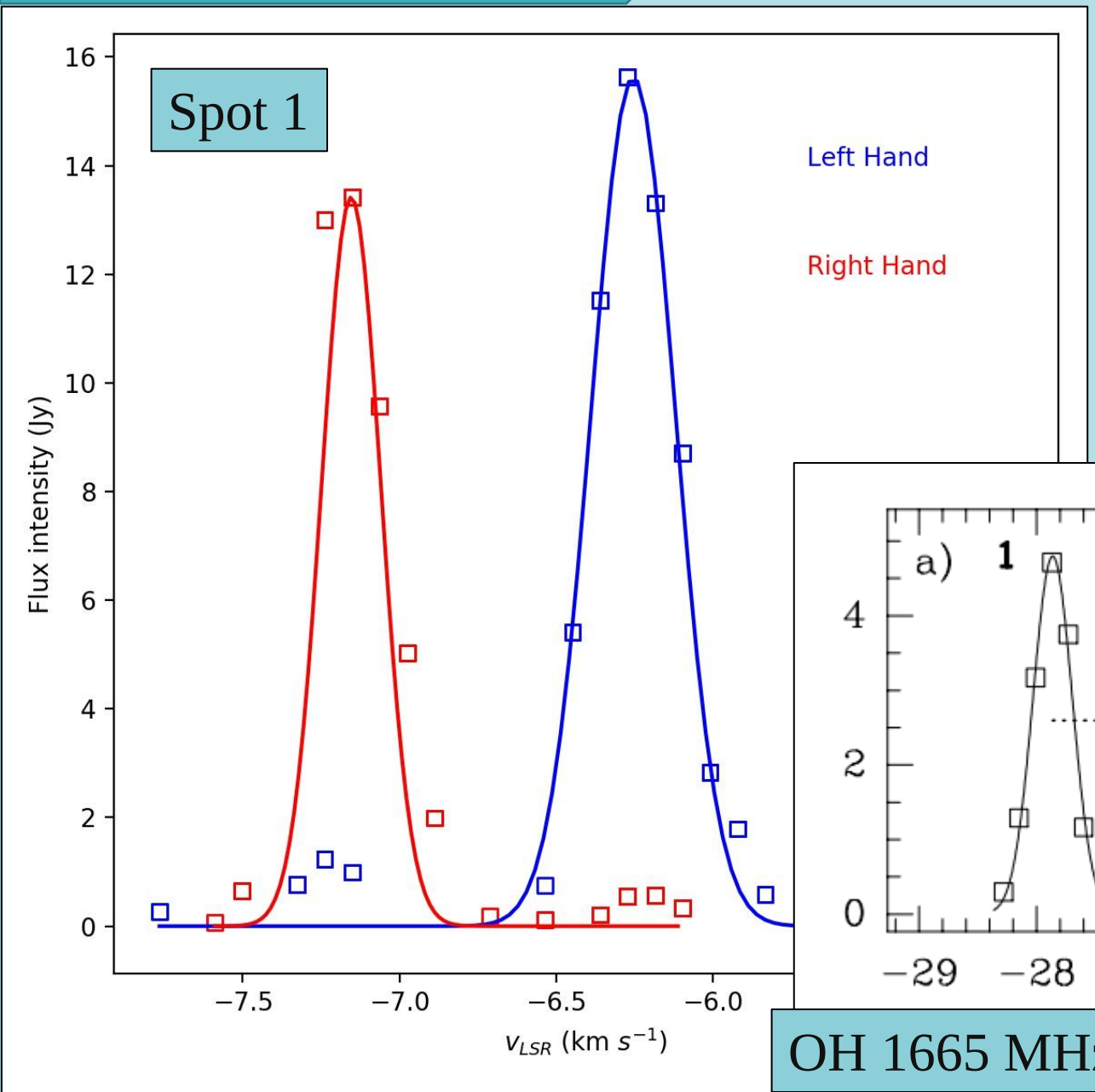
1665 MHz OH Masers

RA: 17h 26m 42.5601s
Dec: -36° 09′ 16.000″

Feature spectra



Magnetic Field



LH

Mean: -6.25 km/s

SD: 0.13 km/s

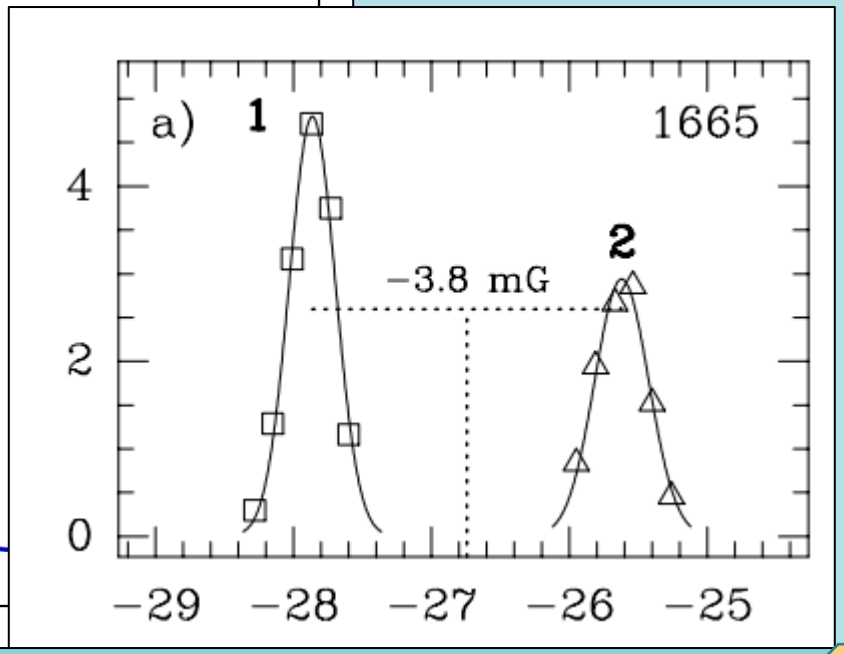
RH

Mean: -7.15 km/s

SD: 0.09 km/s

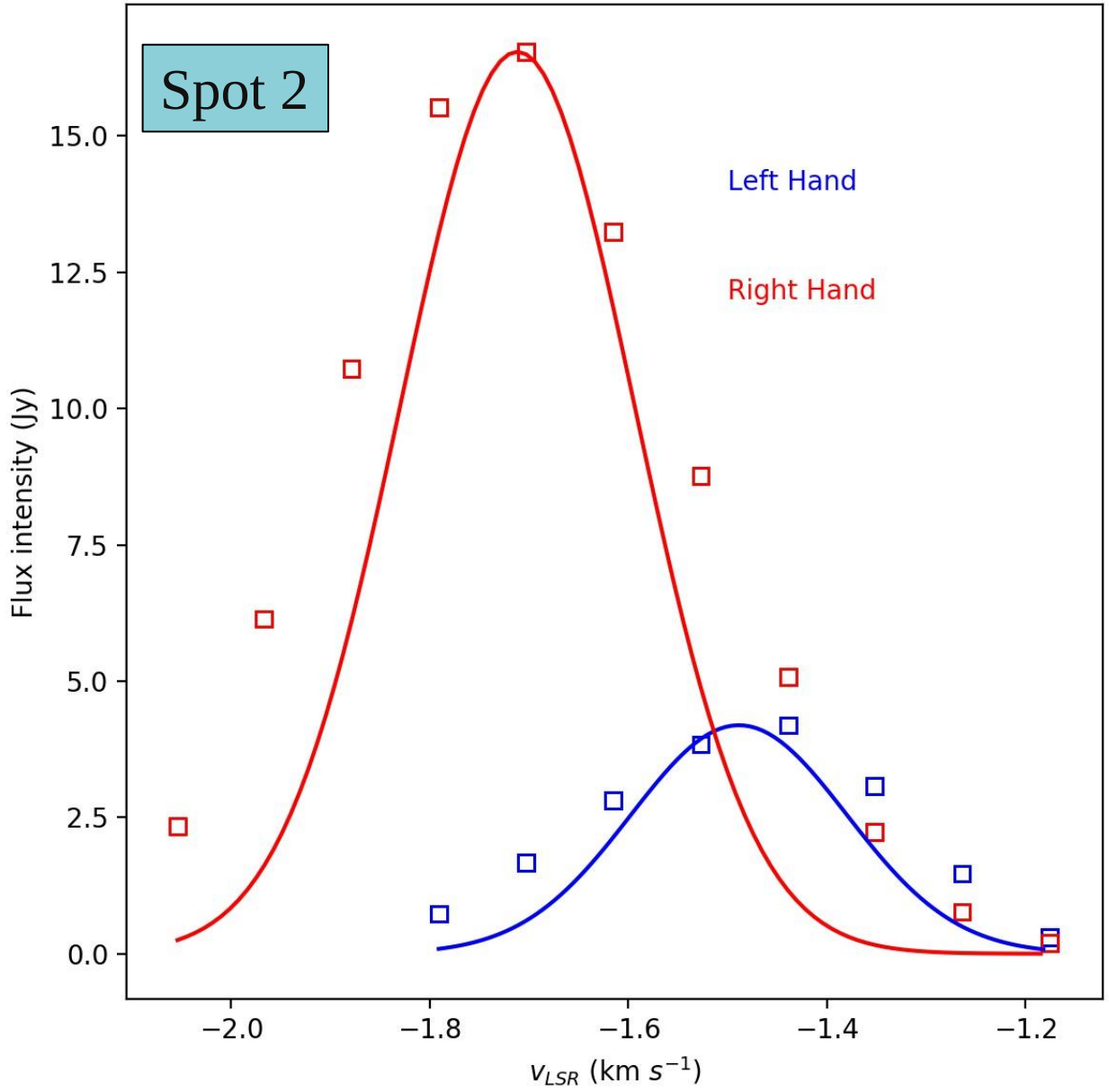
Magnetic Field

B: -1.53 mG



OH 1665 MHz (Fish et al, 2003

Magnetic Field



LH

Mean: -1.49 km/s

SD: 0.11 km/s

RH

Mean: -1.71 km/s

SD: 0.12 km/s

Magnetic Field

B: -0.38 mG

Problem

&

Future Work

- Maser Features
- Zeeman pair
- Calibrated image
- Reduce noise
- Rewrite our software

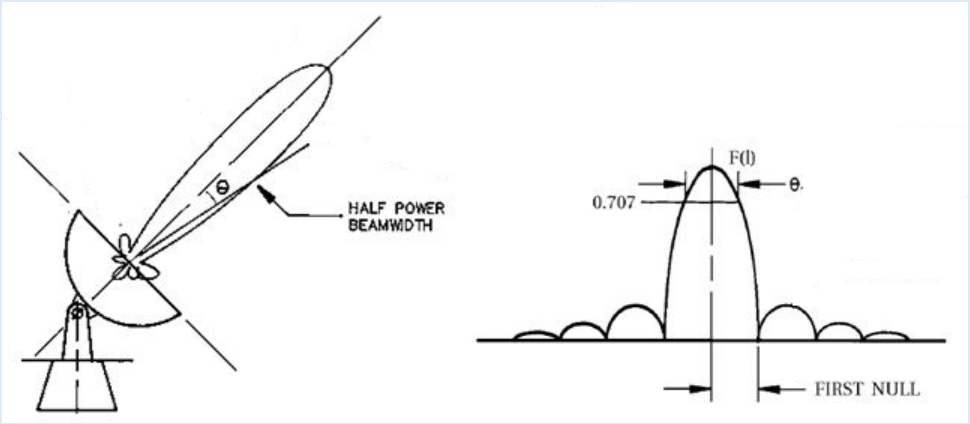
Thank You for Your Attention

Supporting slides: VLBI

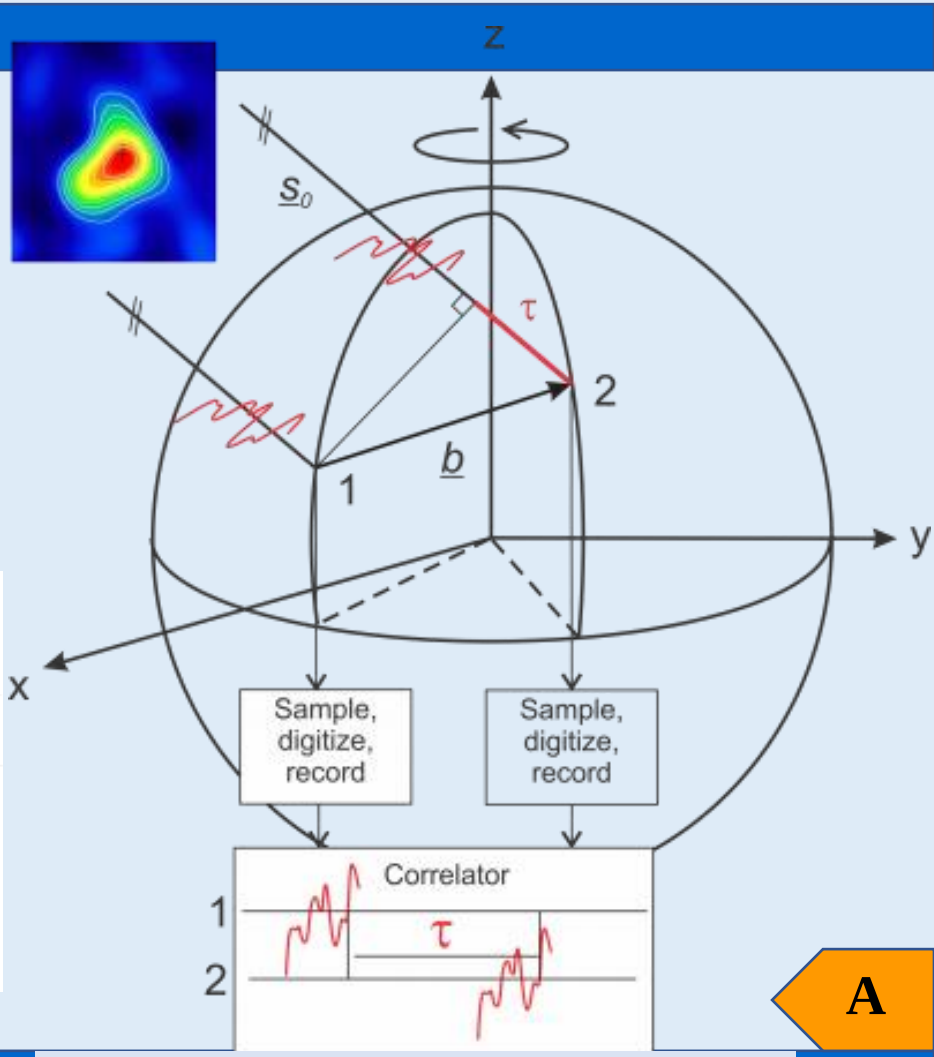
Resolution Angle, θ

$$\theta \approx 1.22 \frac{\lambda}{D}$$

where λ is wavelength
D is telescope diameter



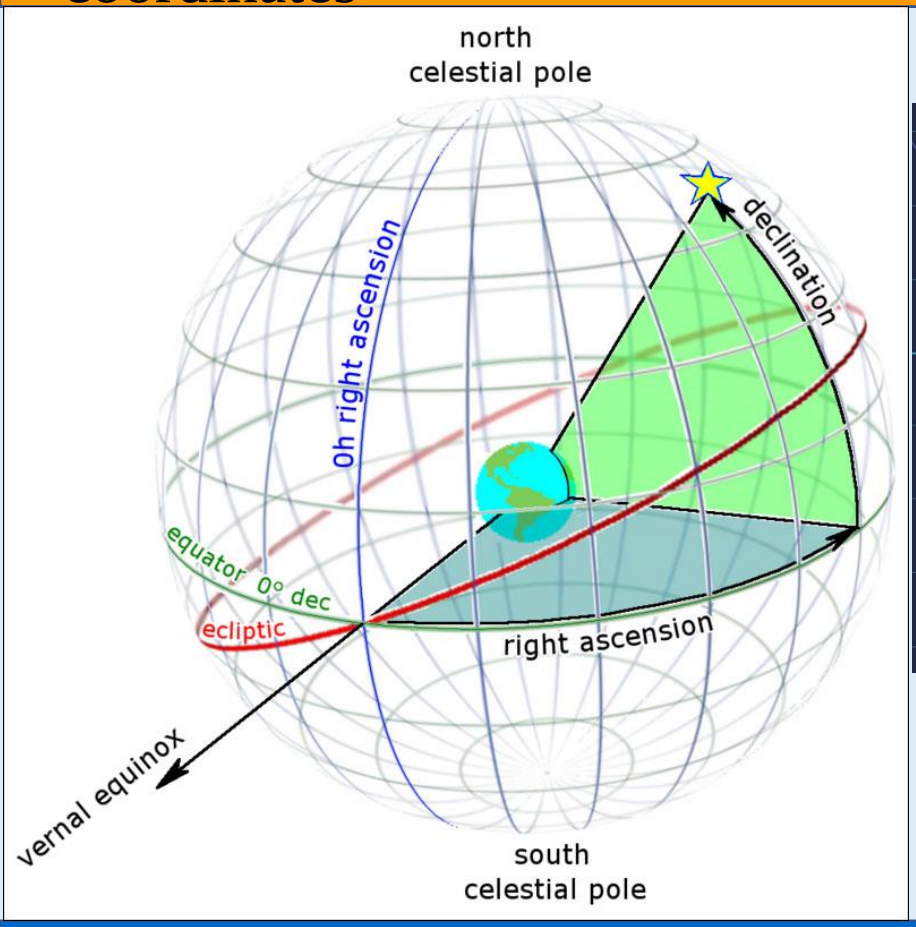
https://slideplayer.com/slide/6171736/18/images/25/Primary+beam+and+Field+of+View.jpg



https://vievswiki.geo.tuwien.ac.at/doku.php?id=public:vlbi_fundamantals:introduction

A

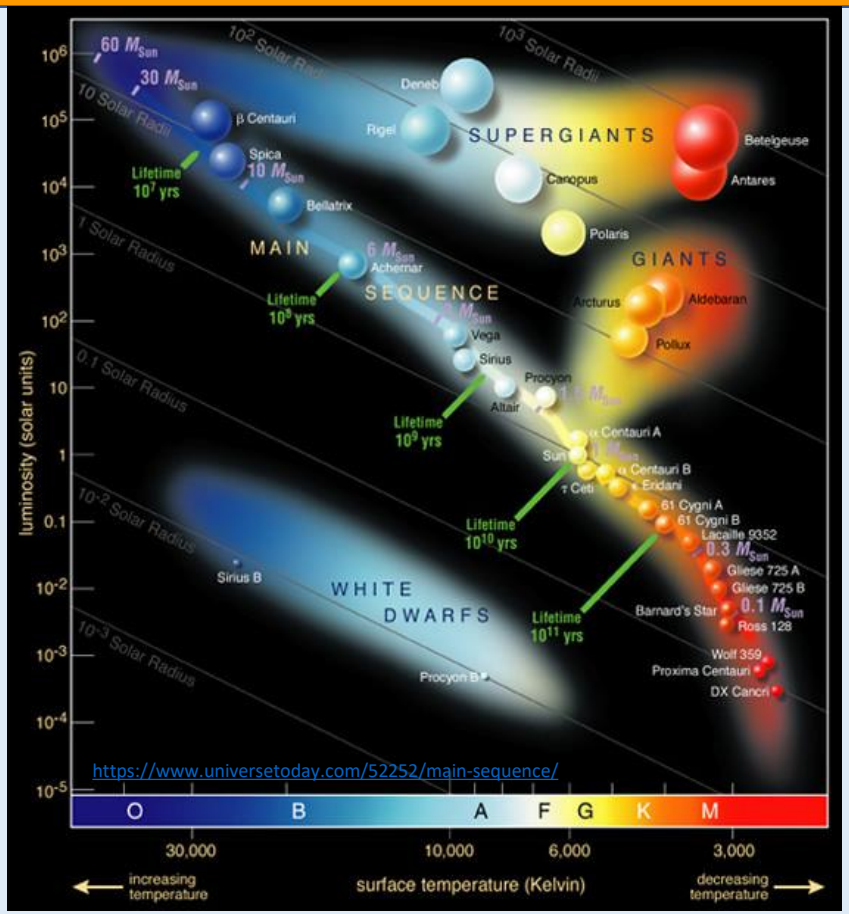
Supporting slides: Equatorial coordinates



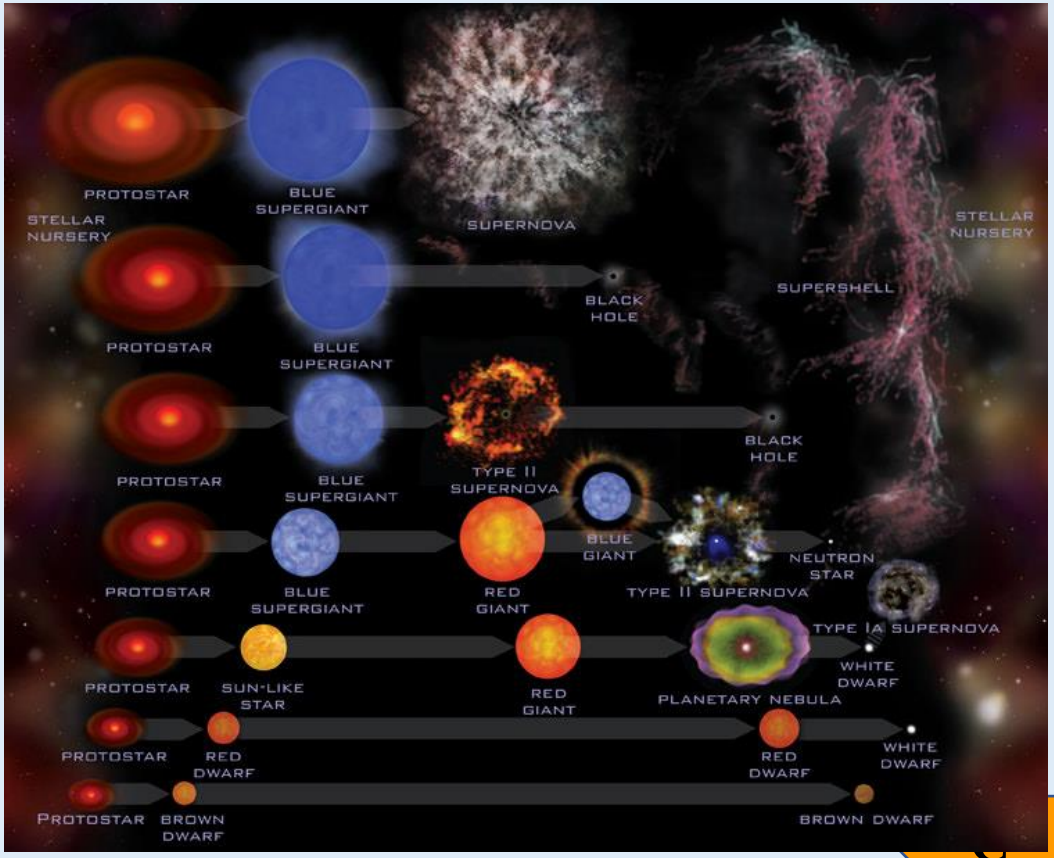
https://www.skyandtelescope.com/astronomy-resources/right-ascension-declination-celestial-coordinates/

B

Supporting slides: Main sequence

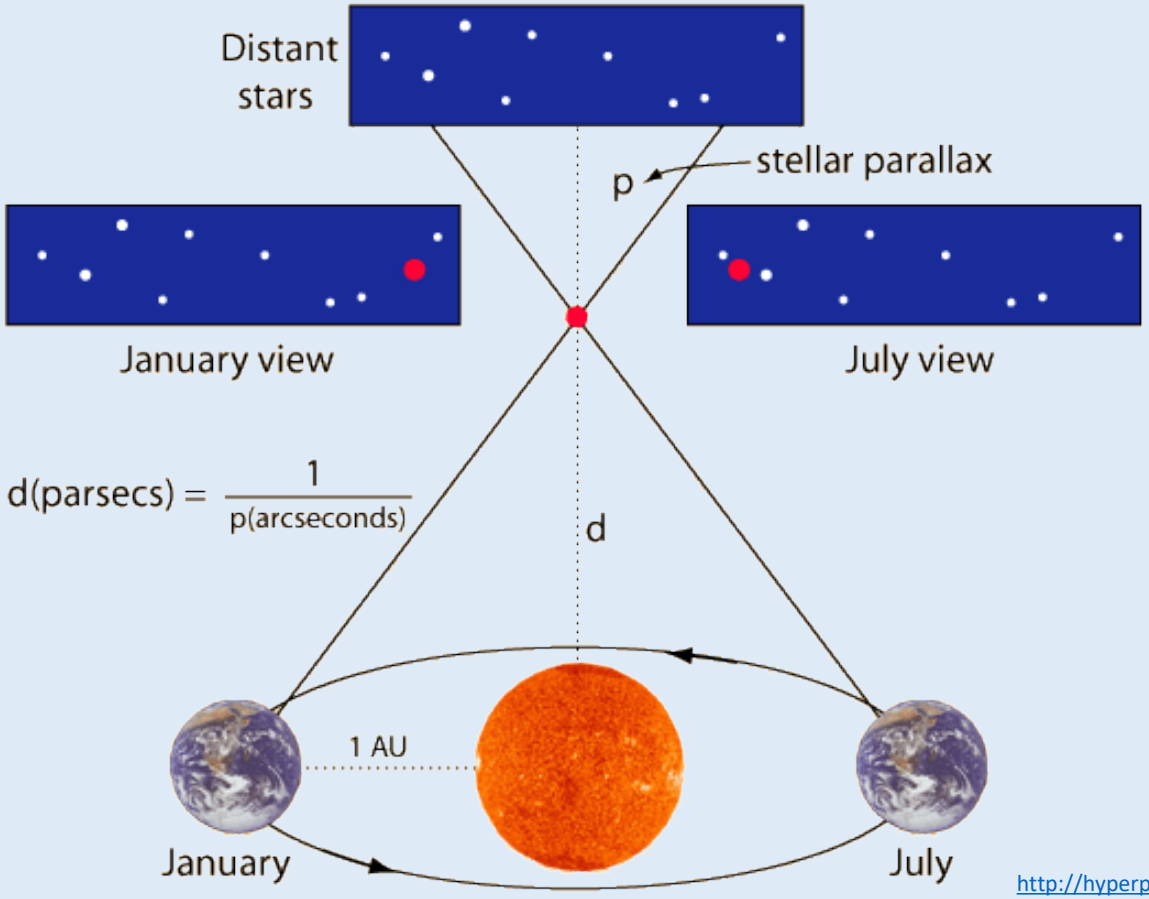


https://www.universetoday.com/52252/main-sequence/



https://www.universetoday.com/24643/star-main-sequence/

Supporting slides: Parallax



$$d(\text{pc}) = \frac{1}{p(\text{arcsecond})}$$

1 pc ≈ 3.0857 x 10^{13} km

1 AU = 149,597,871 km

http://hyperphysics.phy-astr.gsu.edu/hbase/Astro/para.html

F