Parallaxes and Proper Motions of Massive Star Forming Regions: Step 1

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Observe ~ 10 massive star forming regions

A fundamental contribution to Galactic structure

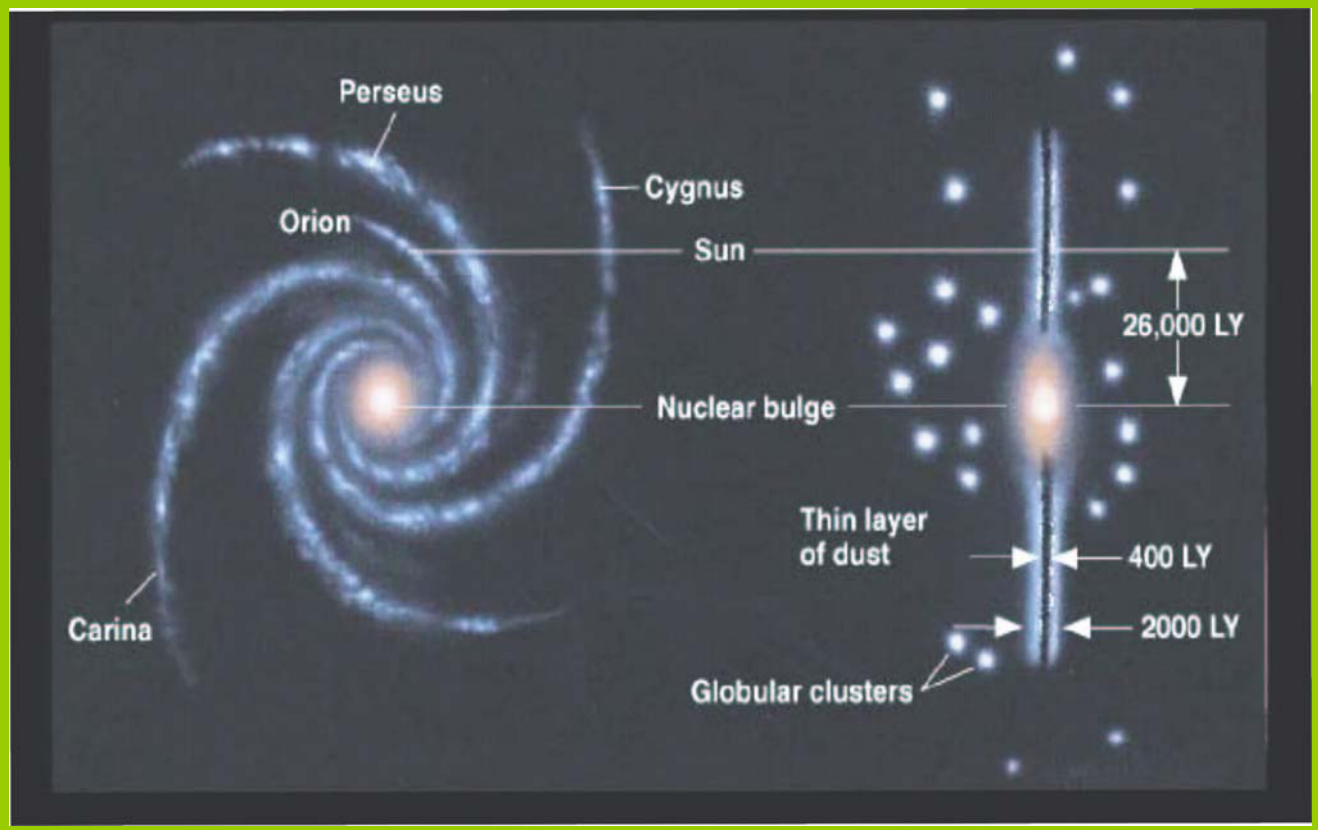
HII regions $\Rightarrow$ spiral arms of galaxies.

Rotation curve $\Rightarrow$

Measure distances to HII regions $\Rightarrow$

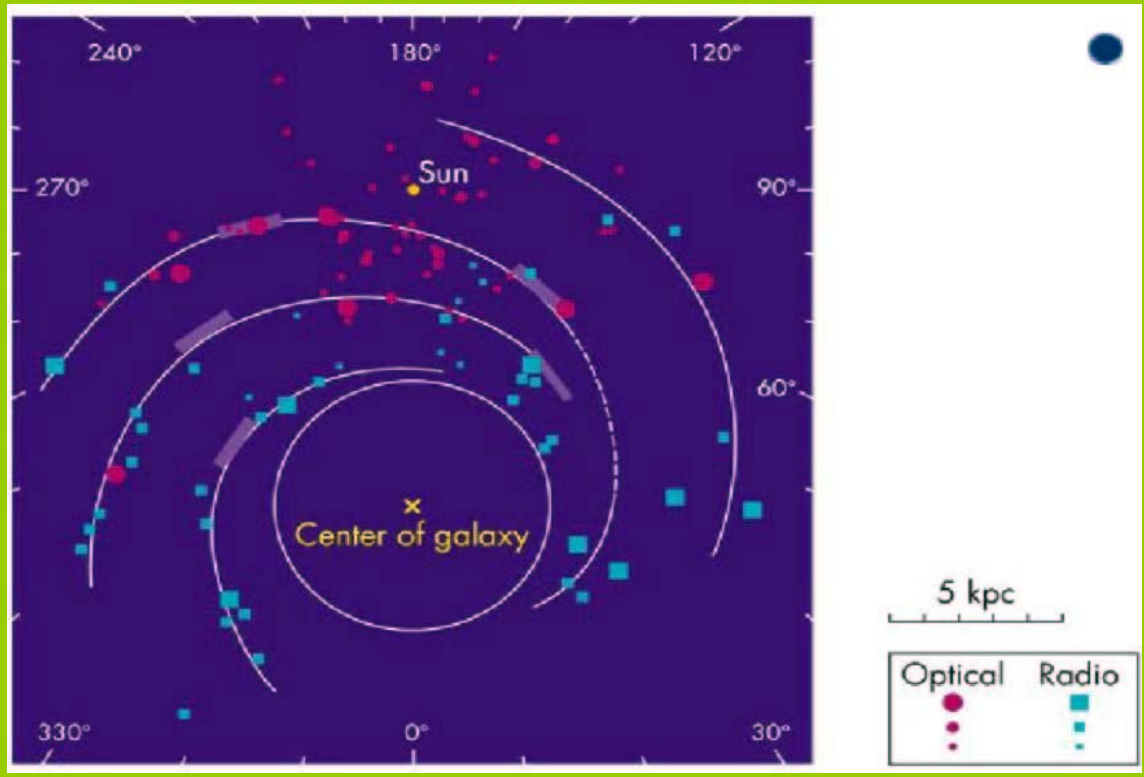
Kinematic distances

Construct a "plan view" of the Milky Way



Problems:

- Kinematic distance ambiguities
  - Fish et al. (2003), APJ, 587, 701
- Non-circular rotation



Trigonometric parallax

---absolute distance

⇒Distance-scale calibration

12 GHz methanol maser

Phase referencing

VLBI ⇒ ~ 0.01 mas

Background sources

JVAS (8 GHz)

NVSS (1.4 GHz)$\Rightarrow$ within 0°.7

$\Rightarrow$ VLA $\Rightarrow$ C- & U- band

Pilot study $\Rightarrow$ Perseus Arm----W3OH

kinematic distance ~ 4.5 kpc

luminosity distance ~ 2.2 kpc

Discrepancy $\Rightarrow$ kinematically anomalous or inaccurate for luminosity distance

Pilot study---(Program BX005)

Five 8-hr tracks

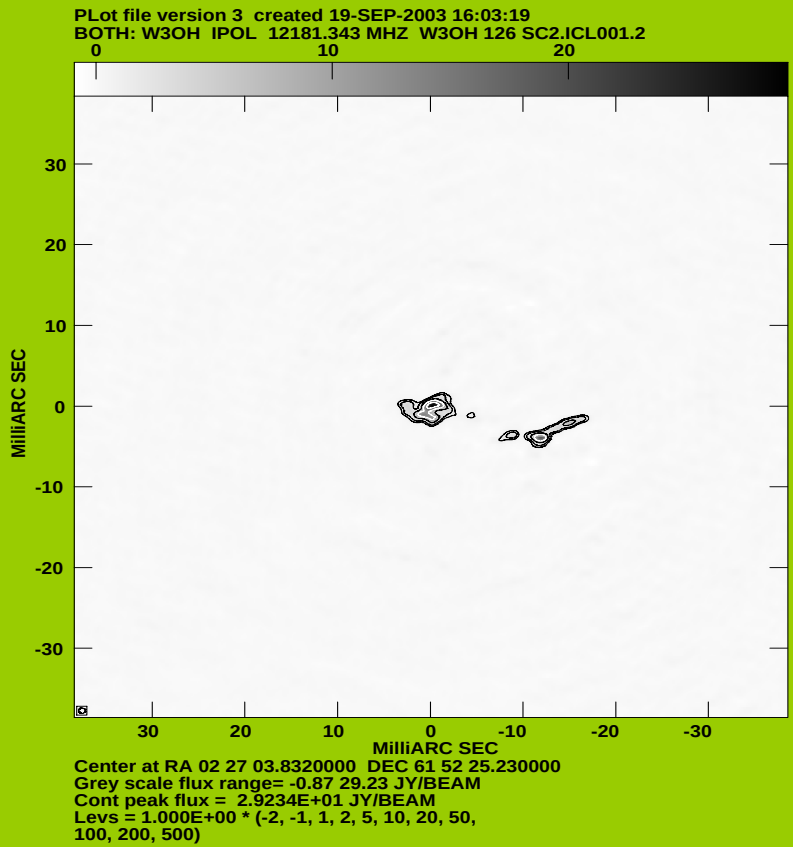
First epoch

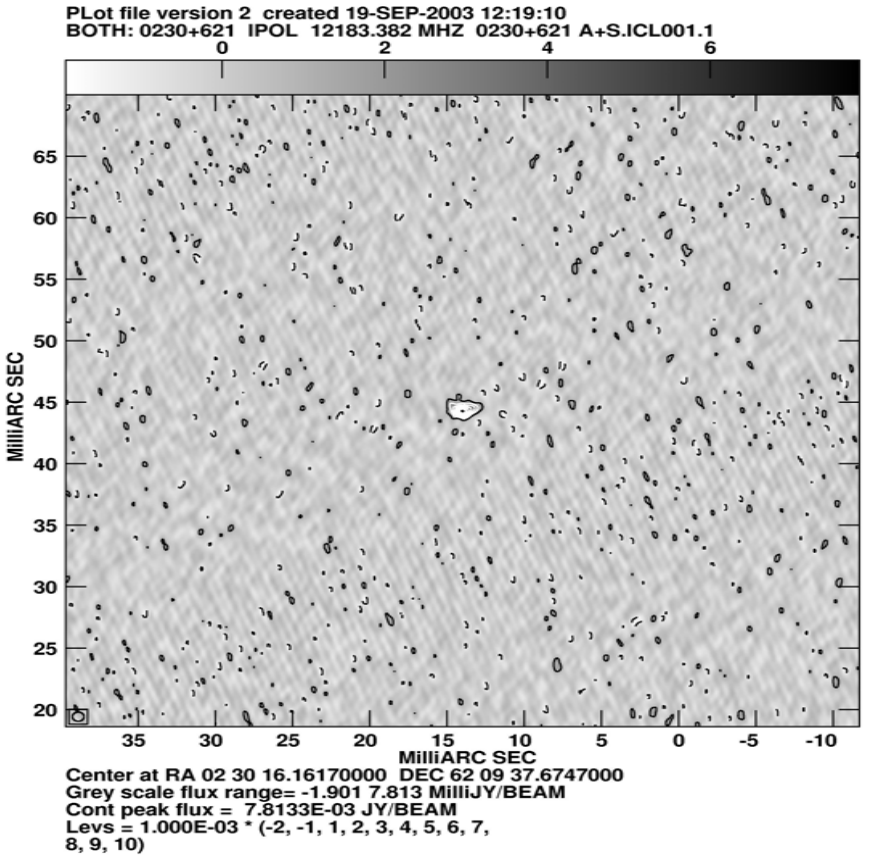
Accuracy better than 0.1 mas

When finished ~ 0.05 mas

~ 10 % at a distance of 2 kpc

Masers in one spectral channel

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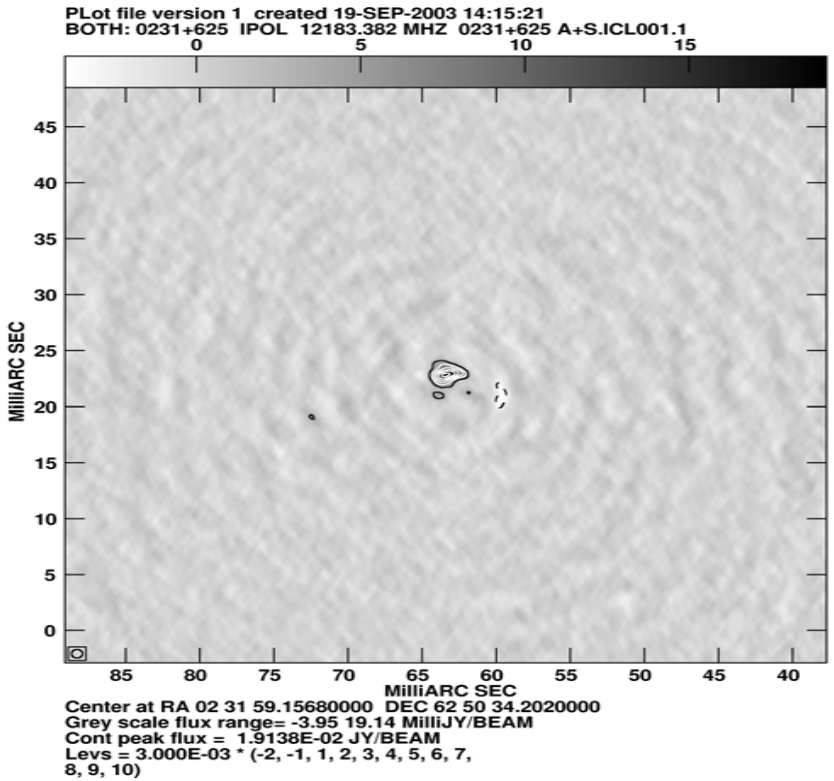
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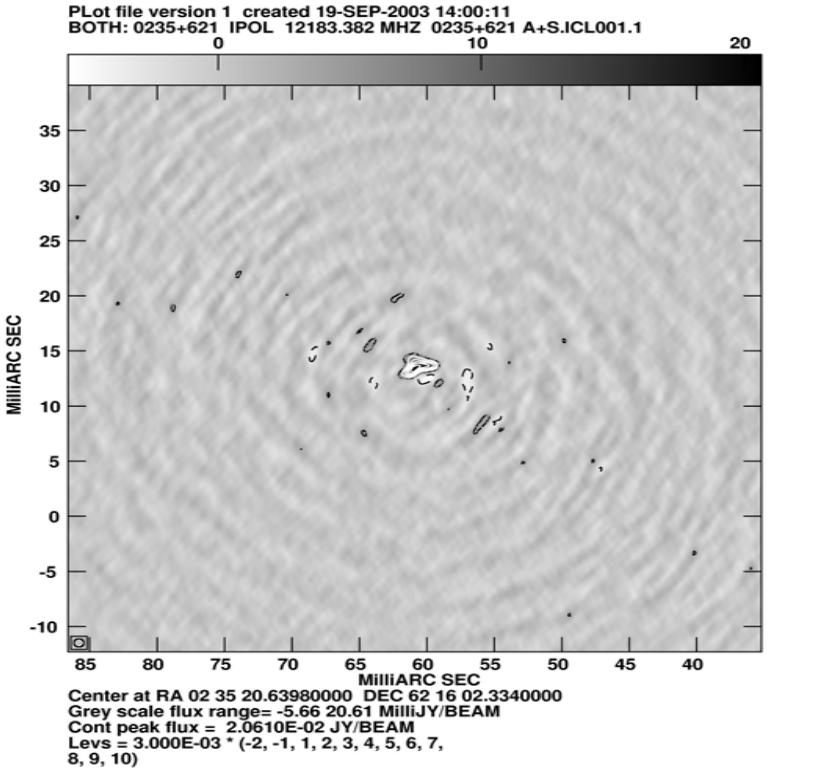
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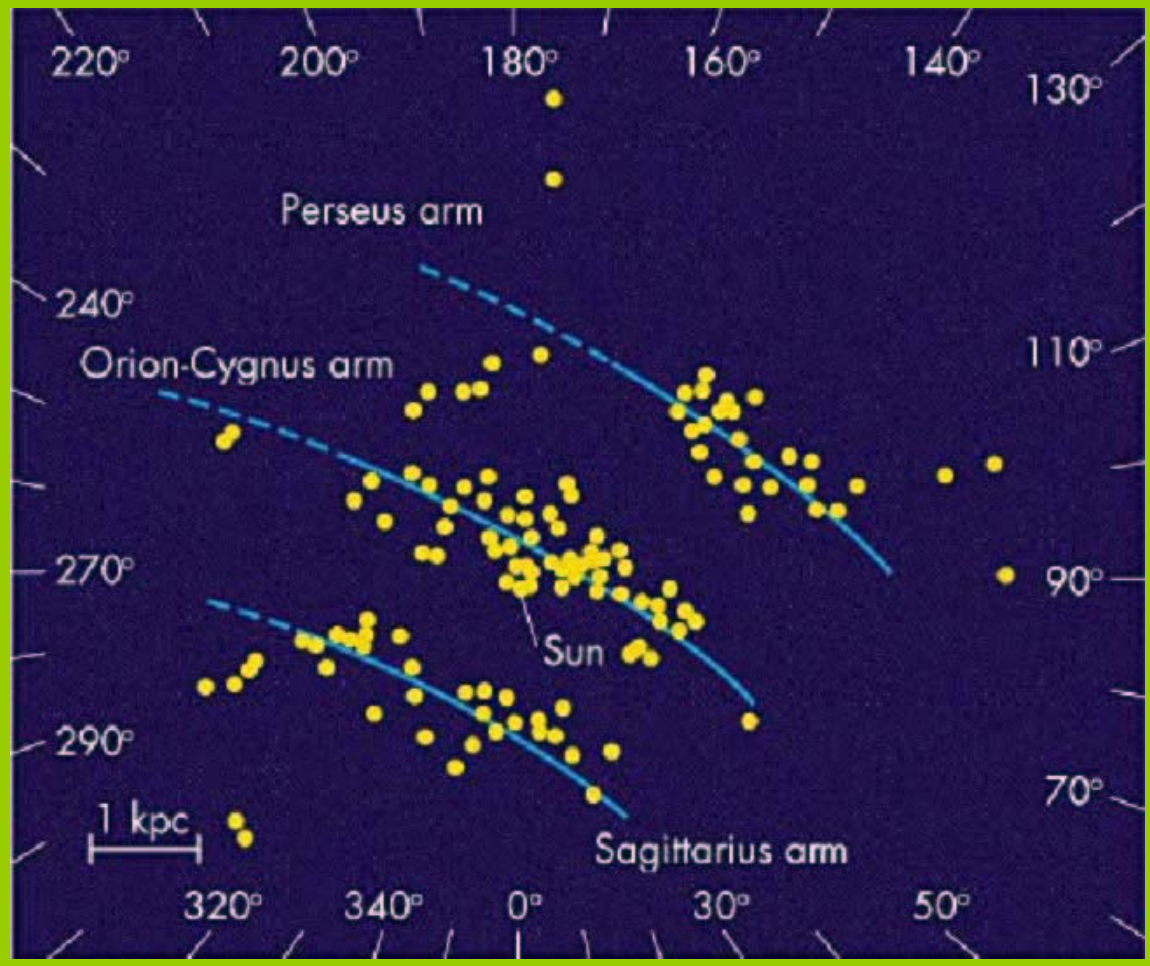
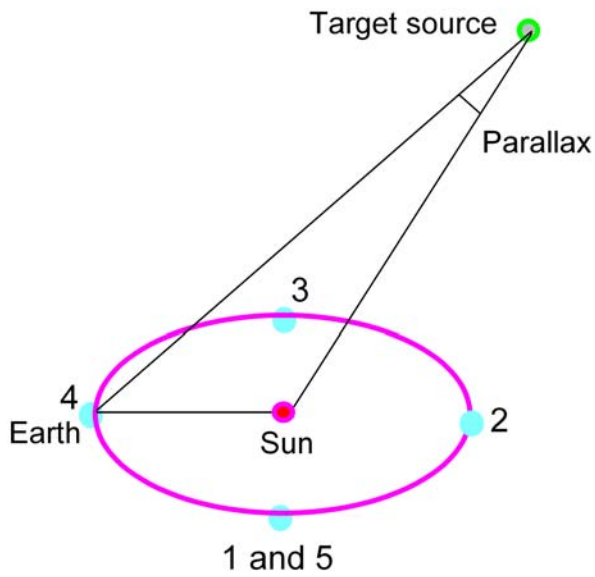

220°
200°
180°
160°
140°
130°
Perseus arm
240°
Orion-Cygnus arm
110°
270°
90°
Sun
290°
70°
1 kpc
Sagittarius arm
320°
340°
0°
30°
50°


Target source
Parallax
3
4
Earth
Sun
2
1 and 5