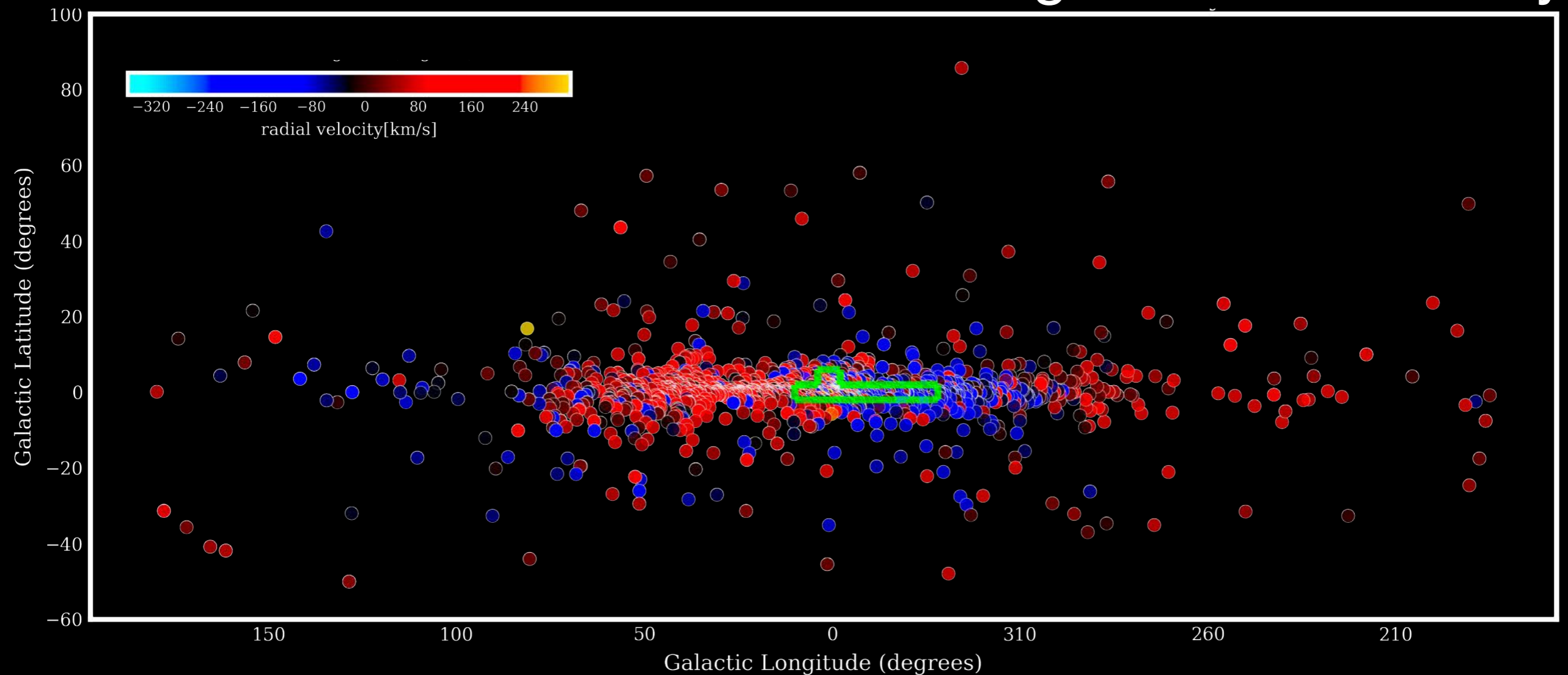


Distribution of evolved stars hosting OH masers in the SPLASH field

Yuri Uno, Hiroshi Imai, Kosuke Shinano et al
Kagoshima University

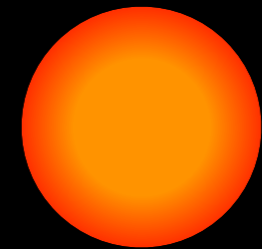


1.1 Motivation

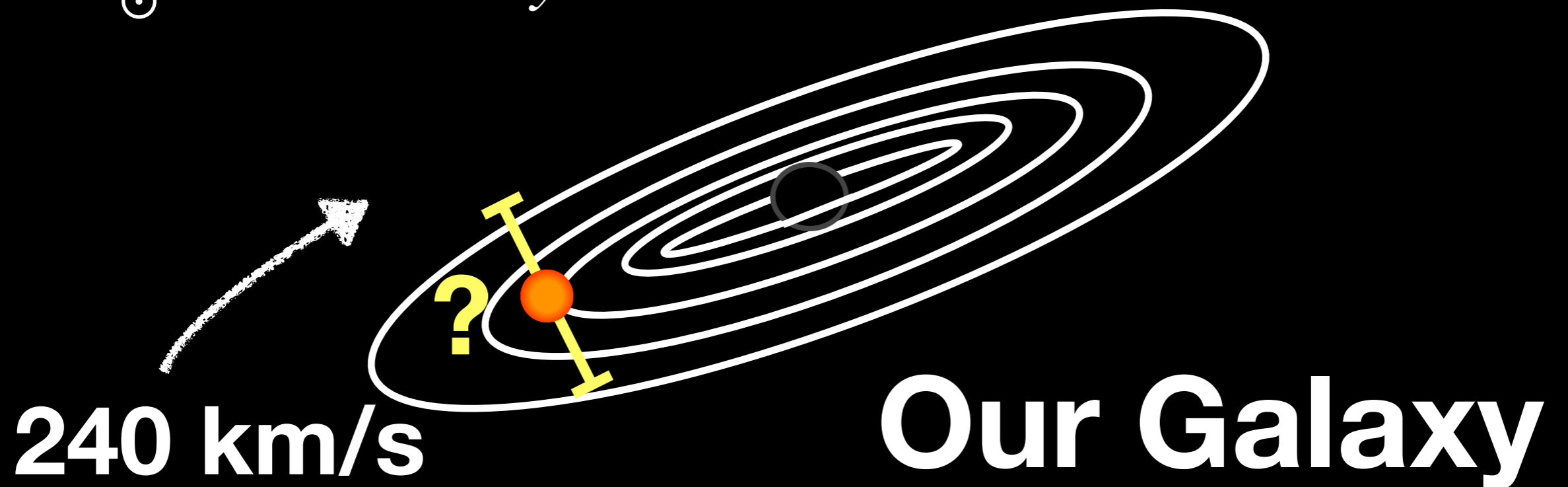
Life time of stars

$1M_{\odot}$: 10 *billion* years

$4M_{\odot}$: 20 *million* years



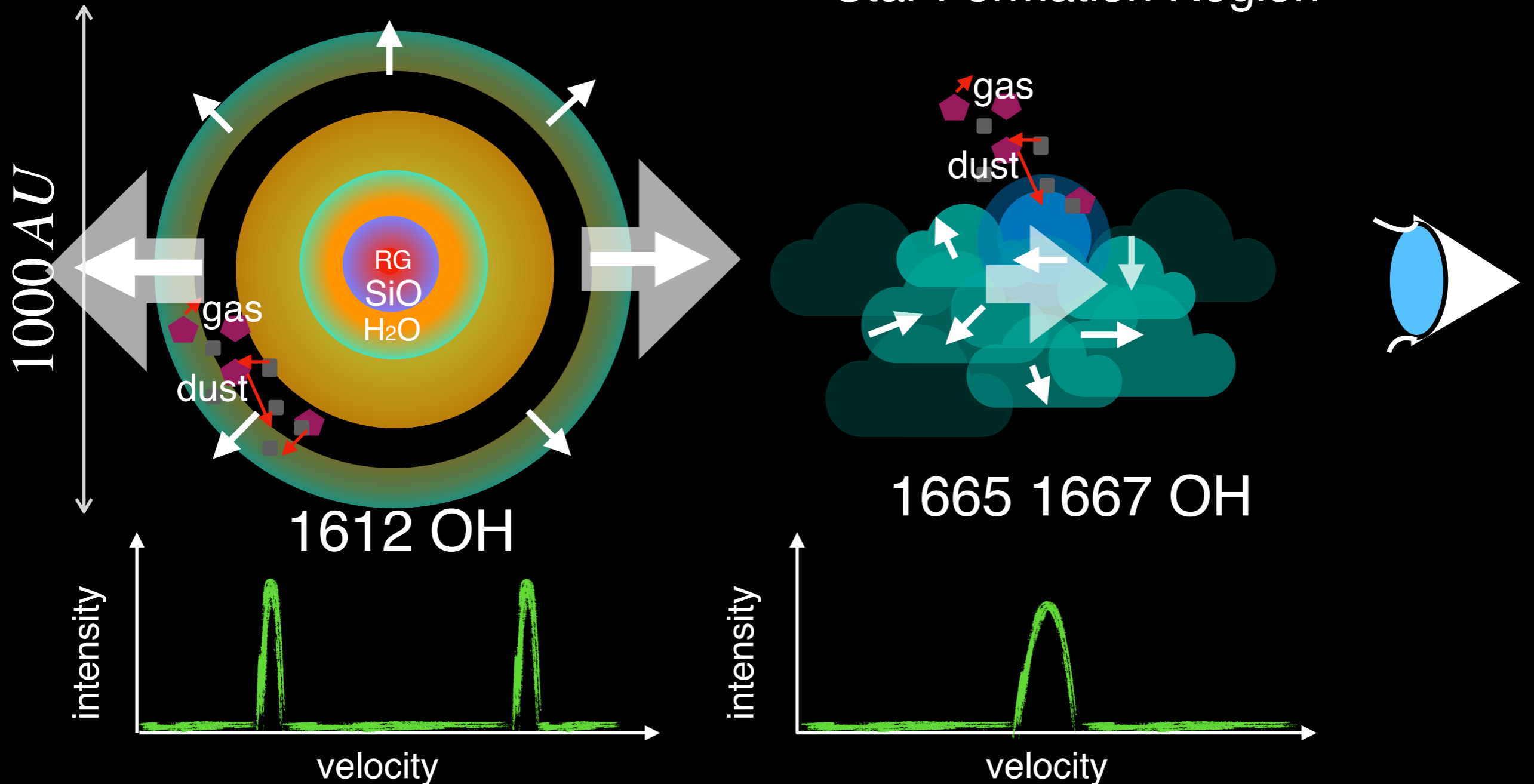
OH/IR Star



1.2 Maser spectrum

Evolved Star

Star Formation Region



1.3 Data



ATCA (Australian Telescope Compact Array)
Oct 2013 ~ Jan 2015

SPLASH: The Southern Parkes Large Area Survey in Hydroxyl

Sensitivity: 0.07 Jy

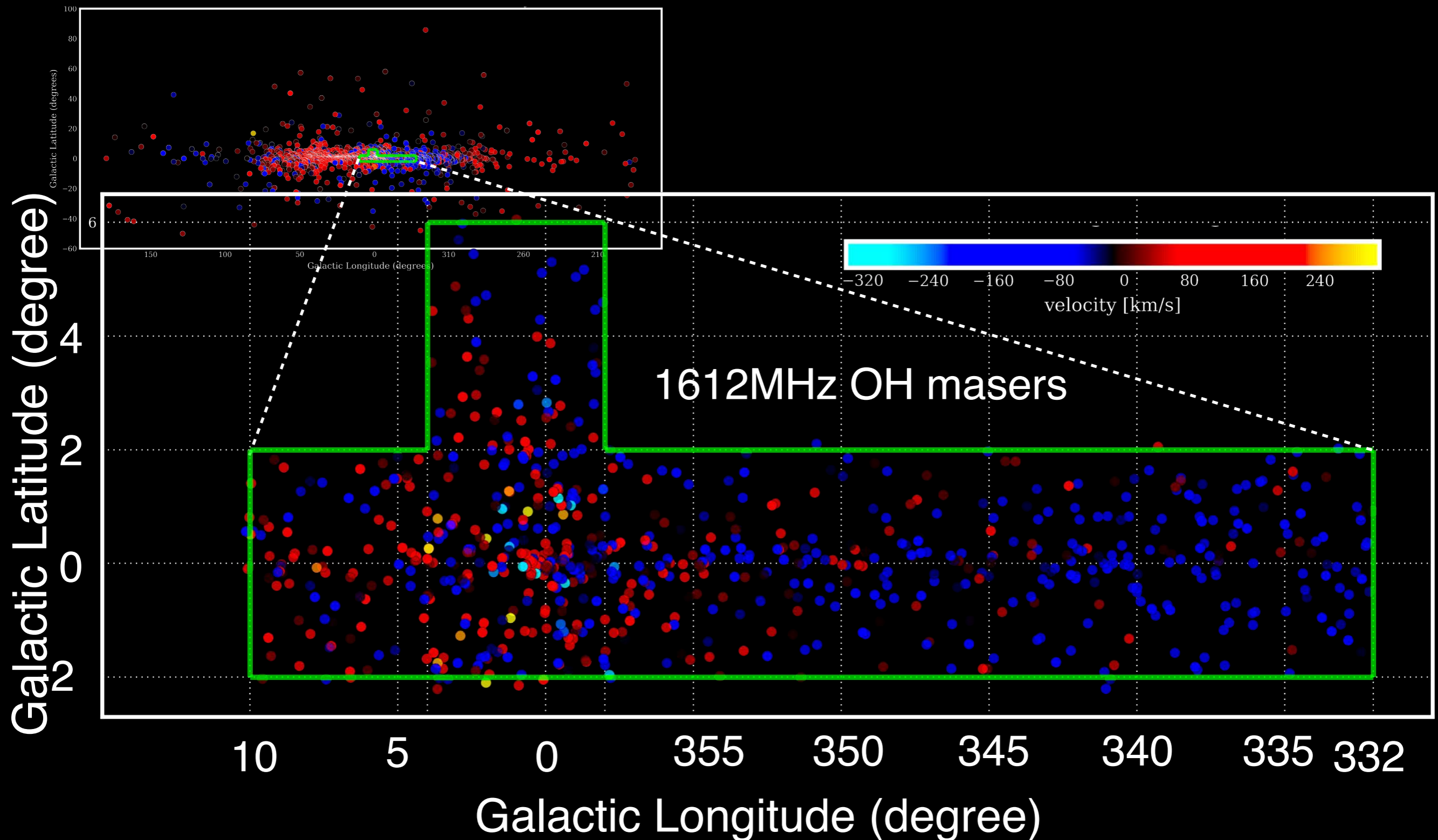
Spatial Resolution: 6.5"x4.4" ~ 22"x5"

Velocity Resolution: 0.09km/s

Frequency: 1612, 1665, 1667, 1720 MHz

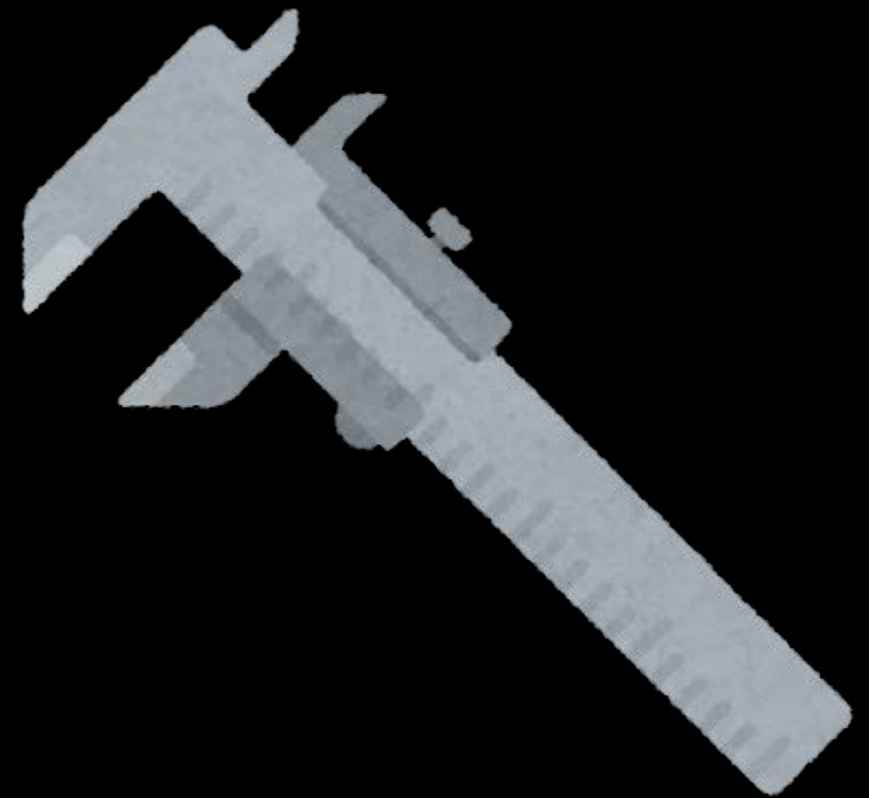
Speciality : **UNBIASED**

1.4 SPLASH field



2. Disc Scale Height

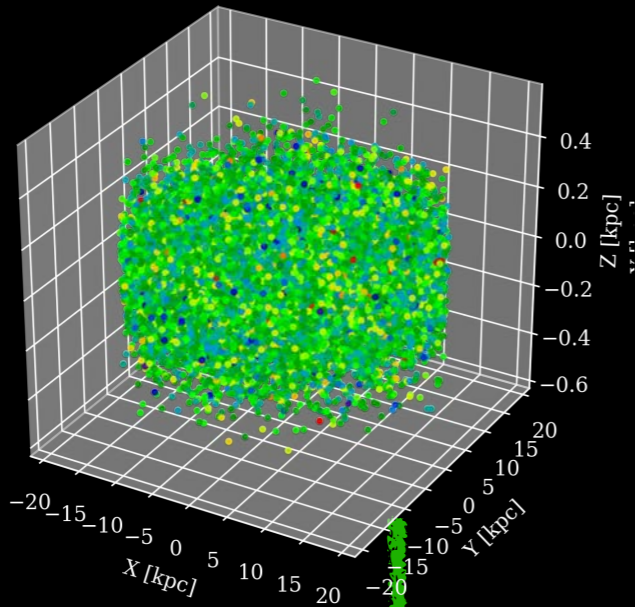
- 1) Galactic TOY model
- 2) Model fitting
- 3) Results



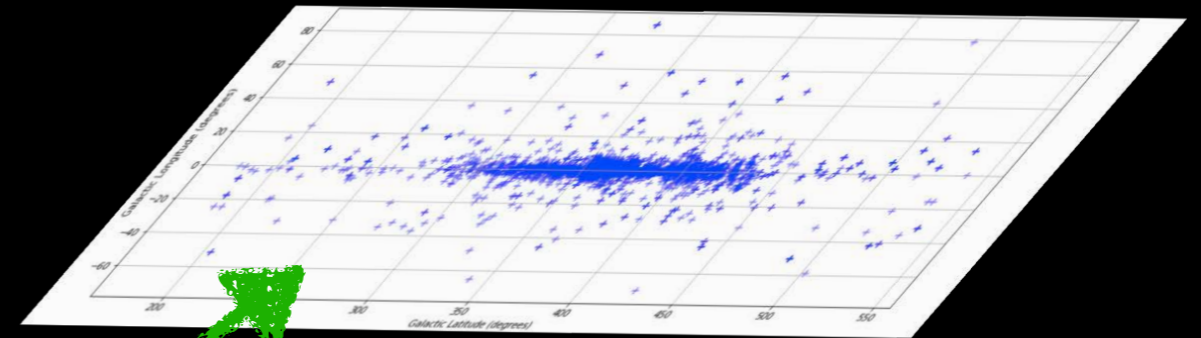
START

Overview

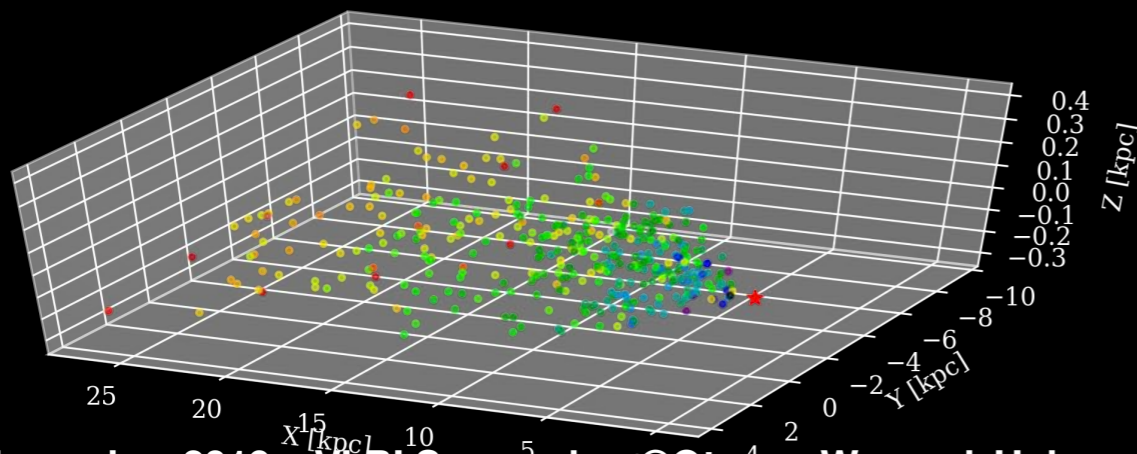
① TOY model



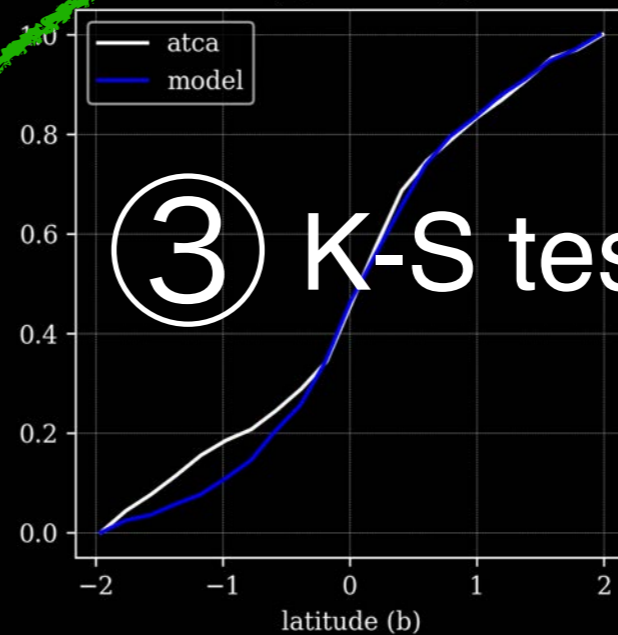
ATCA
observation



② Observable maser sources



Sn(b) and Sn'(b)



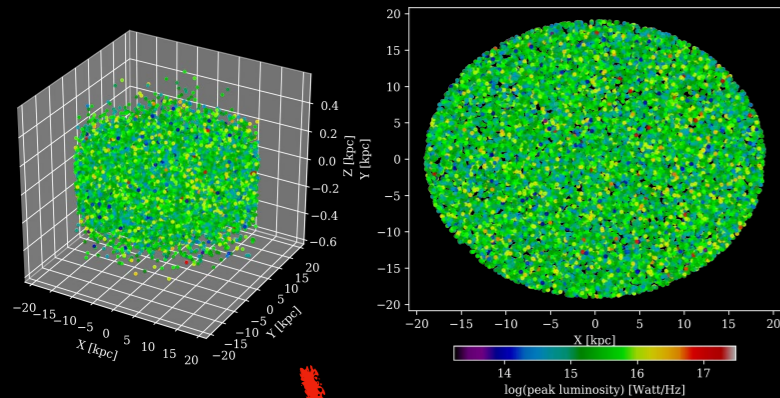
③ K-S test

GOAL

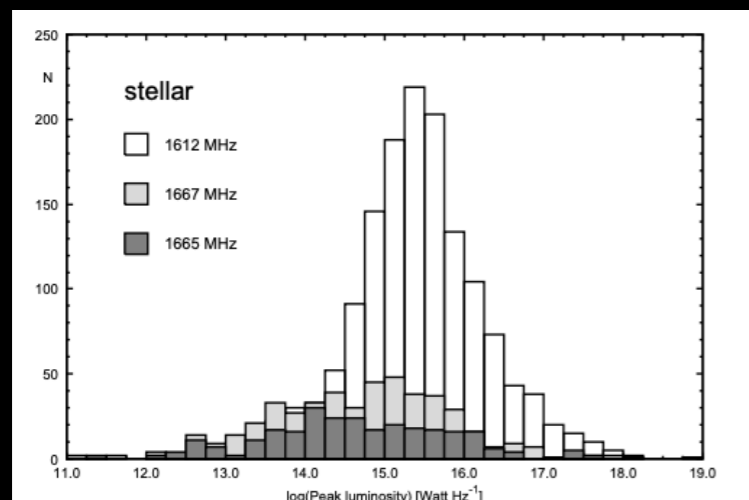
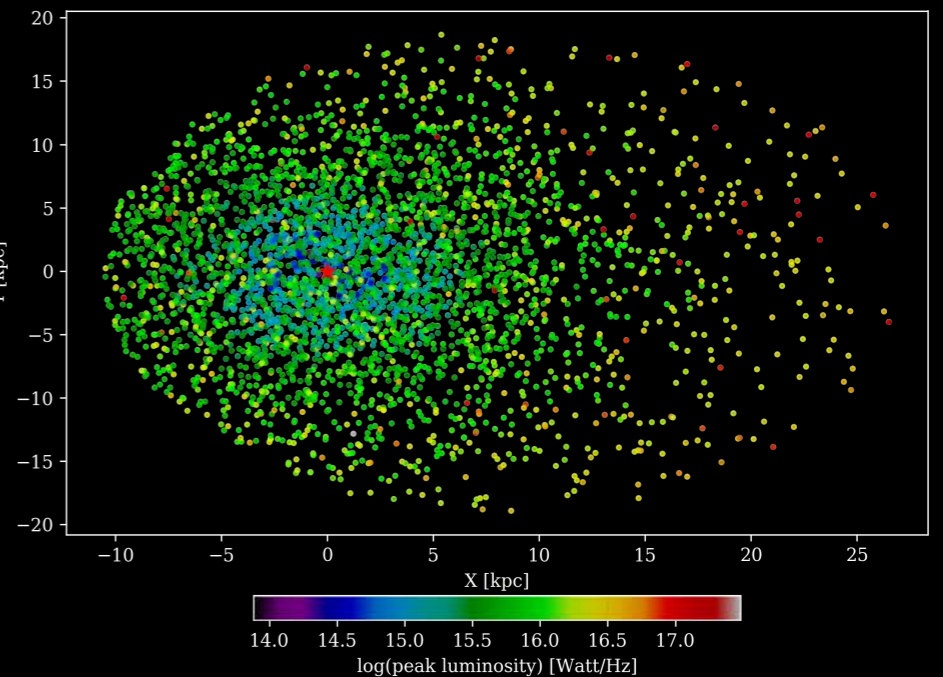
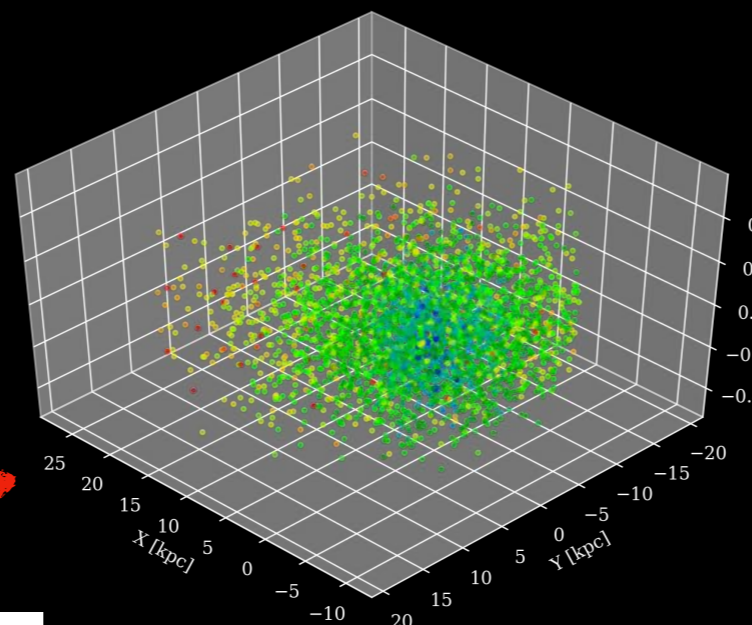
Disk Scale
Height
Yuri UNO

2.1 Galactic TOY MODEL

Initial model



Observable sources with ATCA



Luminosity Function

$$L_v = f_{\text{peak}} * 4\pi D^2$$

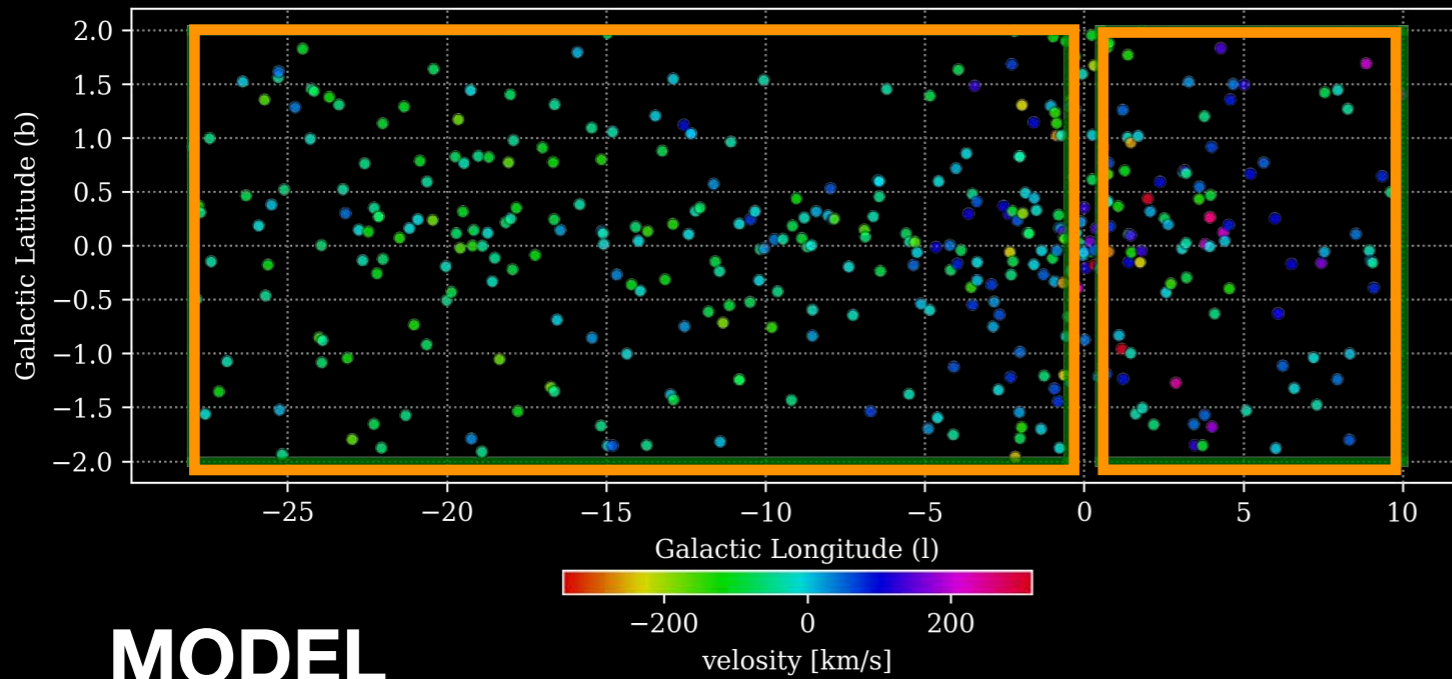
The distribution of the maser specific luminosities L_v is shown in Fig. 7. The core of the 1612 MHz OH maser luminosity distribution can be modeled by a Gaussian curve centered on $\log(L_v) = 15.30$ and with a width $\text{FWHM} = 1.25$, corresponding to a typical luminosity range $0.5 - 8.4 \times 10^{15} \text{ Watt Hz}^{-1}$. In prin-

Engels and Bunzel (2015)

2.2 Model fitting

REAL

1612MHz OH maser observed with ATCA

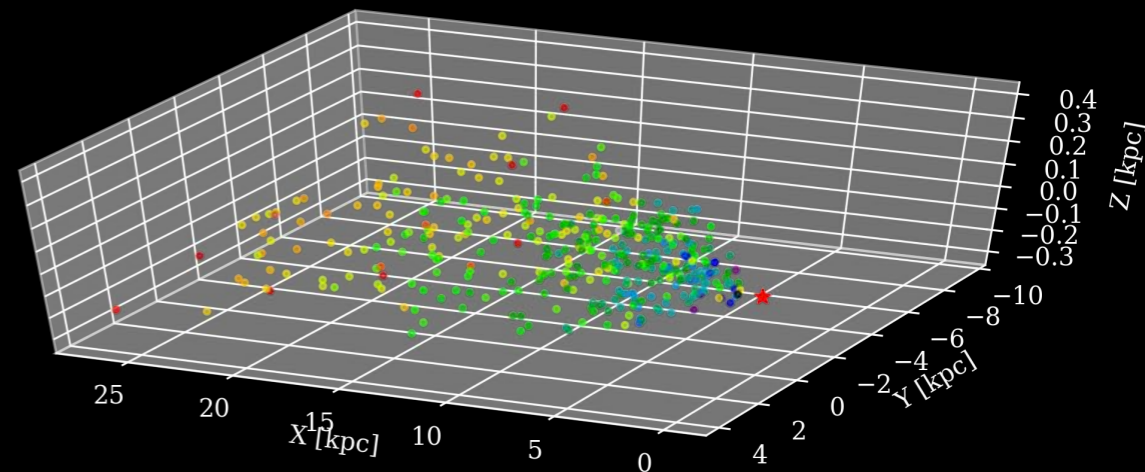
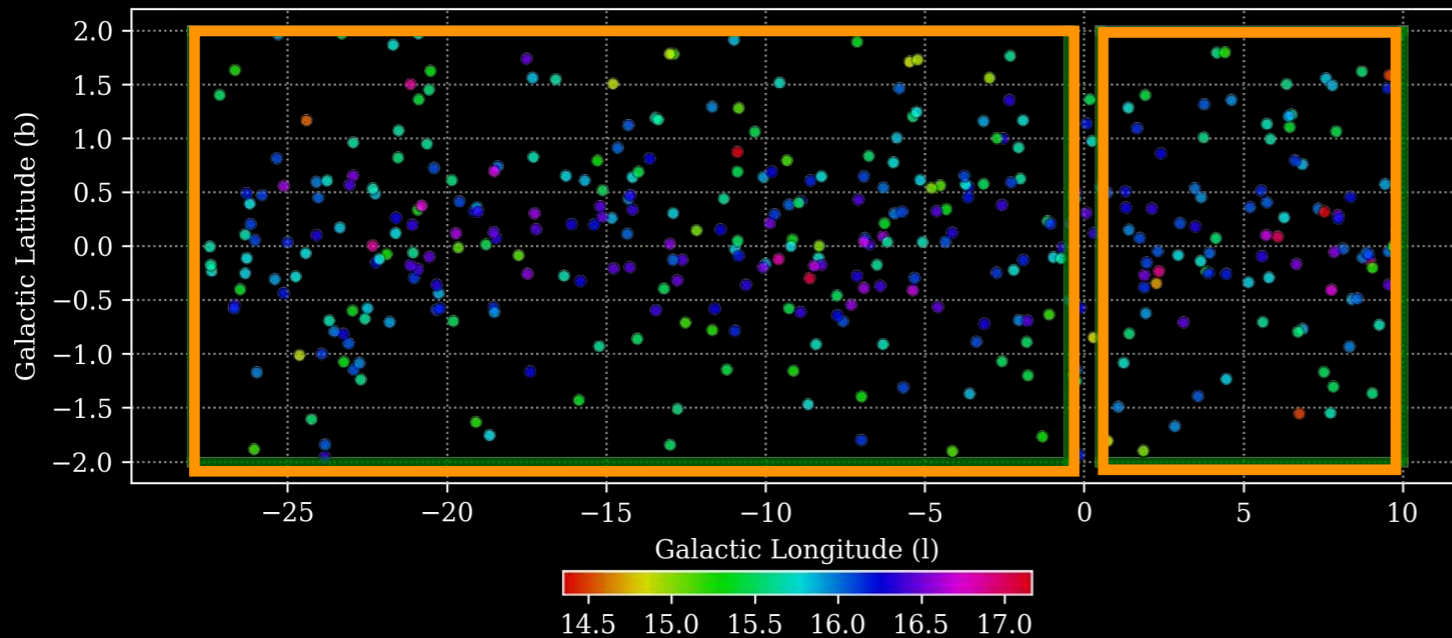


FREE PARAMETERS

- Galactic Radius
- Scale height

MODEL

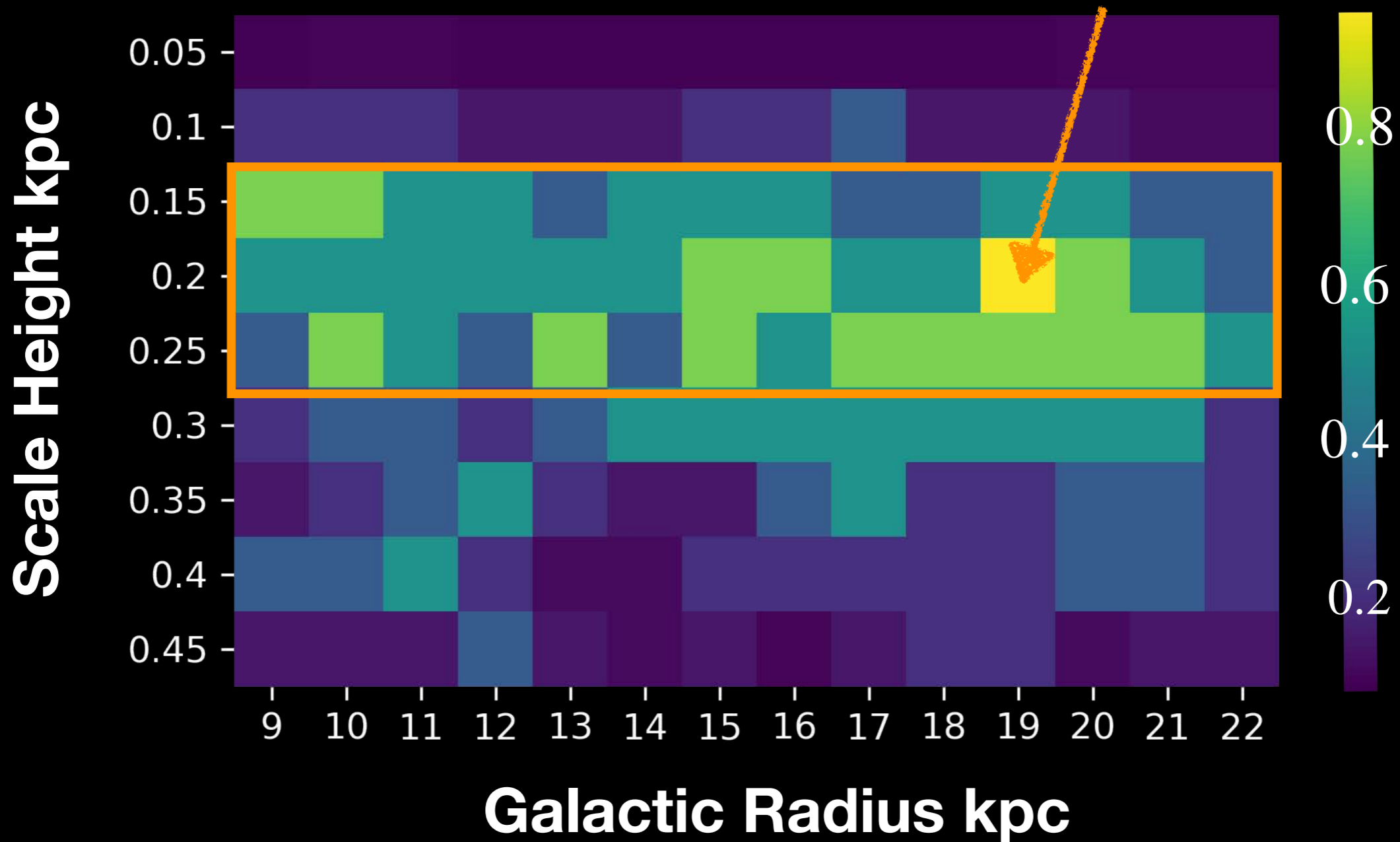
Modeled 1612 MHz OH maser observable with ATCA



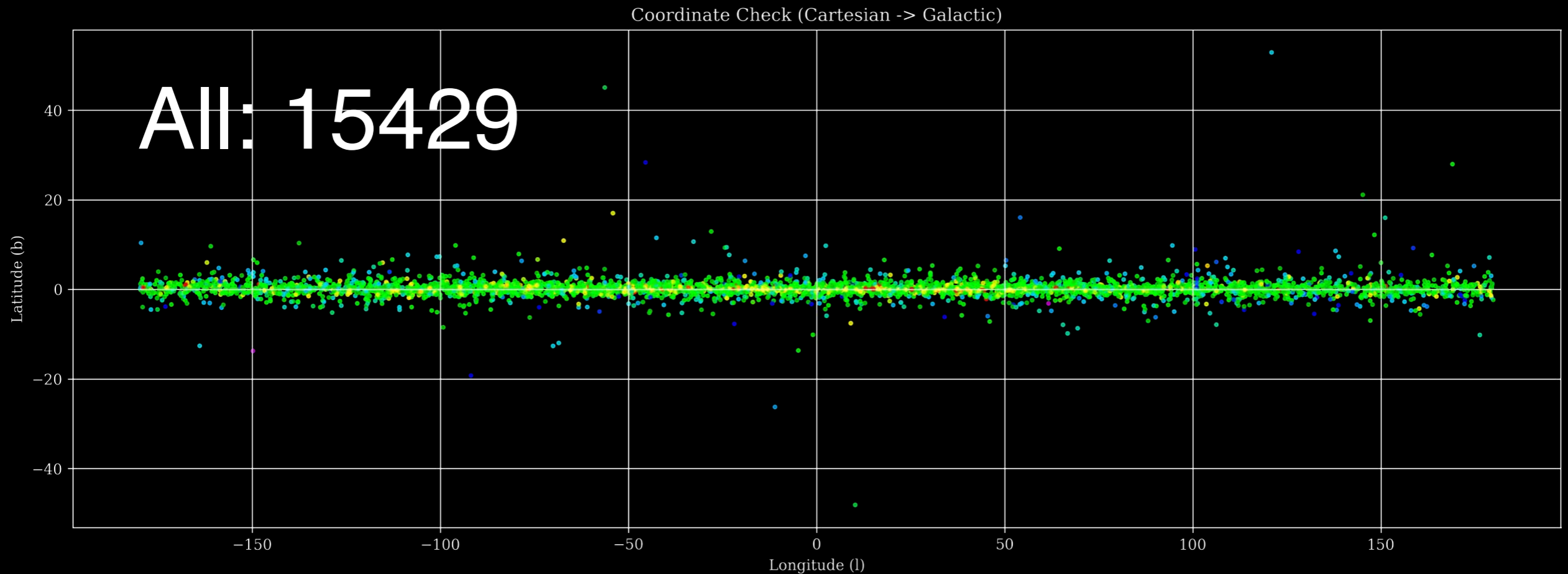
2.3 Results



$Z_0 = 200 \text{ pc}, R = 19 \text{ kpc}$



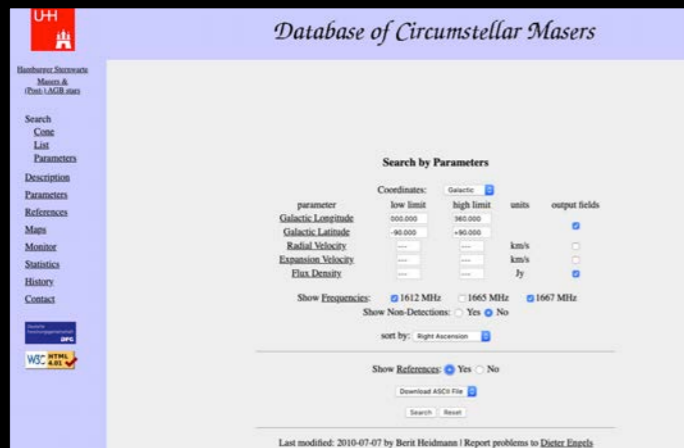
3. Number of 1612 MHz OH masers in our Galaxy



Detectable in ATCA: 3476 (limit=350mJy)

Next generational telescopes: 14775 (limit=10mJy)

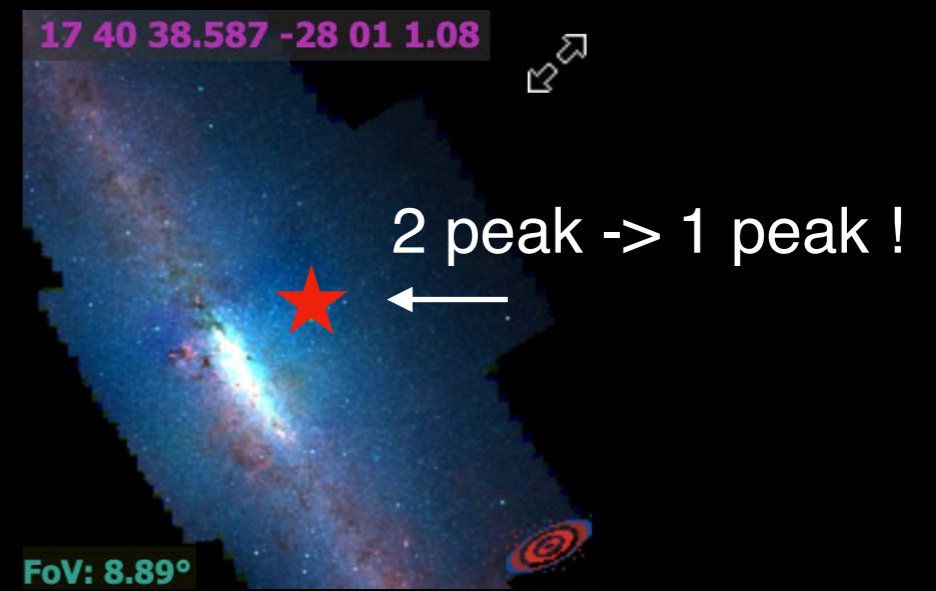
4. Lifetime of OH maser sources



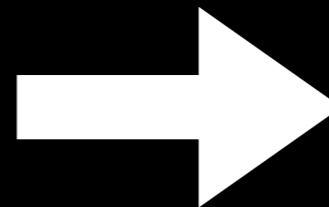
283 sources

Sevenster et al
(1997 A & B)

OH 0.207 +1.414 -- OH/IR star



	A	B	C	D	E	F	G	H
	RA(2000)	DEC(2000)	blue pk veloc	red pk veloc	lux dens blue	lux dens red	reference	
1								
2	OH000.000+00.352	17 44 14.949 -28 45 8.09	115.2	132.7	0.648	0.726	SEV97A	
3	OH000.024-00.874	17 49 6.252 -29 22 5.10	32	58.3	0.28	0.394	SEV97A	
4	OH000.071-00.205	17 46 35.313 -28 58 56.71	99.2	126.9	0.895	1.689	SEV97A	
5	OH000.190+00.036	17 45 55.797 -28 45 18.85	145.9	173.6	1.755	2.035	SEV97A	
6	OH000.207+01.414	17 40 38.587 -28 1 1.08	23.2	30.5	0.916	0.288	SEV97A	
7	OH000.260+01.027	17 42 15.569 -28 10 36.37	-11.8	13	0.668	0.492	SEV97A	
8	OH000.313+01.674	17 39 53.880 -27 47 23.75	-217.7	-198.7	0.295	0.329	SEV97A	
9	OH000.319-00.041	17 46 32.162 -28 41 5.33	56.8	93.3	1.322	3.77	SEV97A	
10	OH000.453-01.216	17 51 27.289 -29 10 31.73	21.8	53.9	0.267	0.392	SEV97A	
11	OH000.484-00.187	17 47 25.081 -28 36 34.22	129.8	153.2	0.911	1.686	SEV97A	
12	OH000.517+00.050	17 46 39.049 -28 28 5.79	153.2	183.8	0.437	0.57	SEV97A	
13	OH000.523-00.667	17 49 27.984 -28 50 1.57	29.1	186.8	0.816	0.721	SEV97A	
14	OH000.621-00.661	17 49 40.151 -28 44 47.92	-62.9	-30.8	0.761	0.701	SEV97A	
15	OH000.667-00.035	17 47 20.117 -28 23 4.10	59.7	67	1.387	1.7	SEV97A	
16	OH000.729+00.451	17 45 35.664 -28 4 44.83	233.5	243.7	0.302	0.844	SEV97A	
17	OH000.814+00.179	17 46 51.086 -28 8 51.61	56.8	88.9	0.617	1.775	SEV97A	
18	OH000.892+01.342	17 42 33.161 -27 28 24.62	-122.8	-93.6	47.866	0.669	SEV97A	
19	OH001.072+00.365	17 46 44.308 -27 49 51.71	-141.7	-108.2	0.987	1.058	SEV97A	
20	OH001.095-00.832	17 51 26.760 -28 25 36.85	-8.9	30.5	45.039	42.403	SEV97A	
21	OH001.134-00.062	17 48 32.242 -27 59 55.36	37.8	64.1	0.468	0.199	SEV97A	
22	OH001.155-00.029	17 48 27.360 -27 57 48.93	-61.4	-39.5	0.394	0.429	SEV97A	
23	OH001.184-00.958	17 52 8.755 -28 24 56.25	296.3	319.6	0.269	0.337	SEV97A	
24	OH001.212+01.257	17 43 38.042 -27 14 44.30	30.5	56.8	4.484	3.44	SEV97A	
25	OH001.234+01.273	17 43 37.355 -27 13 7.86	216	242.2	0.369	0.295	SEV97A	
26	OH001.369+01.003	17 44 58.723 -27 14 43.37	-27.9	2.8	5.396	5.476	SEV97A	
27	OH001.463-00.997	17 52 56.594 -28 11 42.44	-41	-19.1	0.558	0.581	SEV97A	

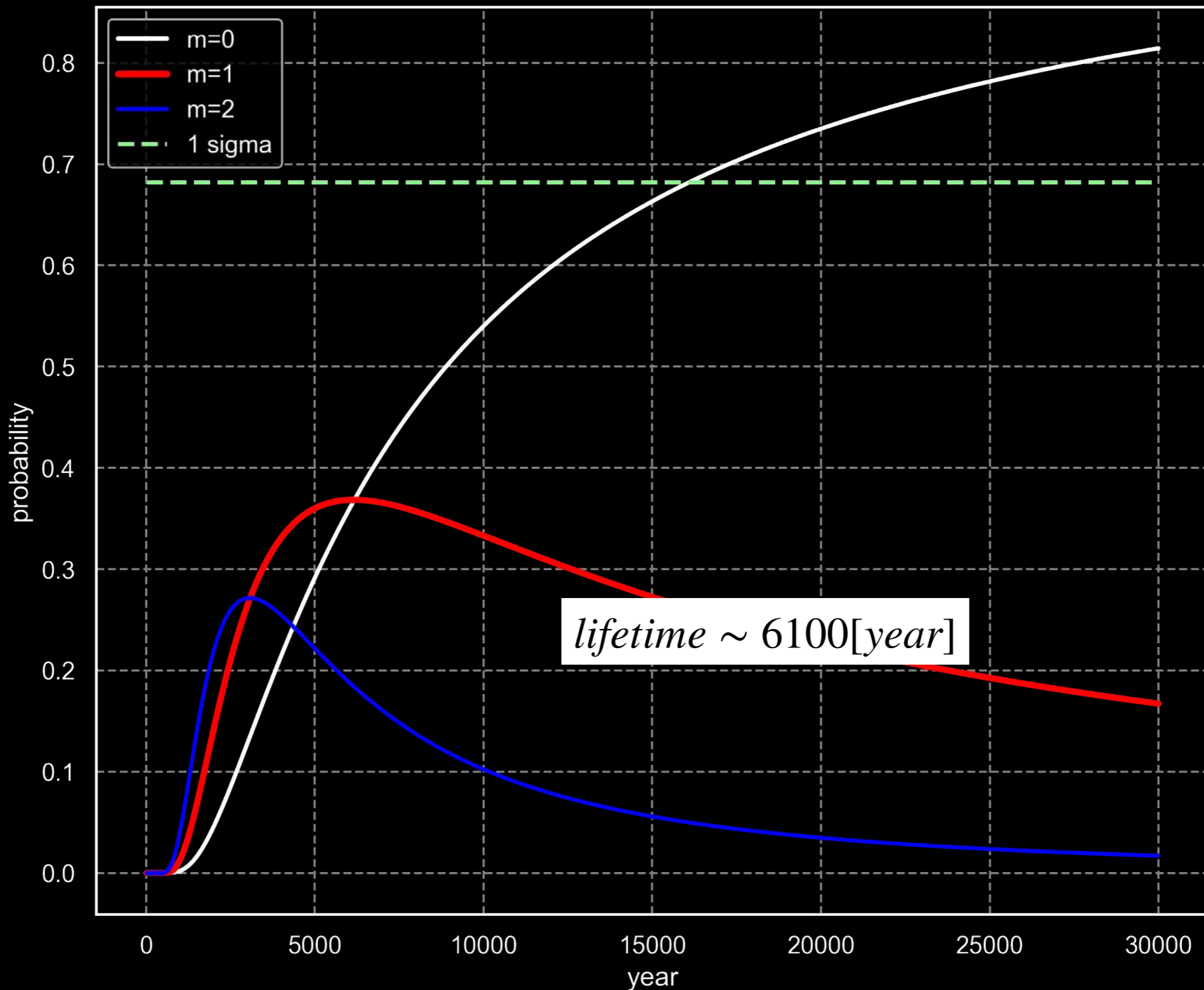


Cross
Matching

$$P_m^n = n C_m \left(\frac{dT}{T} \right)^m \left(1 - \frac{dT}{T} \right)^n$$

Engels and Jimenez, 2007

Lifetime of OH maser sources



Conclusion

1. Disc scale Height: 150 - 250 [pc]
2. More than 15000 1612-MHz circumstellar OH maser sources in the Galaxy
3. Lifetime of double-peaked OH masers: about 6000 [years]