VERA astrometry of the S235AB and IRAS20056+3350 star forming regions

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Self-Introduction

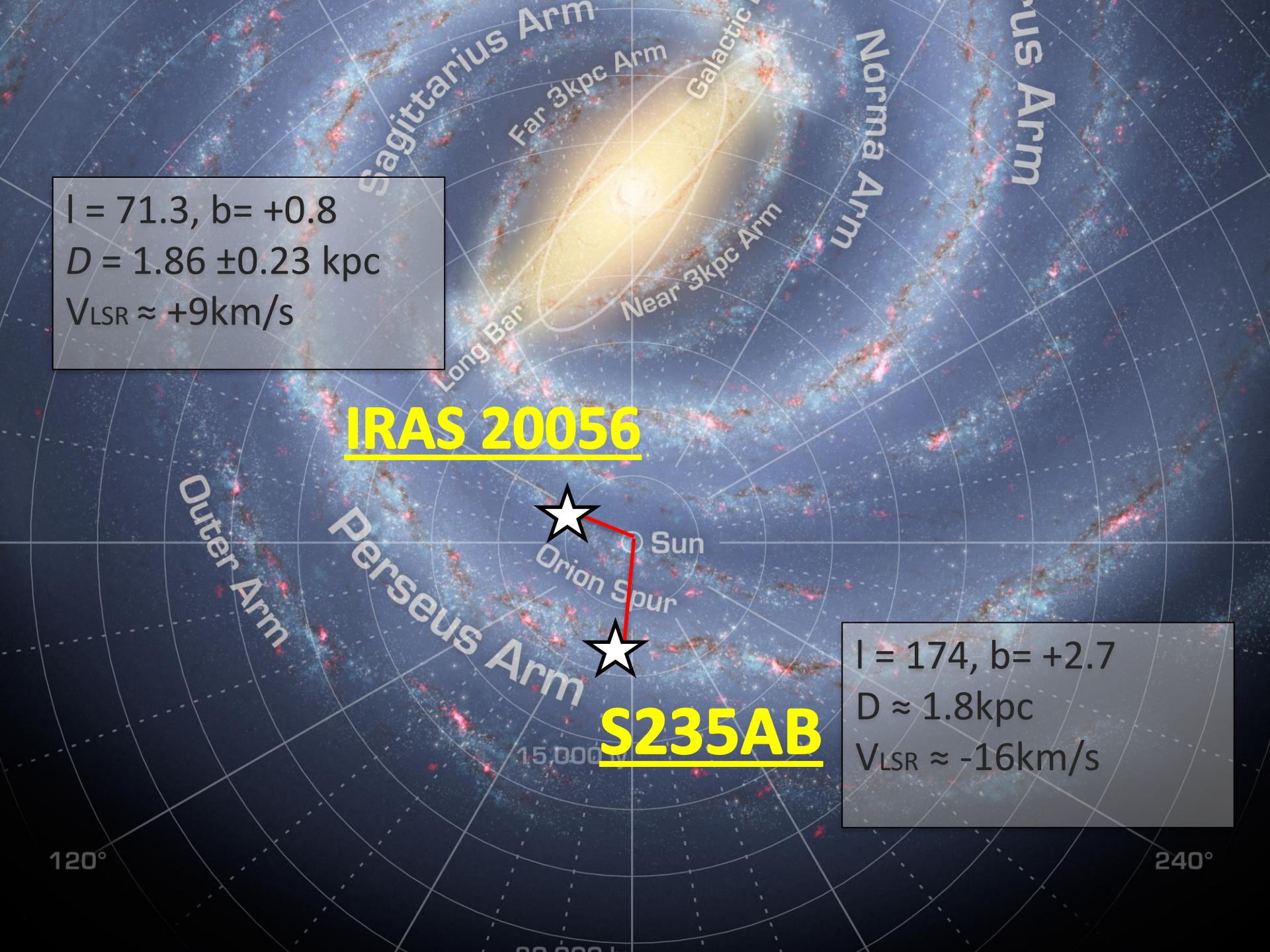
Ross Burns

- Masters degree: Disk Galaxies (Bar vs spiral) in IR using Herschel – Cardiff University, UK

- PhD: Year 1 – Massive star formation and Galactic structure and dynamics.

Kagoshima University.
Supervisor: Handa Toshihiro

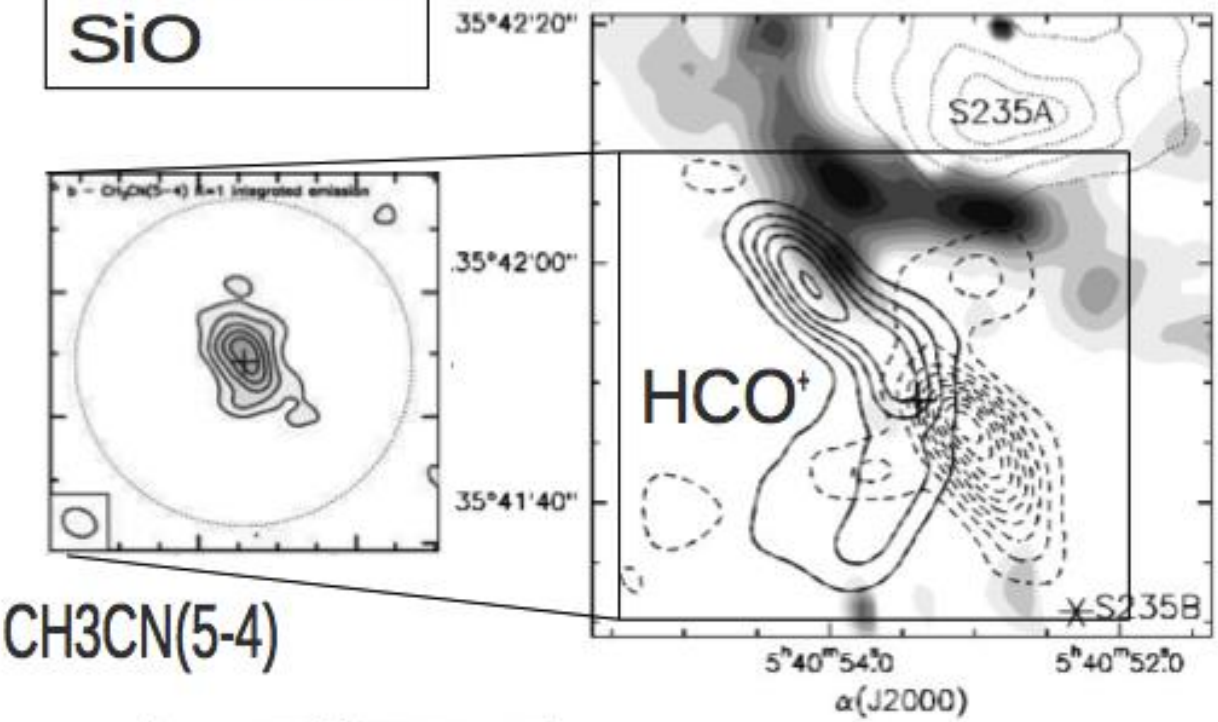
Name	**S235AB**	**IRAS 20056+3350**
Target type	High Mass SFR	Tangent Point source
♯Maser features	~25	~2
QSO Flux(K-band)	J0533+34 >30mJy	J2010+33 ~240mJy
Reduction method	Inverse phase referencing	Normal phase referencing
Epochs observed Epochs reduced	6 3	7 6


l = 71.3, b= +0.8
D = 1.86 ±0.23 kpc
VLSR ≈ +9km/s
IRAS 20056
Sagittarius Arm
Far 3kpc Arm
Galactic
Norma Arm
Perseus Arm
Long Bar
Near 3kpc Arm
Outer Arm
Sun
Orion Spur
S235AB
15,000
120°
240°
l = 174, b= +2.7
D ≈ 1.8kpc
VLSR ≈ -16km/s

S235AB

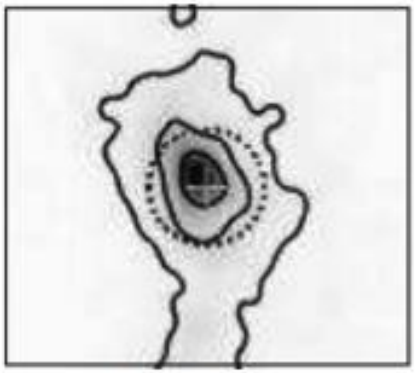
Archive maps

Masers:
Water
Methanol
SiO



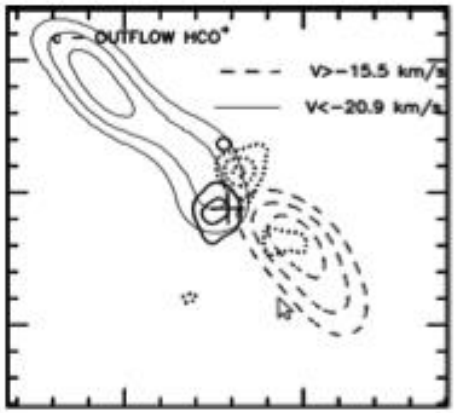
CH3CN(5-4)

- 2 x Bipolar Outflows
- Dusty core
- Cold mm core
- Disk?



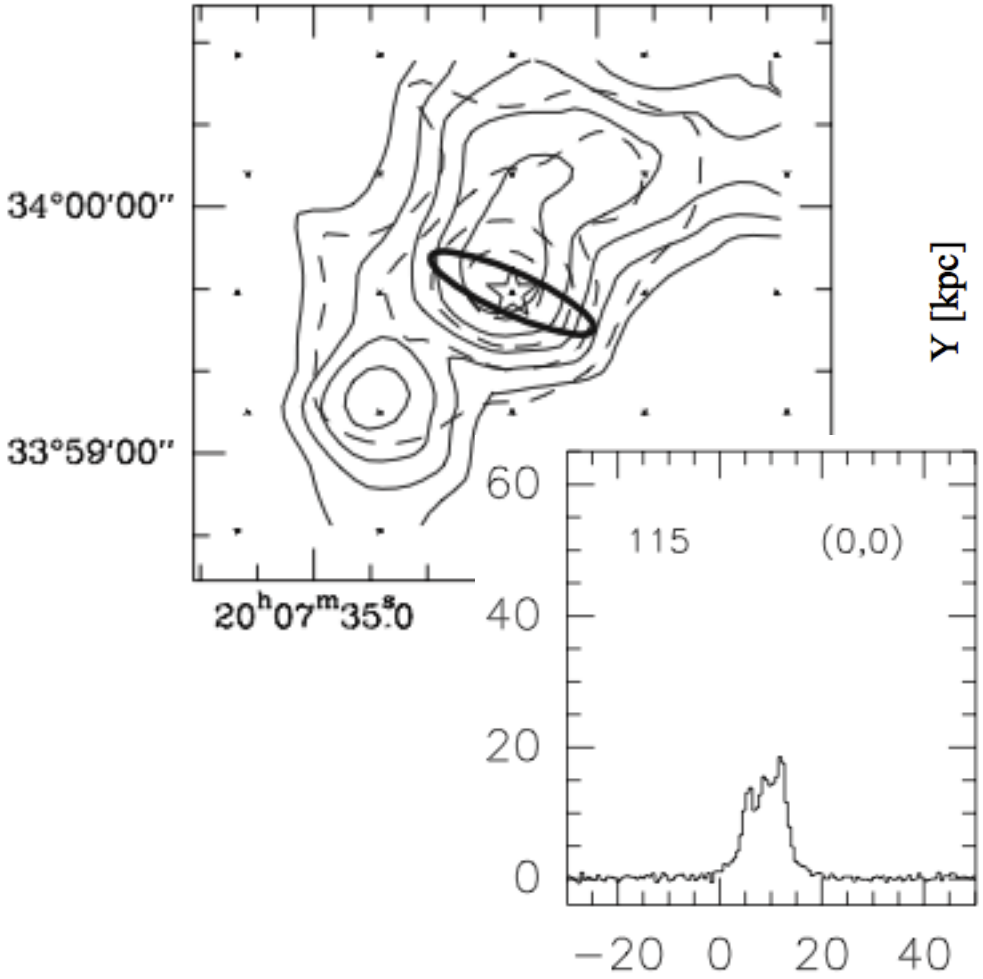
850μ

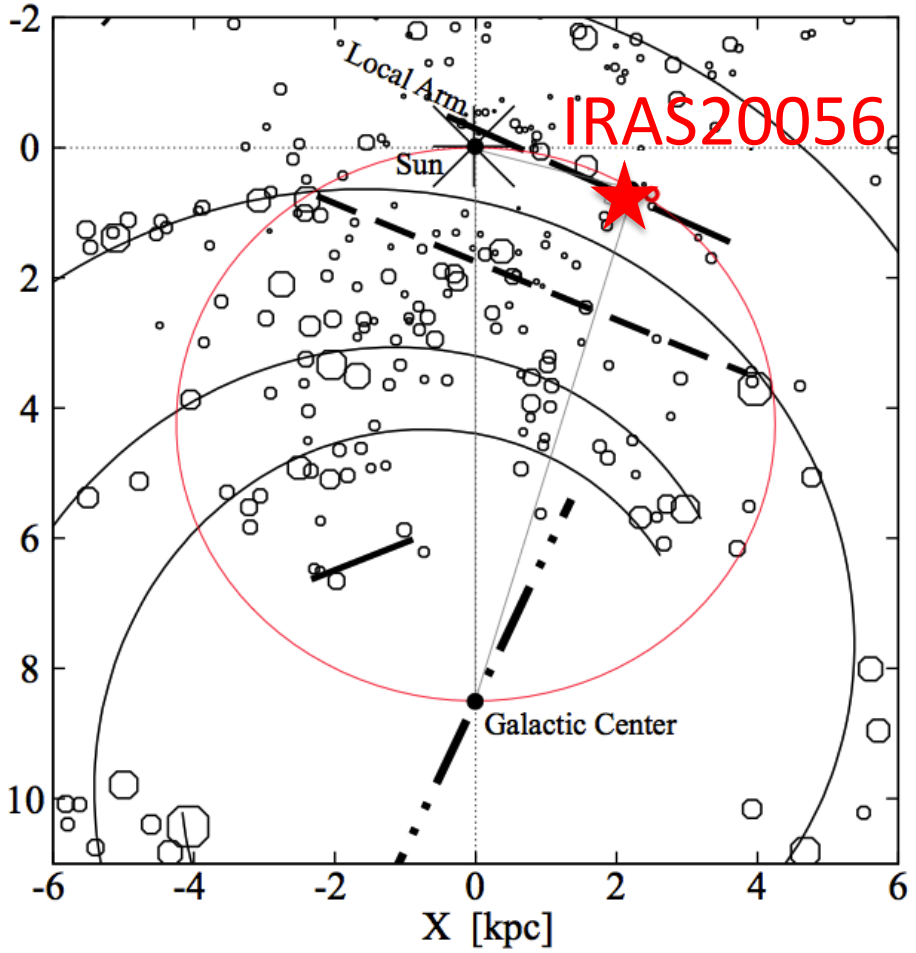
450μ



$C^{34}S$

IRAS 20056+3350





Tangent point source: Useful in deriving the Galactic constants R_o, Θ_o, Ω_o

Reduction method:
Inverse phase referencing in AIPS

How is it different?

- Phase solutions are found (FRING) using the maser emission instead of the QSO.

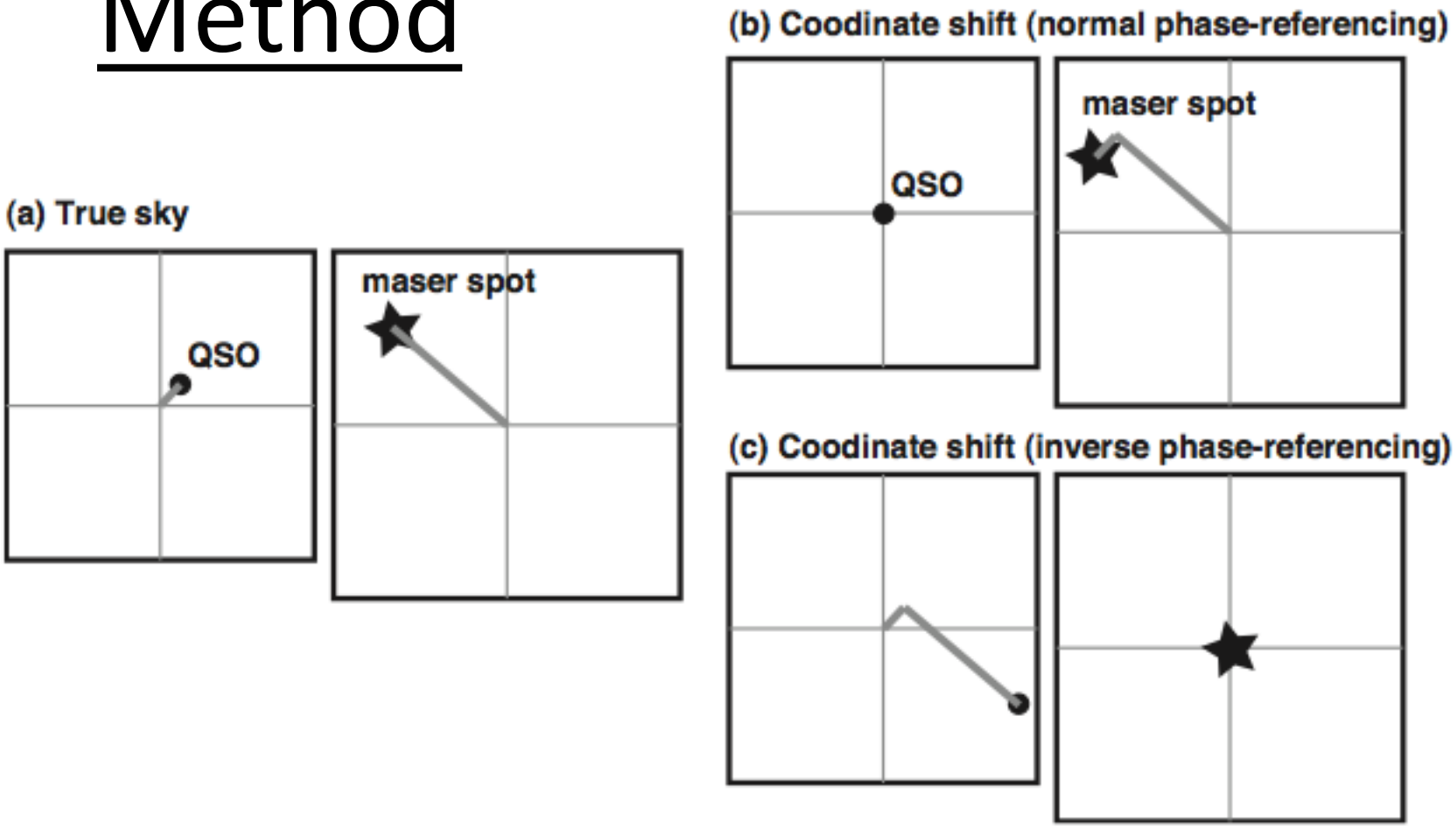
Why is it useful?

- Capable of finding solutions in the case when the reference quasar is weak (>20mJy)

What are the downsides?

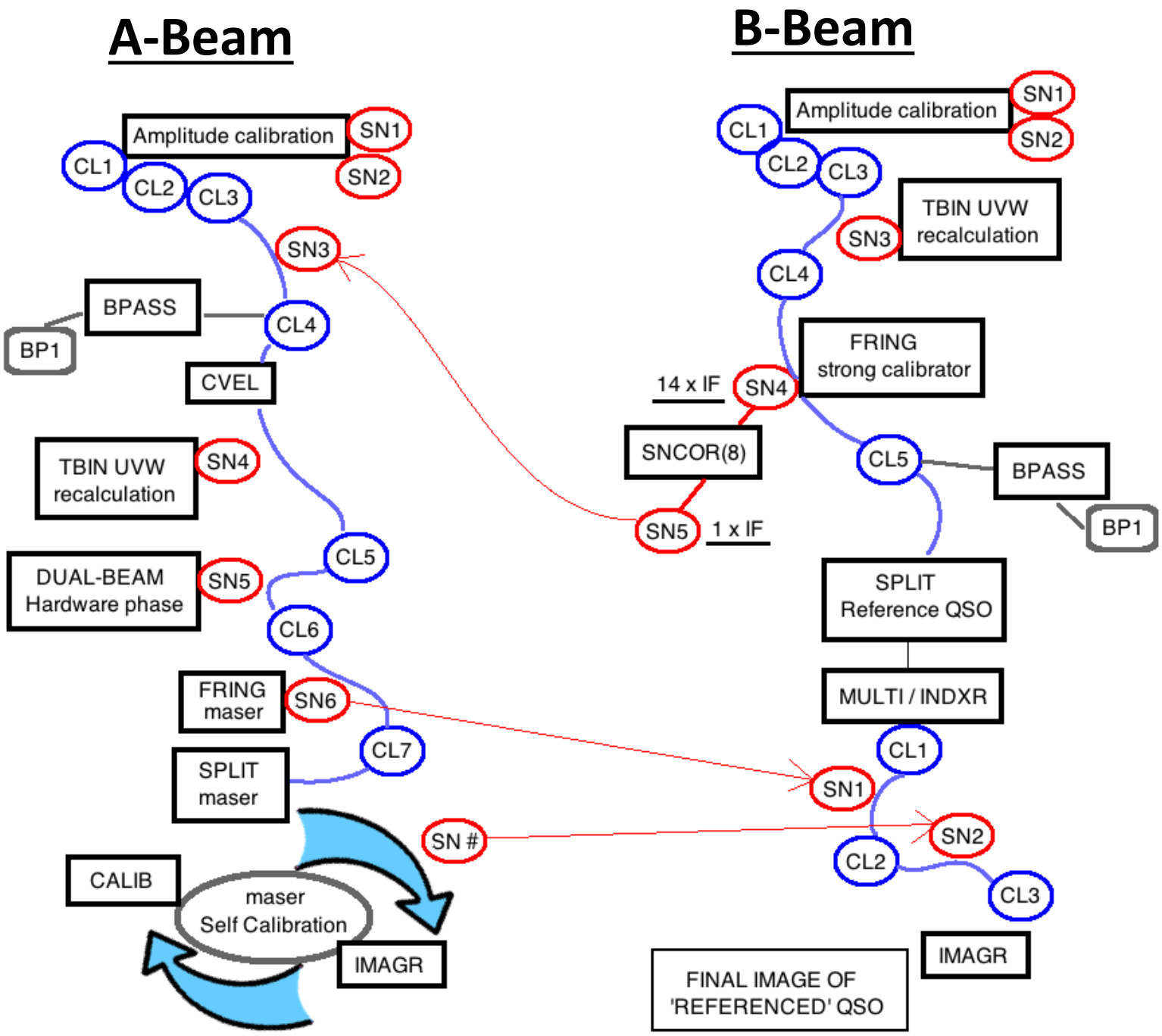
- (My case) Flux loss in the QSO - due to imperfect reduction technique.

Method



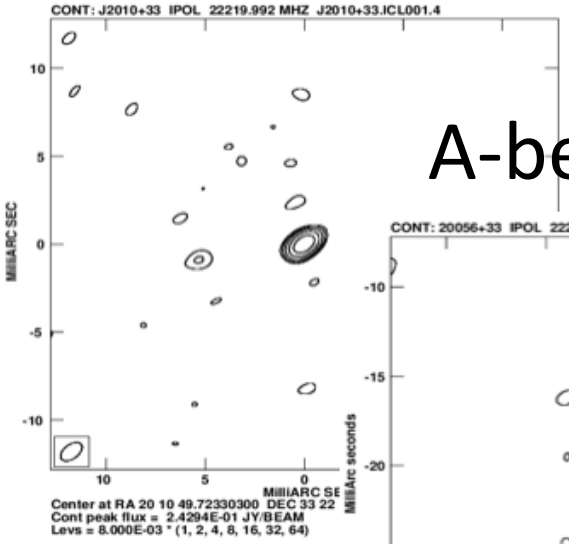
Source: “Special issues in AIPS analysis of JVN/VERA data”- Imai Hiroshi

http://milkyway.sci.kagoshima-u.ac.jp/~imai/VERA-AIPS-analysis.pdf .

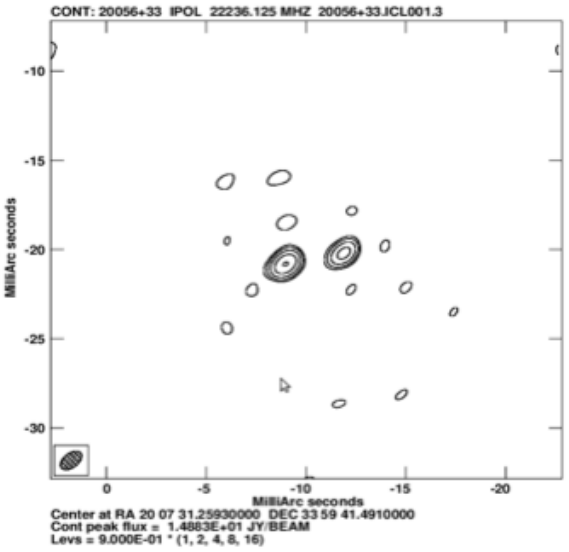

A-Beam
B-Beam
Amplitude calibration
SN1
SN2
CL1
CL2
CL3
SN3
BPASS
BP1
CL4
CVEL
TBIN UVW recalculation
SN4
CL5
DUAL-BEAM Hardware phase
SN5
CL6
FRING maser
SN6
CL7
SPLIT maser
CALIB
maser Self Calibration
IMAGR
SN #
Amplitude calibration
SN1
SN2
CL1
CL2
CL3
TBIN UVW recalculation
SN3
CL4
FRING strong calibrator
14 x IF
SN4
SNCOR(8)
SN5
1 x IF
CL5
BPASS
BP1
SPLIT Reference QSO
MULTI / INDXR
CL1
SN1
SN2
CL2
CL3
IMAGR
FINAL IMAGE OF 'REFERENCED' QSO

Demonstration / Test
IRAS 20056+3350

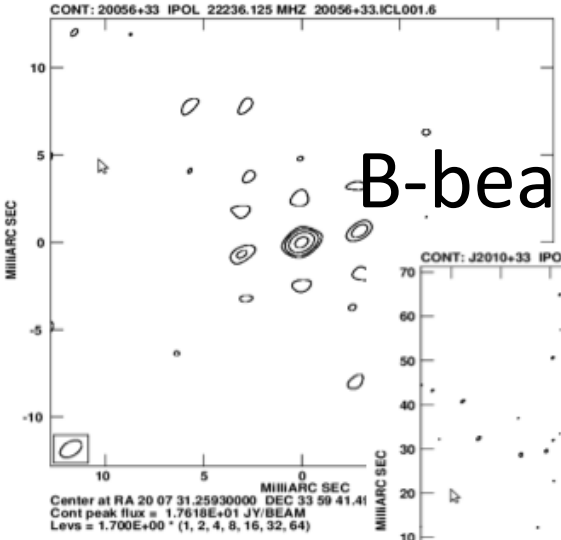
B-beam (240mJy)



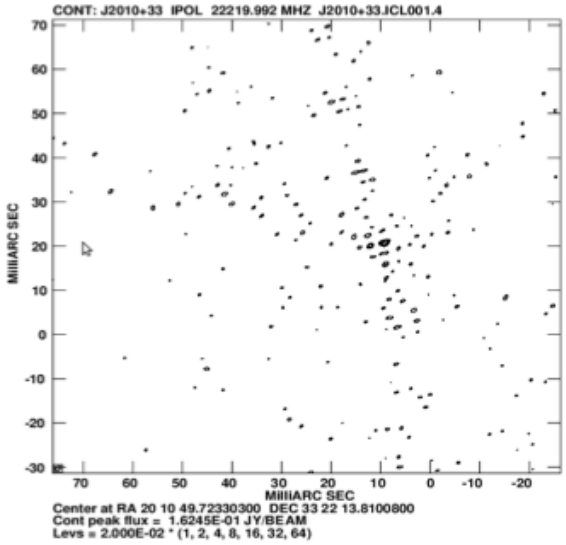
A-beam (15Jy)



A-beam (17Jy)



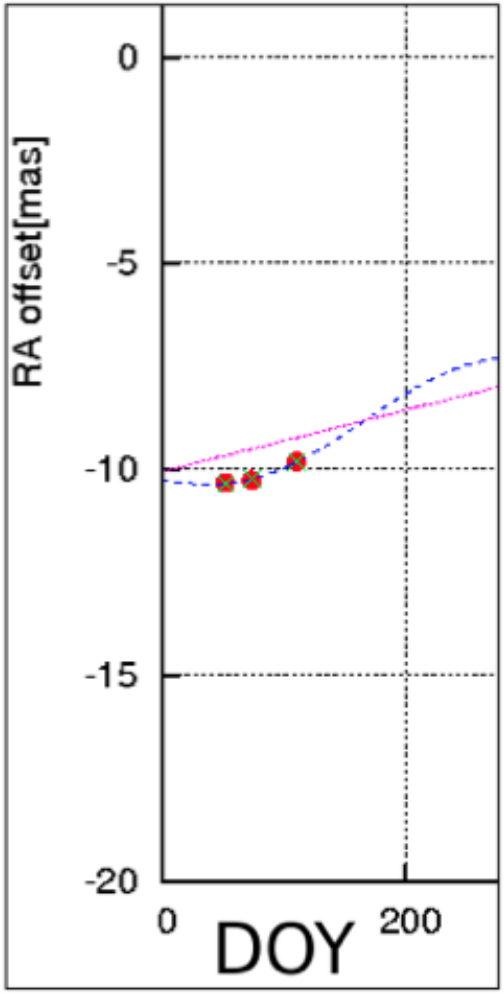
B-beam (160mJy)

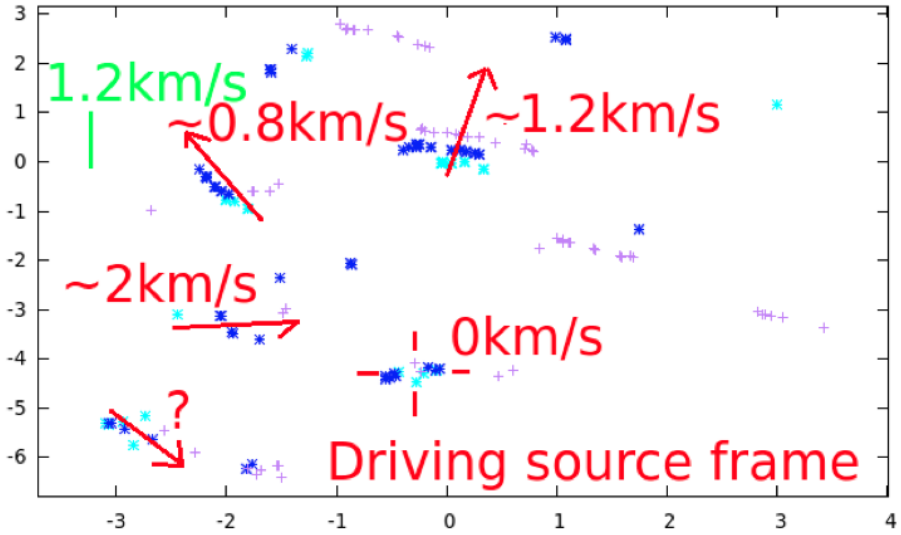


Normal reduction technique

Inverse phase referencing

VERA Results - S235AB





Proper motion of masers:

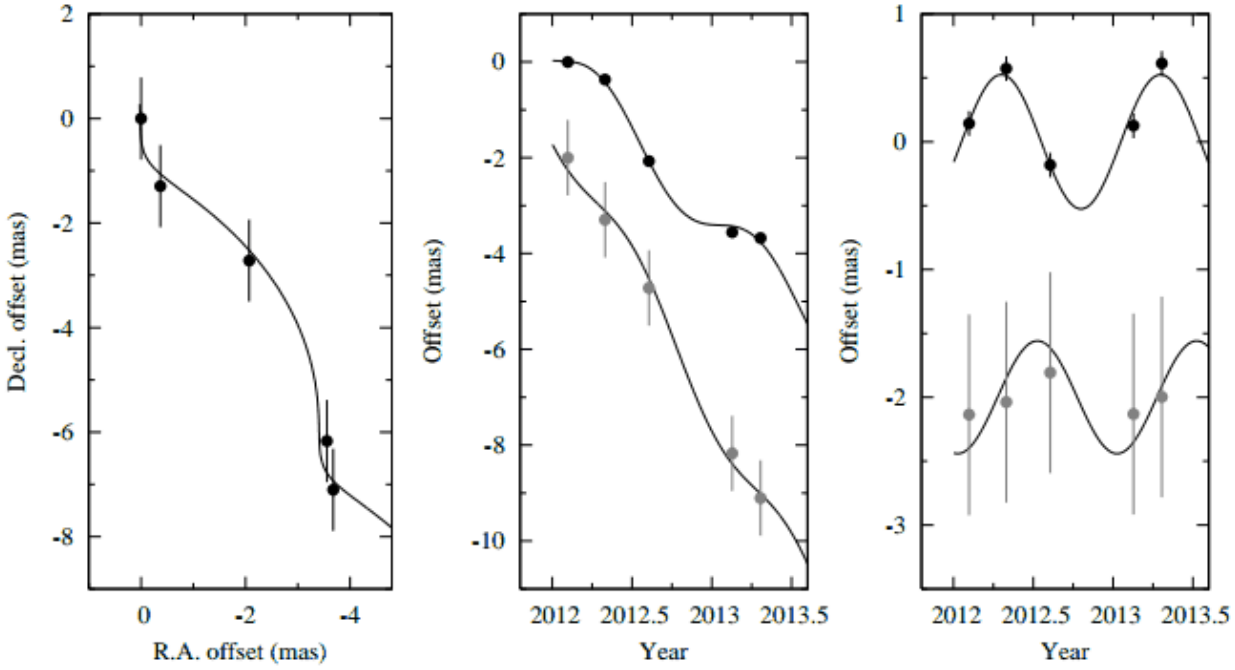
First VLBI images.

Internal motions seem random and small.

Distance (3 x epoch):

D=1.4 ± 0.9 kpc (current error is 67%)

VERA Results – IRAS20056



Current distance estimate D = 1.86 ±0.23 kpc

Project P.I. – Nagayama Takumi

What next?

Case: S235AB

- Continue with VERA observations
- Try to improve reduction technique -> reduce more epochs
- Try to calculate targe distance -> study HMSF
- Plateau de Bure proposal

Case: IRAS 20056+3350

- Complete final observations to improve distance estimate
- Begin analysis and calculation of Galactic constants
- Combine results with those of IRAS20126+4104 (Nagayama)

Thank you

Any questions?