VLBI Phase-Referencing Observation of SiO Masers Toward R Aquarii

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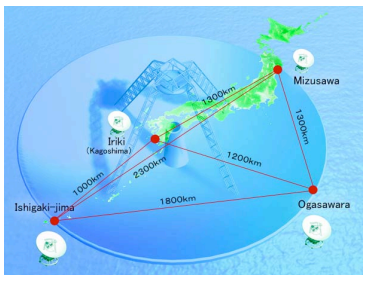
Abstract

We show the phase-referenced Image of SiO masers toward, a Mira Variable, R Aqr. These data have been obtained with VERA. We have estimated the proper motion of the star and compared it with the result of the HIPPARCOS. The proper motion from 2004 to 2005 are deferent with it from 1991 to 2005. It may reflect the orbital motion of R Aqr.

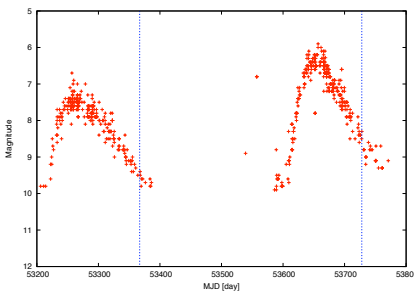
Motivation



R Aqr is one of the brightest SiO maser source and there are a bright external-galaxy source, J2348-1631, within 2.2° of it. The star is a symbiotic stellar system, but no one have obtained the orbital motion of it directly. So, I'm trying to detect it and estimate orbital elements of it with VERA. I also have evaluated the performance of VERA at 43 GHz.

Observation

Targets: R Aqr (23h43m49.4616s -15d17'04.202" (J2000)) &
J2348-1631 (23h48m02.60850s, -16d31'12.0220" (J2000()



Date:

2004.12.23 & 2005.12.24

Bandwidth:

16 MHz x 2IFs (R Aqr)

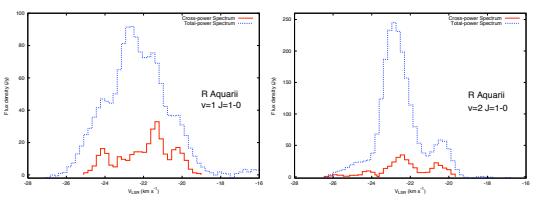
16 MHz x 14IFs (J2348-1631)

Light Curve of R Aqr (Left)

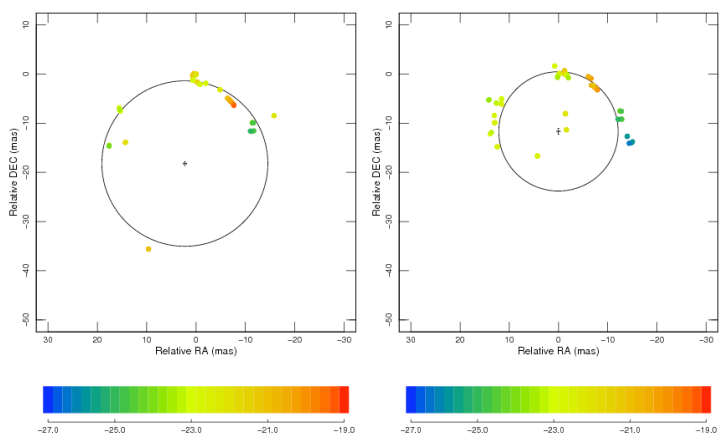
Data Reduction & Result

Self-Calibrated Image (2005.12.24)

We show Self-Calibrated Image produced using AIPS.



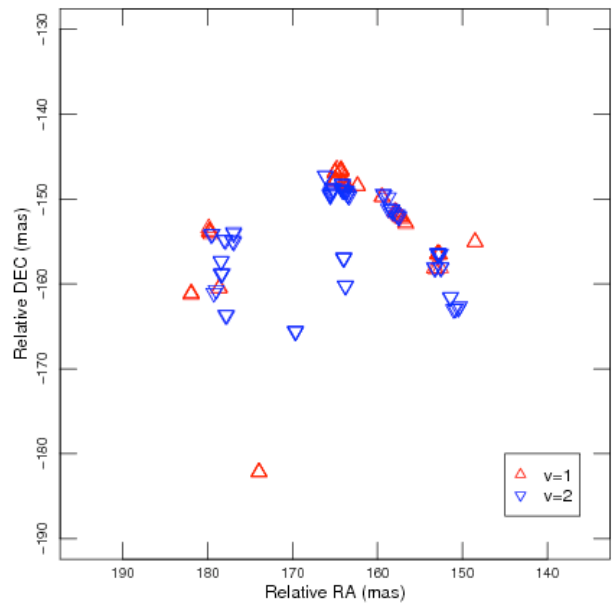
Cross- and Total-power spectrums of SiO masers (Top).; Spatial distributions of them (bottom). The result of circular fitting of them are shown in them.



(v=1 J=1-0) (v=2, J=1-0)

We have analyzed some bright maser spot using the phase-reference technique and obtained the position differences between self-calibrated and phase-referenced image. Then, we have applied these offsets to all spots.

Phase-Referenced Image

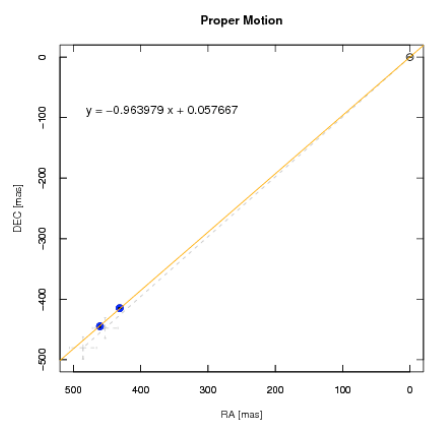


We have obtained the steller position by circular fitting. The position of each date are listed in this table.

DATE	RA (mas)	DEC (mas)
2004.12.23	136.7 ± 1.8	-132.7 ± 0.7
2005.12.24	166.0 ± 0.8	-162.7 ± 3.0

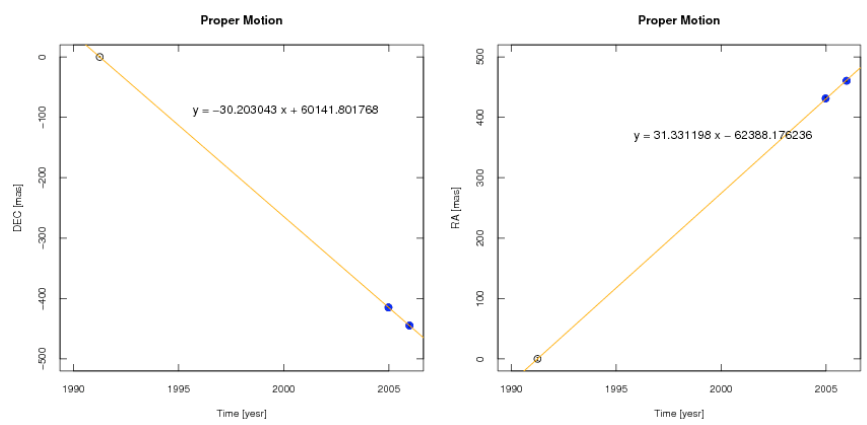
Discussion

Proper Motion



The left figure is a registered map of our result (blue circle) and the position reported by the HIPPARCOS (white circle). Gray cross and line show the motion and position expected from the HIPPARCOS.

The proper motions of RA and Dec obtained from these data are **31.33 ± 0.12** and **-30.2 ± 0.12** [mas yr^{-1}], respectively.



The proper motion of RA and Dec from 2004 to 2005 is **29.3 ± 1.8** and **-30.0 ± 3.1** [mas yr^{-1}], respectively. The differences between the last value and the former of RA and Dec are 2.0 and 0.2 [mas yr^{-1}]. These difference may be consistent with the orbital motion which is suggested by Hollis et at. (1997); (P,a,e,T,i,Ω,ω,K) = (44 yr, 2.54x10^{14} cm, 0.8, 2442100.0 JD, 70°, ~90°, ±90°, 7.2 km s^{-1}). Using their orbital elements, an expected offset of the positions of RA and Dec from 2004 to 2005 are 1.2 and 0.5 mas, respectively.