

VERAによる オリオンKL水メーザーバースト天体の観測

Tomoya Hirota (NAOJ)

Reference; Hirota et al. 2011, ApJL, 739, L59 (Oct. 1)

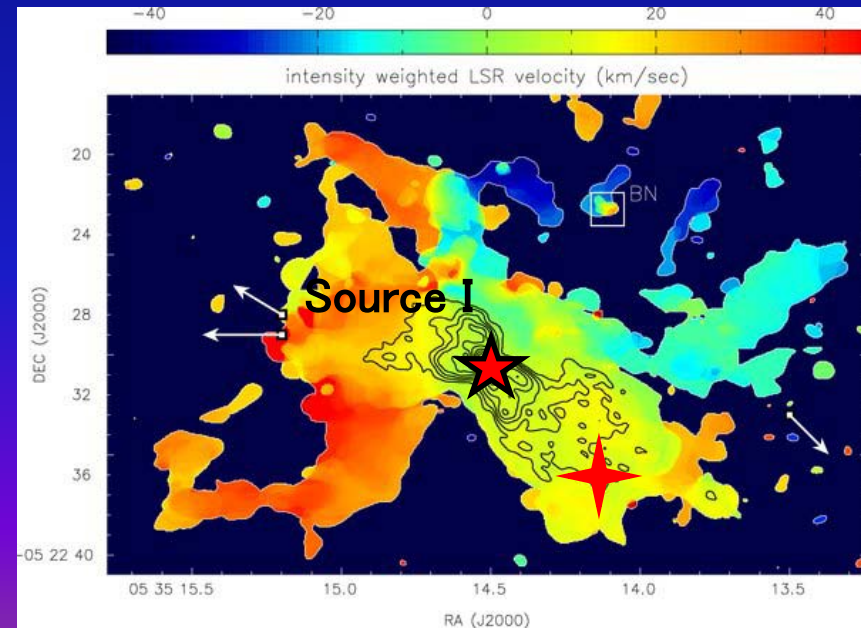
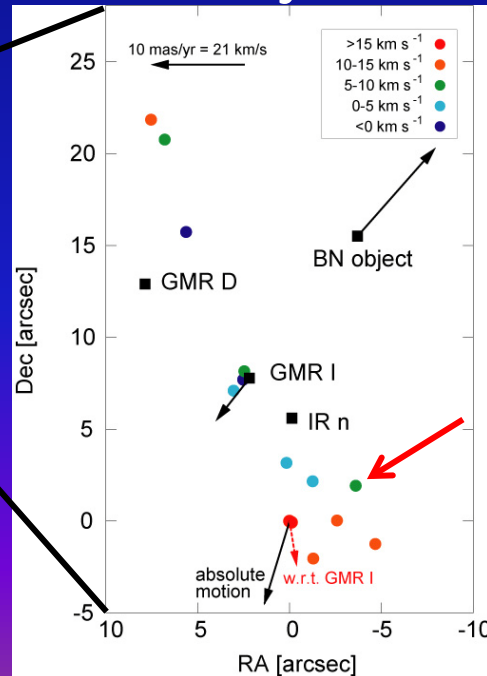
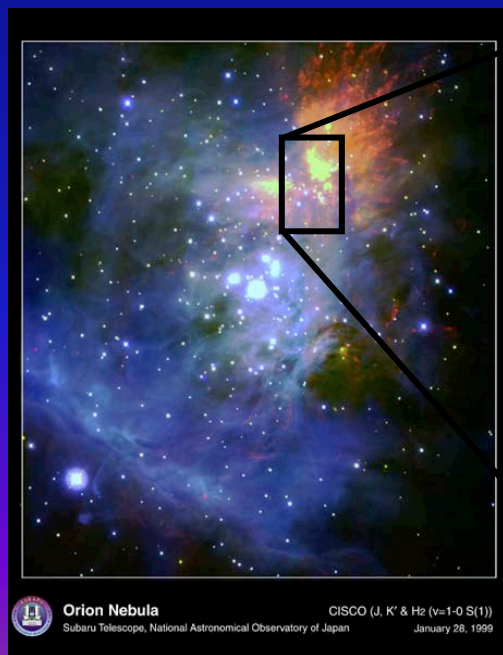
“Identification of Bursting Water Maser Features in Orion KL”

Collaborators

- VERA and JVN members
 - Tsuboi, M. (JAXA)
 - Honma, M., Kawaguchi, N., Kim, M. K., Koyayashi, H., Shibata, K. M. (NAOJ)
 - Fujisawa, K. (Yamaguchi Univ.)
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 - Yonekura, Y. (Ibaraki Univ.)

Orion KL region

- Nearest massive SFR with complex outflows
 - D=420 pc (Kim et al. 2008, Hirota et al. 2007); 1 mas=0.4AU
 - NW–SE high–velocity outflow; H₂
 - NE–SW low–velocity outflow; thermal SiO, H₂O maser



Kaifu et al. (2000)

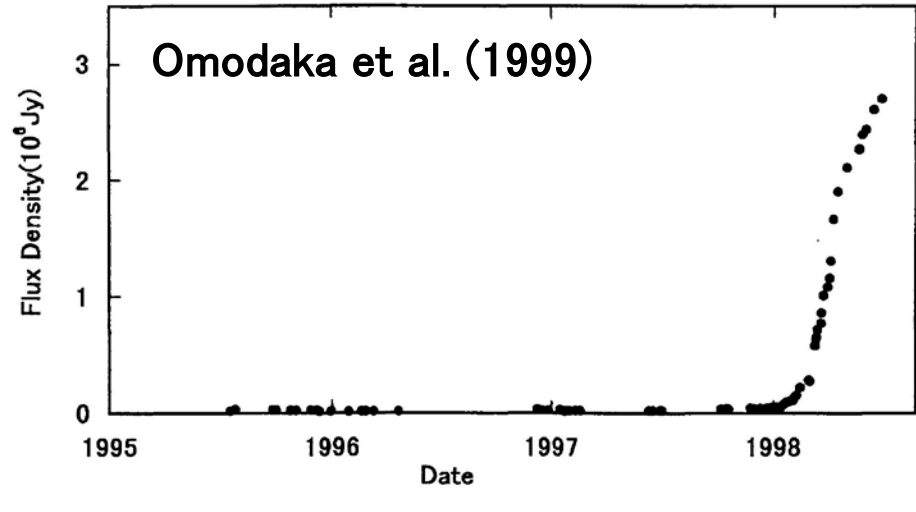
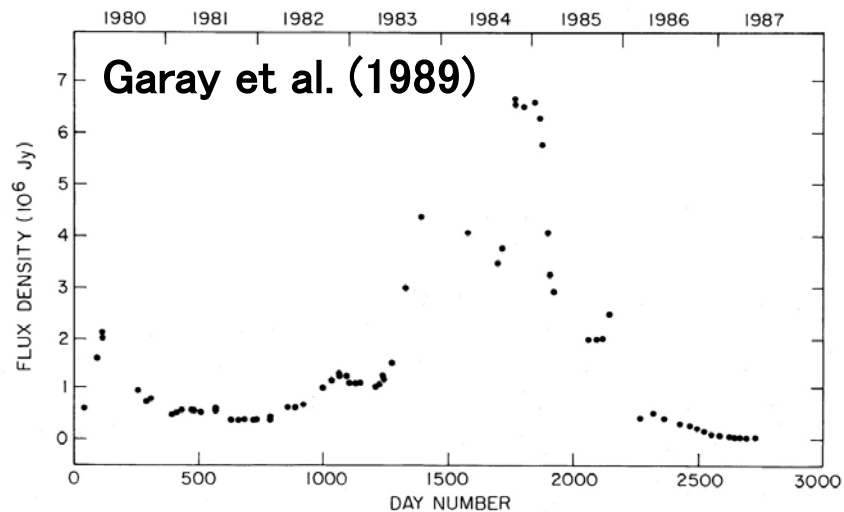
Hirota et al. (2007)

Plambeck et al. (2009)

H₂O maser flare/burst in Orion KL

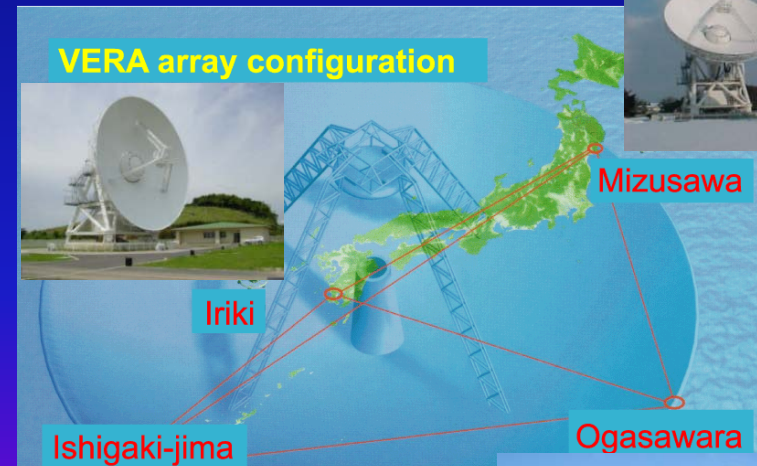
- History

- 1979–1985 (Abraham+1981, Matveyenko+1988, Garay+1980)
- 1998 (Omodaka+1999, Matveenko+2004, Shimoikura+2005)
- **2011 (Tolmachev+2011) — 200000 Jy(?) on 2011 Mar 1**
- 13-year possible periodicity?



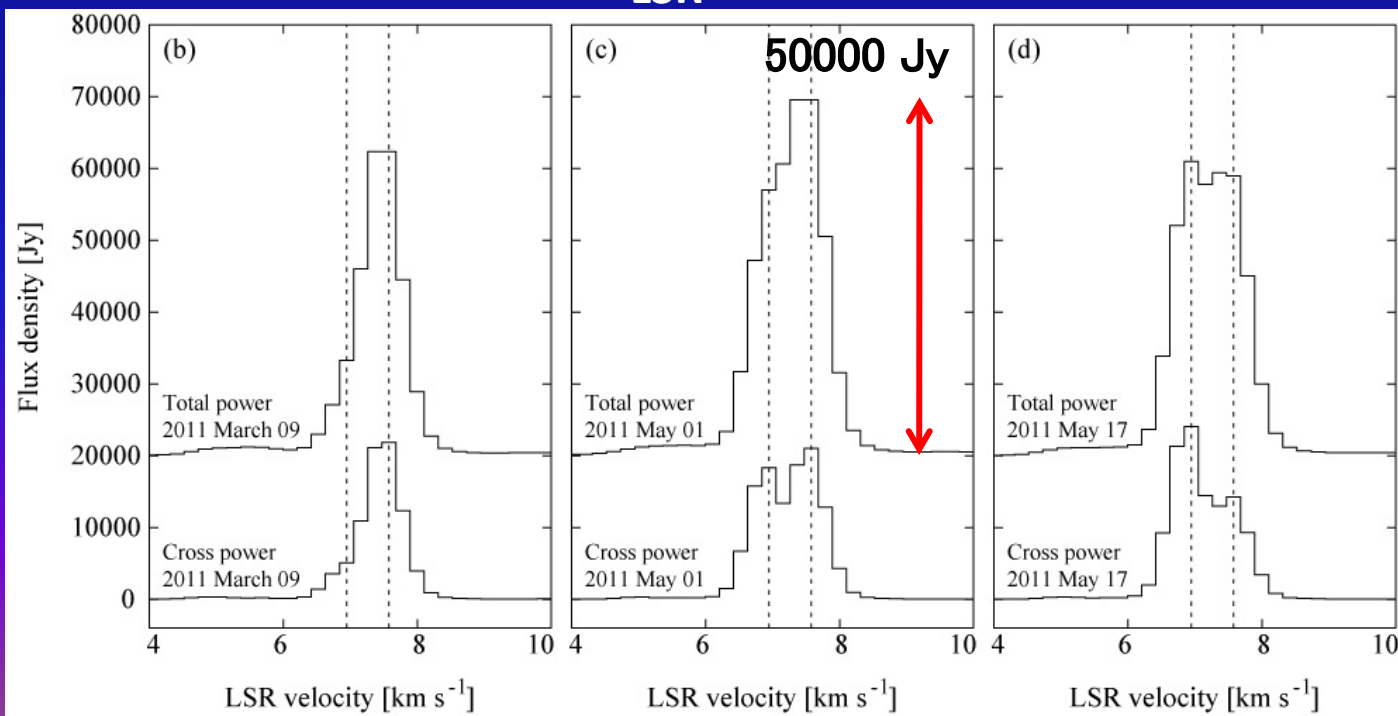
Observations

- Aim
 - Providing hints for pumping mechanism
 - Understanding dynamics in Orion KL region
- Detail
 - VERA 4 station
Beam size=1.7mas*0.9mas
 - **Dual-beam astrometry**
 - March 09, May 01, May 17
and still ongoing



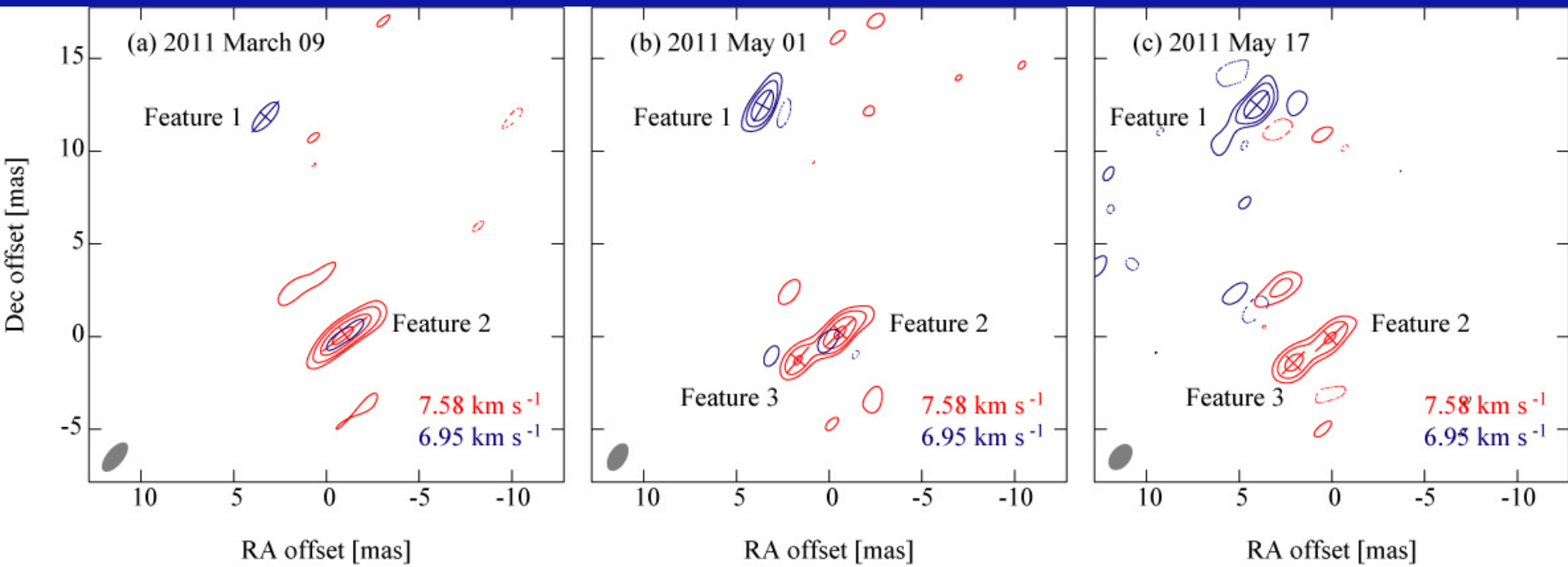
Spectra

- **50000 Jy in May 2011**
 - Factor of 1000 brighter than in 2006 (<50 Jy)
 - But weaker than in 1998 burst ($>10^6$ Jy)
- **Two components at $V_{\text{LSR}}=7.58$ km s $^{-1}$ and 6.95 km s $^{-1}$**



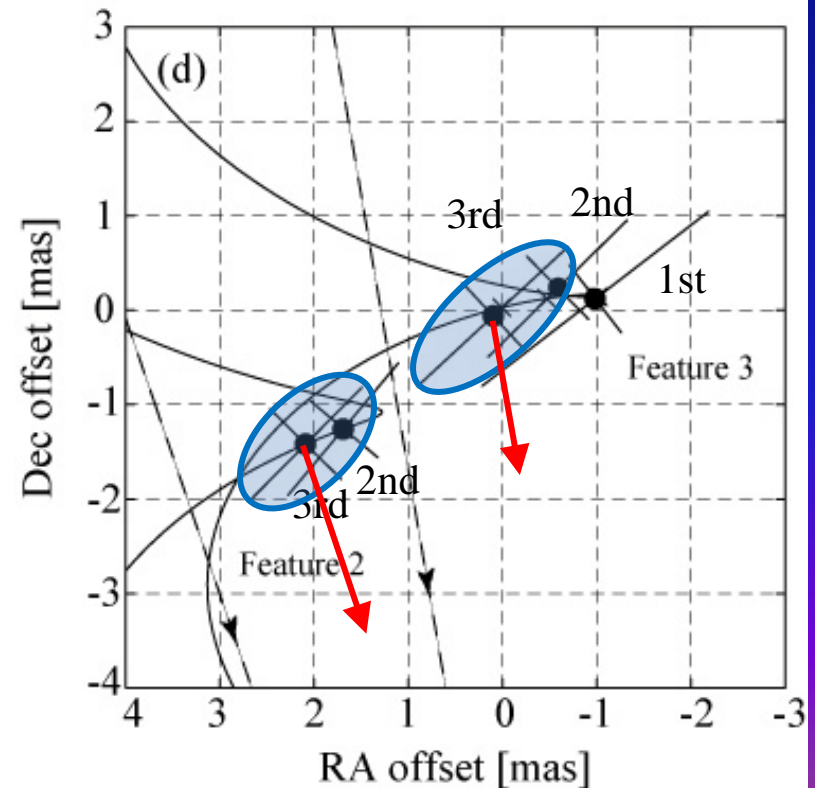
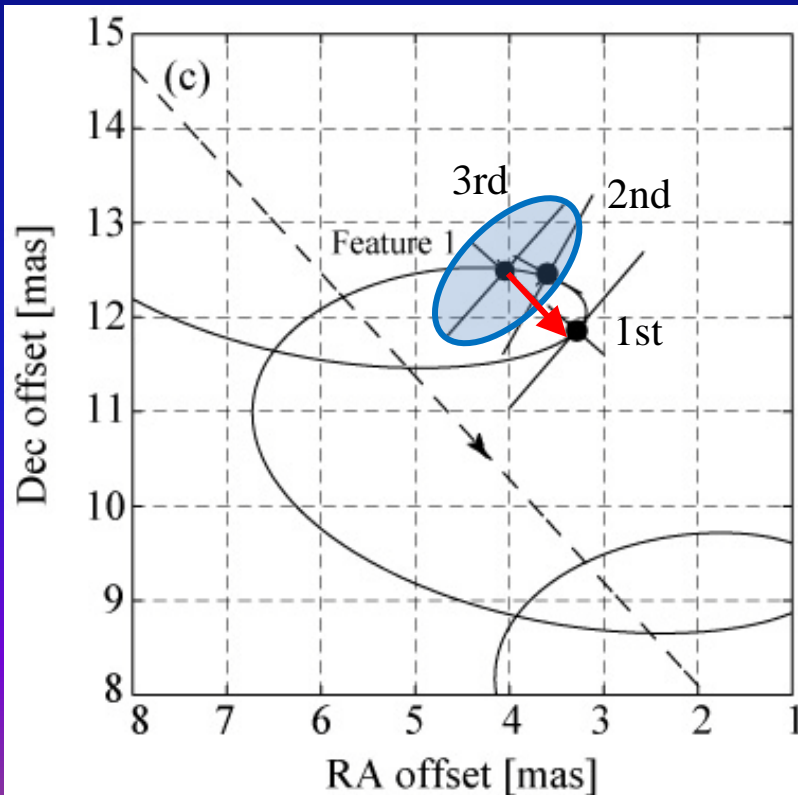
Result: VLBI mapping

- Two spatially distinct features
 - $V_{\text{LSR}} = 7.58 \text{ km s}^{-1}$ and 6.95 km s^{-1}
- Elongation along NW–SE
 - Similar to previous bursts (Shimoikura et al. 2005)



Result: astrometry

- Proper motions toward southwest, 8–18 km s⁻¹
 - Perpendicular to the NW–SE elongation



Summary

- **First astrometry of bursting features with VERA**
 - Located in Orion Compact Ridge
 - Excited by the shock between outflow from source I (or another YSO?) and ambient dense gas
- **Future**
 - Astrometry with VERA
 - Sub-mm masers, thermal lines, and continuum with ALMA