

# Astrometry of H<sub>2</sub>O maser sources in nearby molecular clouds with VERA

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**Abstract.** We have carried out multi-epoch VLBI observations of the H<sub>2</sub>O maser sources associated with young stellar objects (YSOs) in nearby molecular clouds with VERA (VLBI Exploration of Radio Astrometry), which is a newly constructed VLBI network in Japan (Kobayashi *et al.* 2003). The main goal of our study is to measure the absolute proper motions and distances to nearby molecular clouds within 1 kpc from the Sun, to reveal their 3-dimensional structures and dynamical properties. Using the VERA dual-beam receiving system (Honma *et al.* 2003), we have carried out phase-referencing VLBI observations and measured annual parallaxes and absolute proper motions of the H<sub>2</sub>O maser features with respect to the extragalactic radio sources. We have successfully detected the annual parallax of one of the H<sub>2</sub>O maser features in Orion KL to be  $2.29 \pm 0.10$  mas, corresponding to the distance of  $437 \pm 19$  pc from the Sun (Hirota *et al.* 2007). In addition, the annual parallax of SVS13 in NGC 1333 is also determined to be  $4.10 \pm 0.17$  mas, corresponding to the distance of  $244 \pm 10$  pc from the Sun, although the life time of the maser features are only 6 months. The absolute proper motions of the H<sub>2</sub>O maser features associated with Orion KL and NGC 1333 are derived, possibly indicating the outflow motions from the YSOs as well as the systemic motions of the powering sources.

**Keywords.** Astrometry, ISM: individual (Orion KL, NGC 1333), masers (H<sub>2</sub>O)

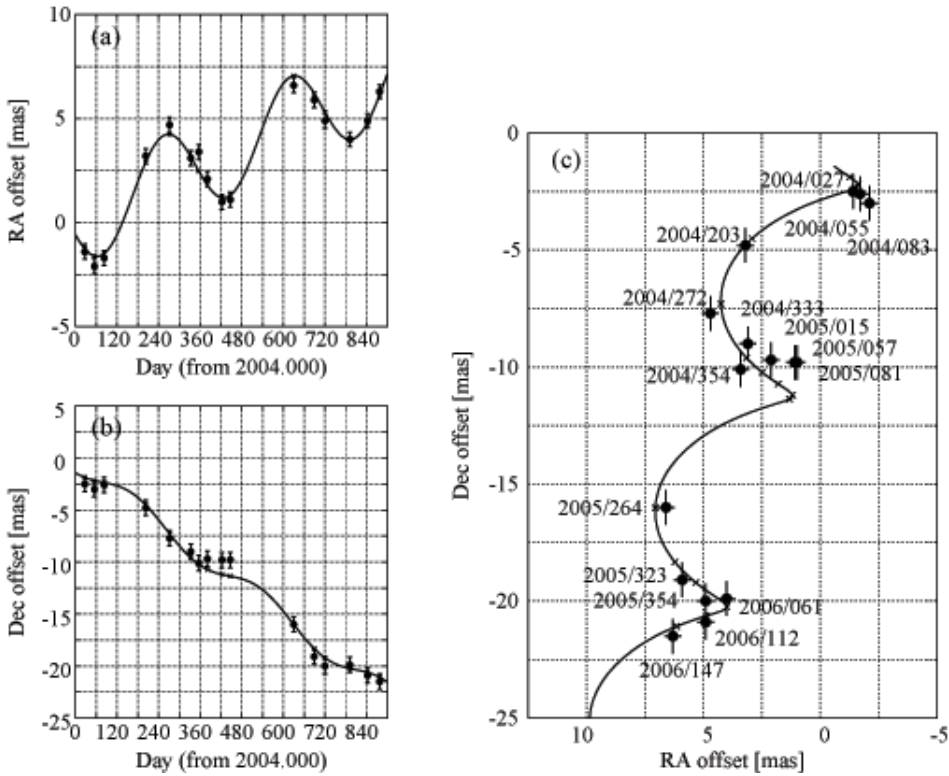
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## References

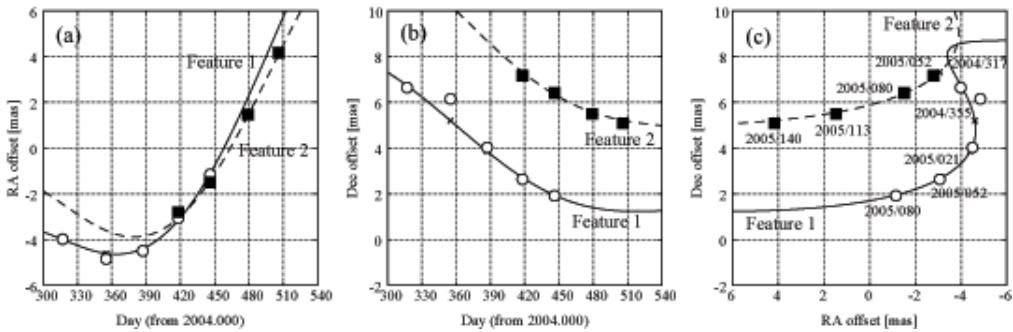
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**Figure 1.** Results of the position measurements of the maser feature in Orion KL. (a) The movement of the maser feature in right ascension as a function of time. (b) The same as (a) in declination. (c) The movement of the maser feature on the sky. Solid lines represent the best fit model with the annual parallax ( $2.29 \pm 0.10$  mas) and linear proper motion for the maser feature. Filled circles with error bars represent the observed positions of the maser features.



**Figure 2.** Results of the position measurements of the maser feature in NGC 1333 SVS13. (a) The movement of the maser feature in right ascension as a function of time. (b) The same as (a) in declination. (c) The movement of the maser feature on the sky. Solid and dashed lines represent the best fit model with the annual parallax ( $4.10 \pm 0.17$  mas) and linear proper motion for the maser features 1 and 2, respectively. Open circles and filled squares represent the observed position of the maser features 1 and 2, respectively.