

## Outward Motions of SiO Masers around VX Sgr

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**Abstract.** We report the proper motions of SiO maser features around VX Sgr from the two-epoch VLBA observations (2006 December 15 and 2007 August 19). The majority of maser feature activities show a trend of outward motions. It is consistent with our previous finding that the outflow may play an important role for SiO maser pumping.

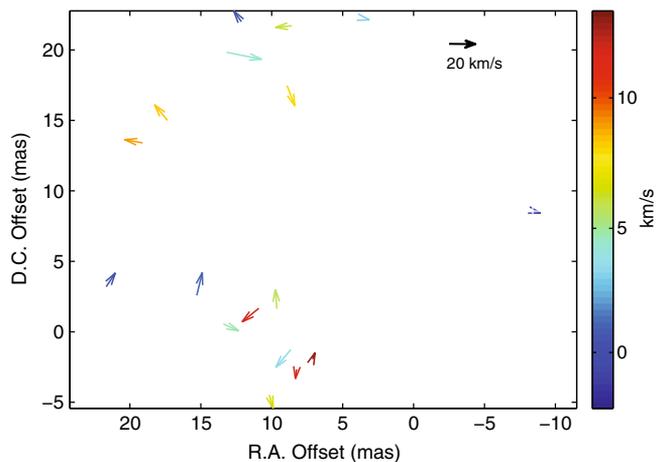
*Key words.* Stars: individual (VX Sgr)—SiO maser.

### 1. Introduction

Circumstellar SiO masers often occur in the envelopes of late-type stars and are very close to the stellar surface. Diverse astrophysical processes take place in the maser forming region, such as dust condensation, mass loss and shock waves, wherein the dynamics environment is very complex. The high resolution VLBI observations of SiO masers enable us to investigate the kinematics of the region. Many observations have shown that VX Sgr hosts intense SiO maser emission (e.g., Chen *et al.* 2006). The inward proper motions of SiO masers have also been detected in this source (Chen *et al.* 2006).

### 2. Observations and results

The two-epoch observations of 43 GHz ( $v = 1$ ,  $J = 1-0$ ) SiO maser line toward VX Sgr were made using Very Long Baseline Array (VLBA) on 2006 December 15 and 2007 August 19. The data calibration was performed using Astronomical Image Processing System (AIPS). AIPS task SAD was used to estimate the positions and flux densities of the maser components in each channel map. These components in each channel map are defined as maser spots. Several maser spots within a small region in terms of both space and the Doppler velocity (typically 1 AU and 1 km s<sup>-1</sup>, respectively) constitute a same maser feature, which is expected to be a physical feature consisting of a single gas clump. Here we identify a maser feature based on the same criteria adopted by Chen *et al.* (2006). Then we can investigate the kinematics of the circumstellar envelope around VX Sgr by tracing the matched maser features that appeared in both epochs. Figure 1 shows proper motions



**Figure 1.** The velocity vectors of matched features. The length of vectors is proportional to the velocity. The colours represent the Doppler velocity with respect to the local standard of rest.

of the matched maser features in the two epochs. From this figure, we can clearly see that most of these masers have a trend of outward motions, which is consistent with our previous findings that outflow may be the key for SiO maser pumping (Su *et al.* 2012).

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