Cosmic Masers - from OH to H_0
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TWINKLING STARS
The disappearing SiO masers of W Aql

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Abstract. W Aql is a binary S-type AGB star showing SiO maser emission. The dust distribution around the star is asymmetric, possibly indicating gravitational interaction between the binary pair. There are indications that the gas distribution also exhibits asymmetries. To investigate the source of the circumstellar structures, we applied for and were rewarded VLBI time to map the distribution of the SiO masers around this source and to constrain the presence and distribution of a possible magnetic field. Using VERA observations we also aim at measuring an accurate parallax to determine the binary separation, however, from showing peak emission of 21 Jy in June 2010, the SiO(1-0) v=1 line at 43 GHz has now disappeared. We find no correlation with the stellar pulsational period.

Keywords. masers, stars: AGB and post-AGB, stars: mass loss

1. Binary interaction and the shaping of planetary nebulae

The late evolution of low- to intermediate-mass stars is still subject to several open questions. The physical conditions required for AGB stars to become planetary nebulae (PNe), and which processes govern the shaping of the circumstellar environment, are currently being studied. A binary companion could explain circumstellar asymmetries

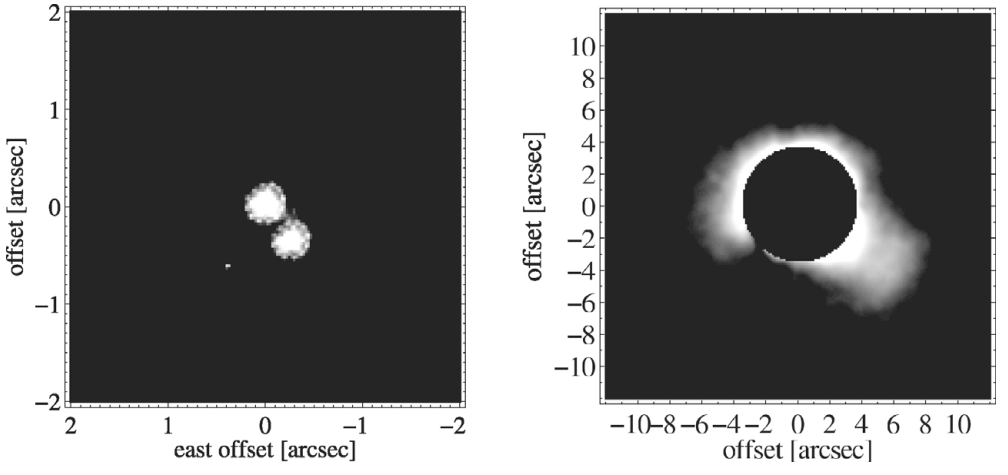

Figure 1. *Left:* The high-resolution B-band HST image of W Aql. The binary pair is clearly resolved and separated by 0.46″. *Right:* The circumstellar envelope around W Aql imaged in dust-scattered polarized light (Ramstedt *et al.* 2011). Note the different scales.

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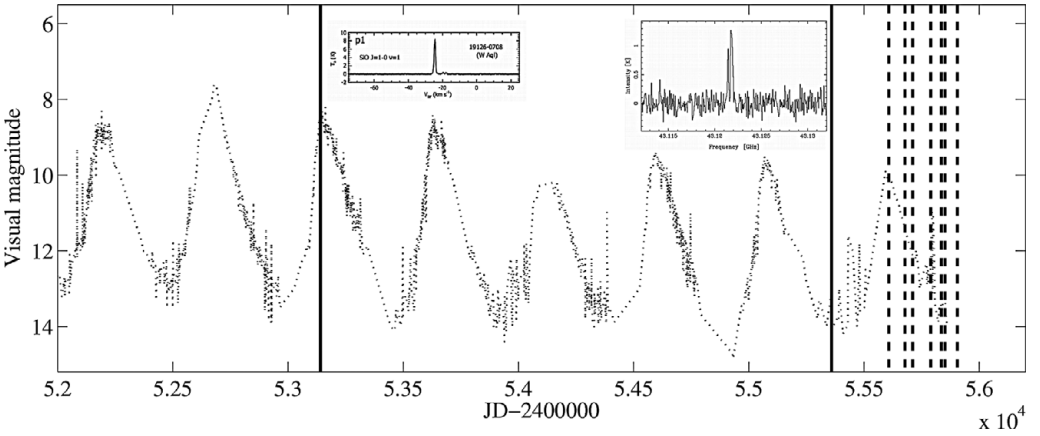

Figure 2. The AAVSO light curve of W Aql showing the visual magnitude versus the Julian date in JD-2400000. The dates of the SiO maser observations are marked by horizontal lines (solid for detections and dashed for non-detections). The two $\sim$ 21 Jy detections from the Nobeyama 45 m telescope (Nakashima & Deguchi 2007) and the Onsala 20 m telescope are shown as subplots.

both directly through its gravitational influence, as well as indirectly by being the necessary component required to sustain a large scale magnetic field around the AGB star. The different shaping scenarios will be strongly dependent on the separation between the binary pair and the resulting morphologies can range from slight distortions or bubbles for the very wide binaries (100 AU), to bi-polar or even multi-polar outflows, jets and disks, for the closer binaries. W Aql is an ideal source to study in order to reach a better understanding of these very important issues for stellar evolution. It is relatively nearby (D=200 pc), binary, and the fact that it is known to have an asymmetric dust distribution (Fig. 1) makes the source particularly intriguing.

2. SiO maser observations and the visual light curve

The SiO(J=1-0, v=1) maser emission was observed in May 2004 with the Nobeyama 45 m telescope (Nakashima & Deguchi 2007) and with the Onsala 20 m telescope in June 2010. On both occasions the peak intensity was around 21 Jy. VERA interferometric observations of the source started in February 2011 and around the same time the source was observed with the VLBA interferometer. VERA observations have been performed on with a three-month interval throughout 2011. Unfortunately, we found that the source was not detected during several epochs. We observed the source again with the Onsala 20m in October 2011. This observation confirmed that the maser emission from the source has disappeared. We find no correlation with the visual light curve of the source (tracing the stellar pulsations, Fig. 2) and the reason for the sudden decline is not understood. The emission from the source is continuously being monitored.

References

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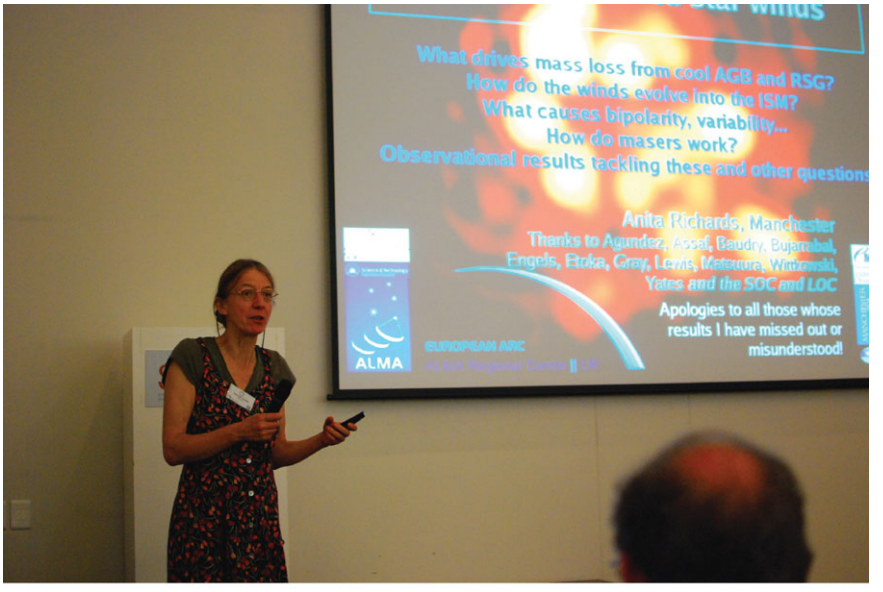

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