Trigonometric parallax distance and kinematics of the fastest water fountain source

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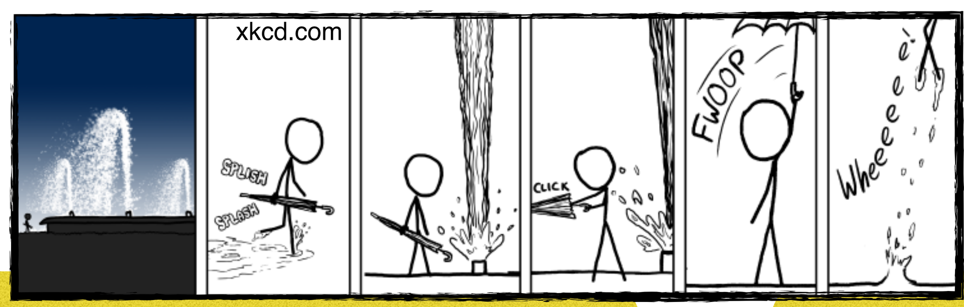
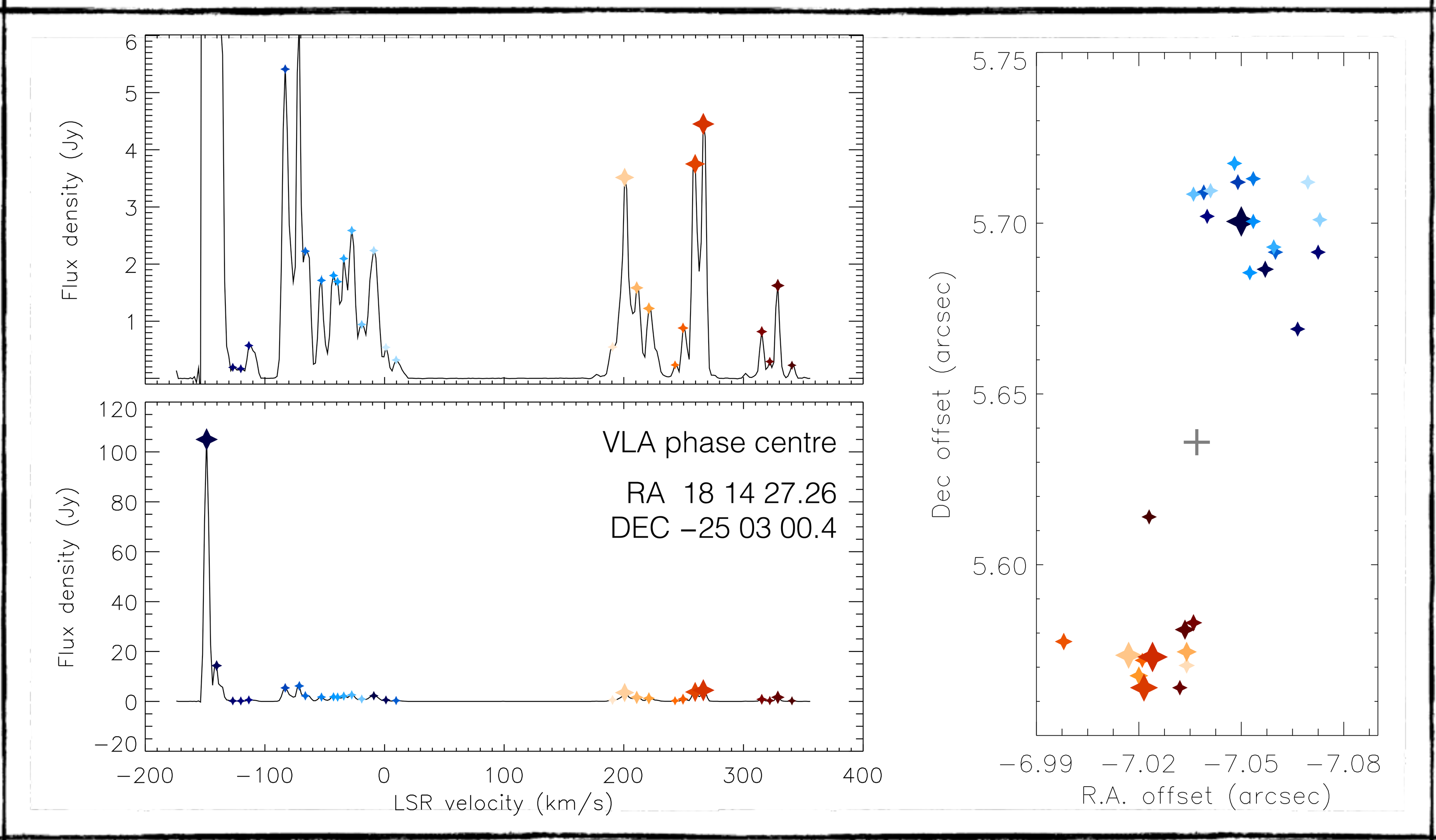
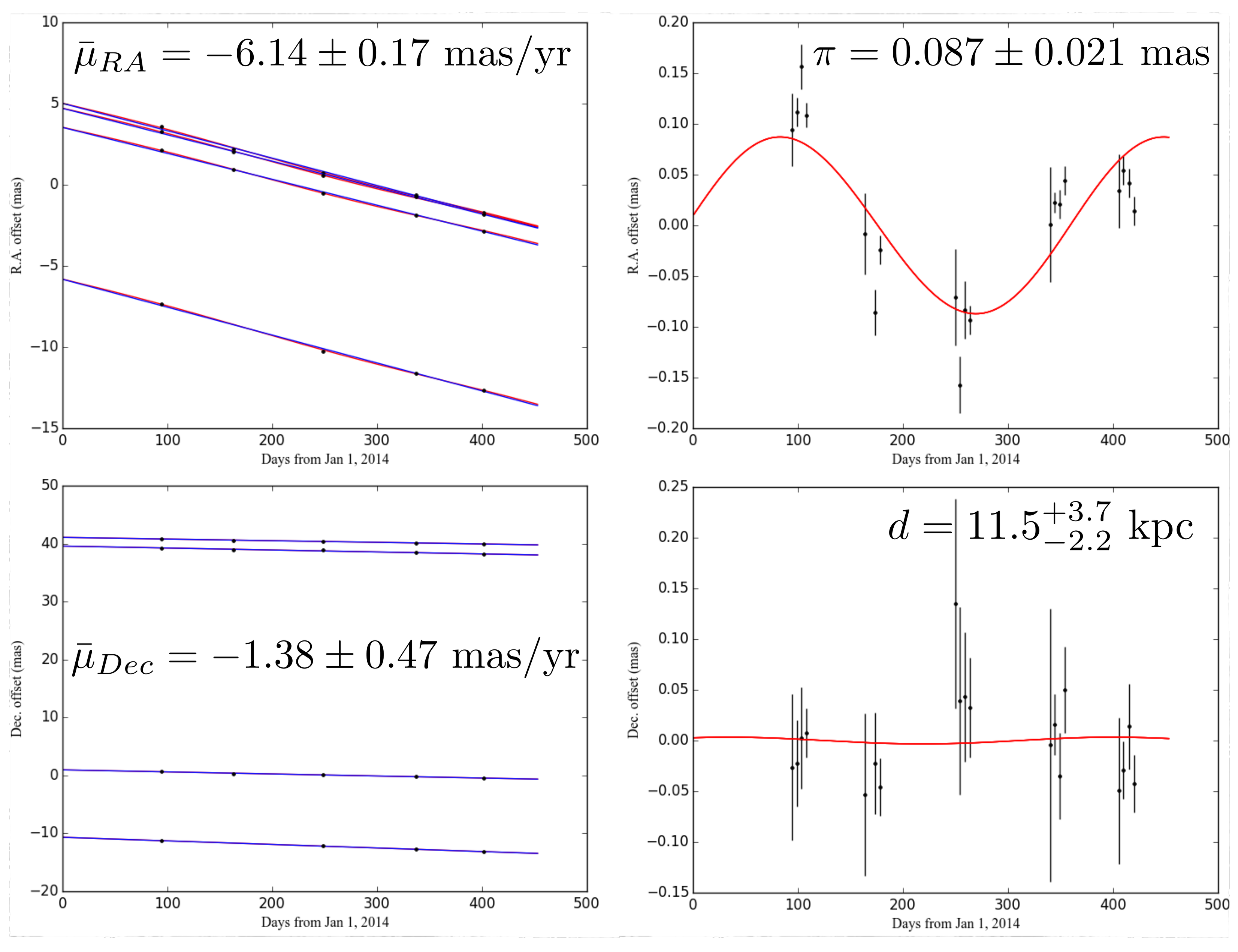


Water fountains

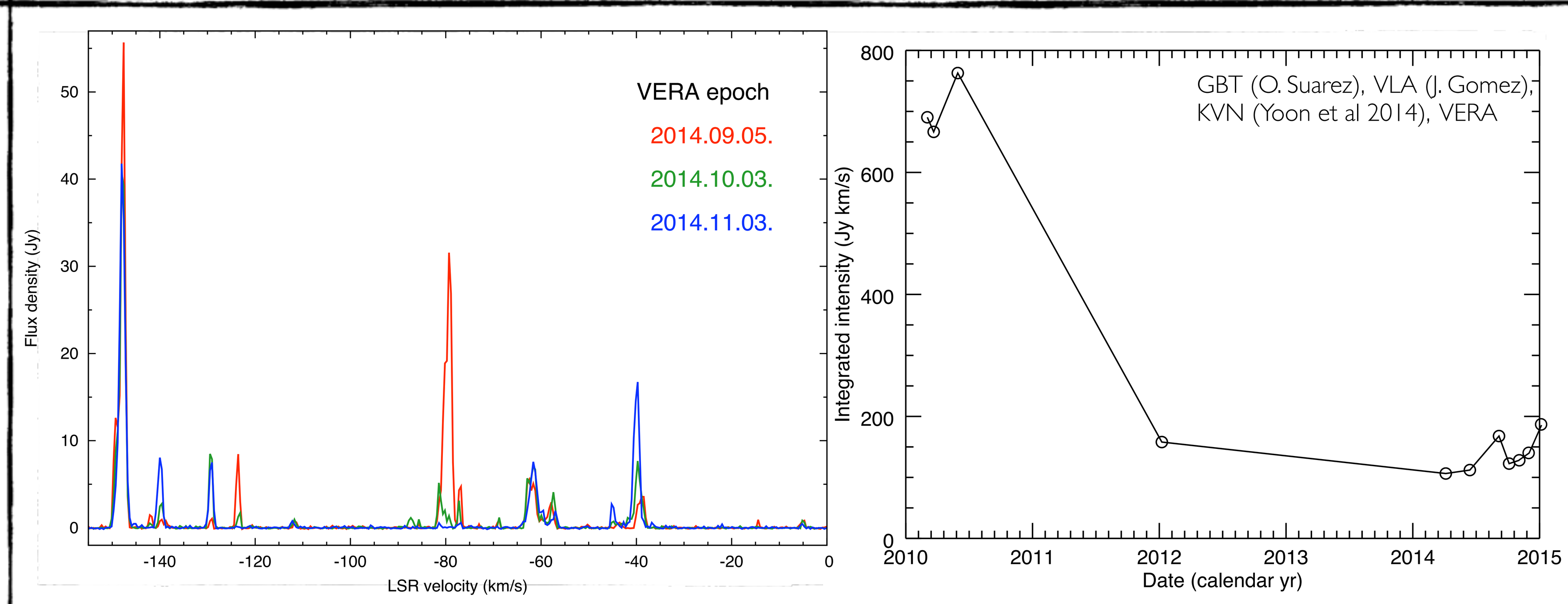
Water fountain sources are evolved stars with morphologically and kinematically highly collimated fast jets traced by water maser emission. Interferometric observations show that the maser emission is shock-excited in bipolar outflows. Water fountains are believed to be associated with a very short transitory phase in late stellar evolution (~1000 years) after the AGB period, which should play an important role in the sculpting of the intricately shaped planetary nebulae (Sahai and Trauger 1998). Due to the short lifespans of water fountains, only about a dozen are known so far.



The VLA observation shows the fastest bipolar outflow in a water fountain. Due to the large spread in velocity, we could only observe one lobe with VERA. The parallax is around ~0.1 mas, making it probably the furthest water fountain known to date. The parallax is consistent with the far kinematic distance to 1σ.

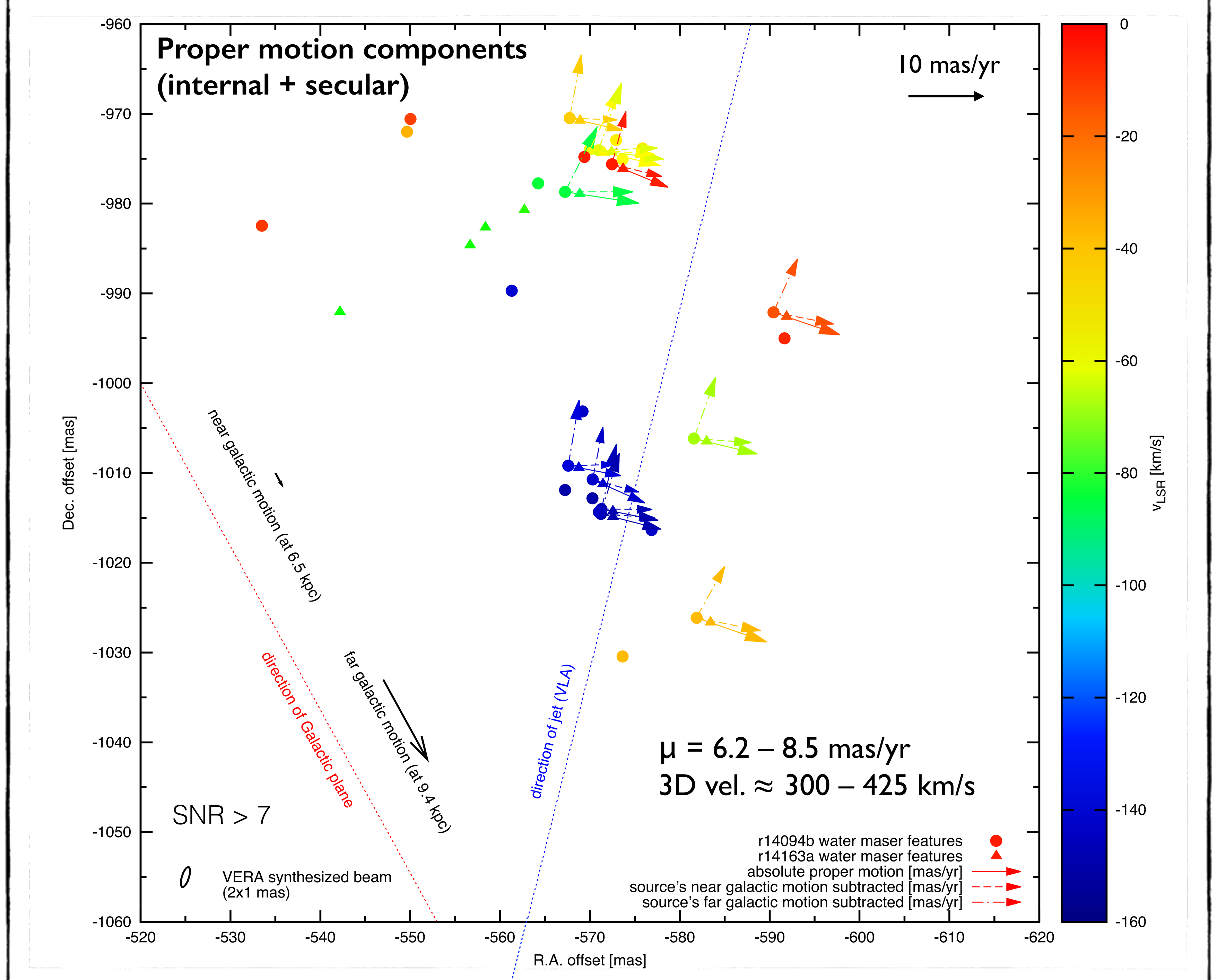


Spectrum components show rapid variability on monthly scales (left), making it difficult to trace the masers over a year. The integrated maser intensity also varies on a longer scale (right), however it is not clear whether this is the fading of the source or possibly a recurring event, e.g. from discontinuous mass loss.

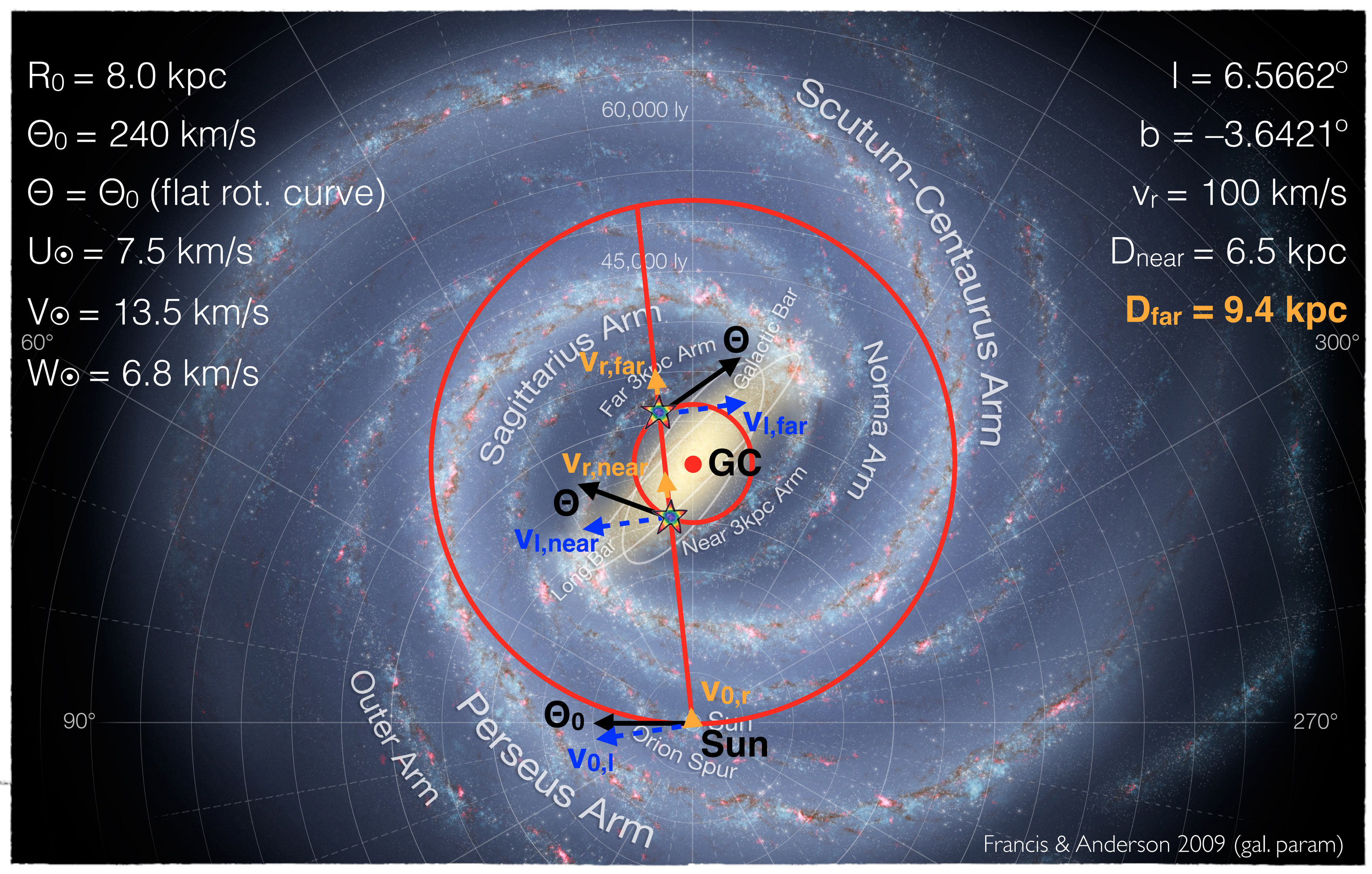


IRAS 18113–2503

This water fountain is located towards the Galactic Centre in the thick disk, with jets spanning a very large line-of-sight velocity range of ~500 km/s. Both lobes show a high velocity dispersion as well, ~170 km/s. The blue- and redshifted water masers are clustered in two distinct 0.″1×0.″1 regions separated by 0.″12, with PA = –14° (Gómez et al. 2011). In order to measure the motion and parallax of the water fountain, we have been monitoring the brighter blueshifted lobe of the source with the Japanese dual-beam VLBI network (VERA). We show a preliminary parallax and analysis of the outflow kinematics, as well as some spectrum characteristics. Final results are due after the last two remaining epochs have been reduced.



Subtracting the independently modeled Galactic rotation from the measured maser proper motions, we can estimate the internal motions in the outflow. At the far kinematic distance the masers follow the jet axis derived from VLA observations (Gómez et al 2011), but at the near distance they do not.



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