Peculiar motions along the Sagittarius spiral arm

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3D velocities of high-mass star-forming regions and O-type stars can give us insights into the kinematic structure of the star-forming molecular gas in spiral arms. Notable differences between high-mass star-forming regions and short-lived O-type stars are not expected. However, if detected these would be interesting to high-mass star-formation theory as evidence of star-formation in shocks, for example. The **Sagittarius spiral arm** is the first spiral arm from us towards the Galactic Centre (see Figure 1). This arm is, due to its vicinity and the availability of VLBI maser astrometry of high-mass star-forming regions from the BeSSeL programme (Reid et al. 2019, ApJ 885, 131) and the O-type star astrometry from *Gaia's* Data Release 3 (DR3) together spanning about 140 degrees in Galactic azimuth a good candidate for such kinematic studies. In the DR3 *Gaia* now releases also stellar types and radial velocities.

The O-type stars have been selected from *Gaia*'s DR3 catalogue imposing the stellar type to 'O', the effective temperature to >= 30,000 K, and the availability of a radial velocity following Gaia Collaboration et al., (2022), arXiv 2206.06207. A total of 164 O-type stars with parallaxes uncertainties better 20% have been selected of which 26 were positionally associated with the Sagittarius arm.

The maser-bearing high-mass star-forming regions were taken from Reid et al. (2019), ApJ 885, 131, and references therein. A total of 39 masers are found to be associated to the Sagittarius spiral arm.

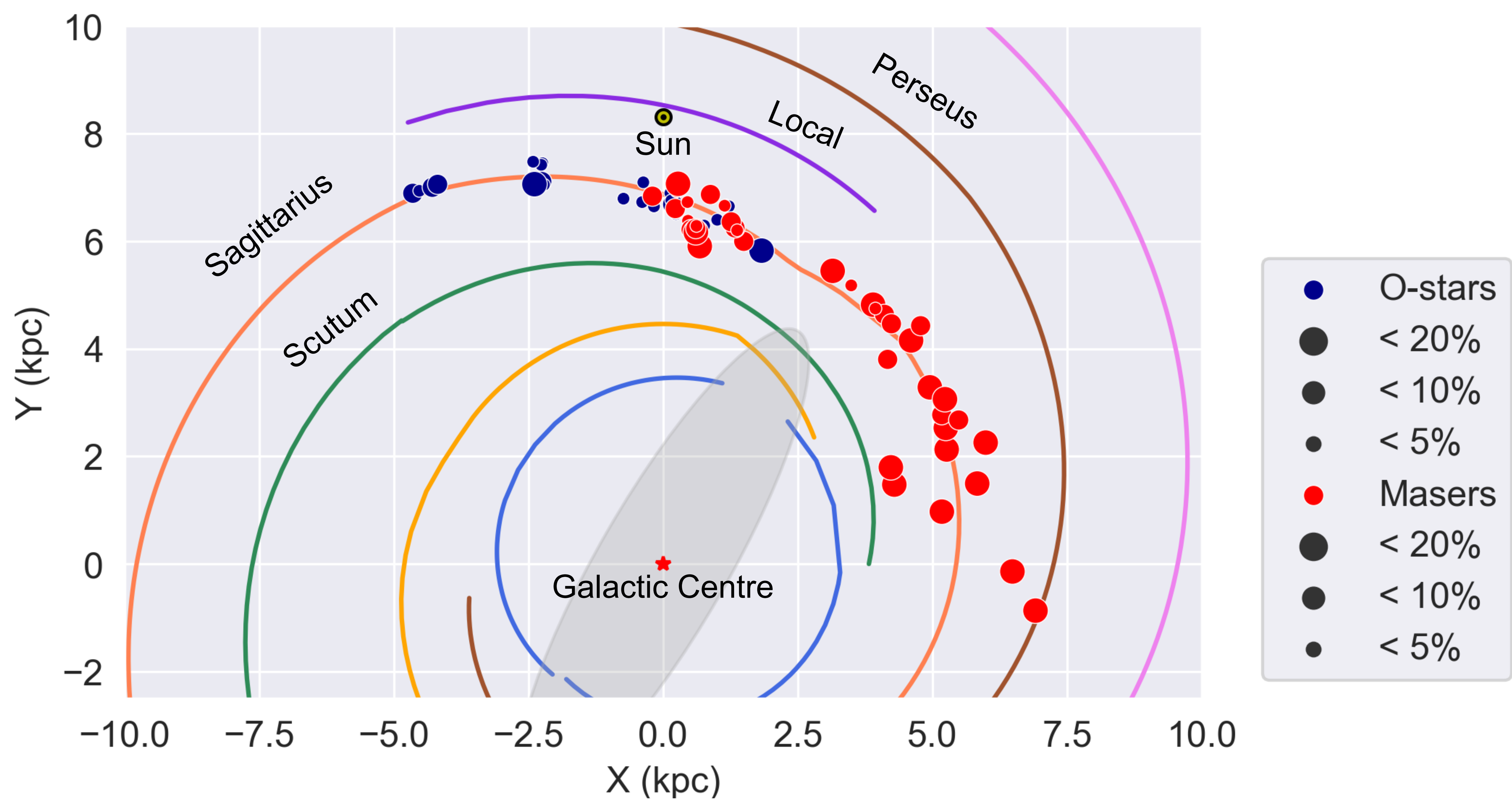

Figure 1 O-type stars (blue, *Gaia* DR3) and maser-bearing high-mass star-forming regions (red, VLBI astrometry) belonging to the Sagittarius spiral arm (see blue and red boxes for details on target selection).

The U, V, W peculiar motions of stars and star-forming regions are largely similar (see Fig. 2). For 0-20 degree in Galactic azimuth where both O-star and VLBI maser astrometry is available, the peculiar motions agree well (see Fig. 3). For future studies it would be interesting to combine the astrometry of these objects when investigating spiral arm motions.

However, a few outliers for O-type stars are seen in each motion component (Fig. 2). These outlying velocities belong to O-stars at negative Galactic azimuth (Fig. 3) where there is no VLBI maser astrometry to compare with. The origin of these outliers is therefore not clear without additional data.

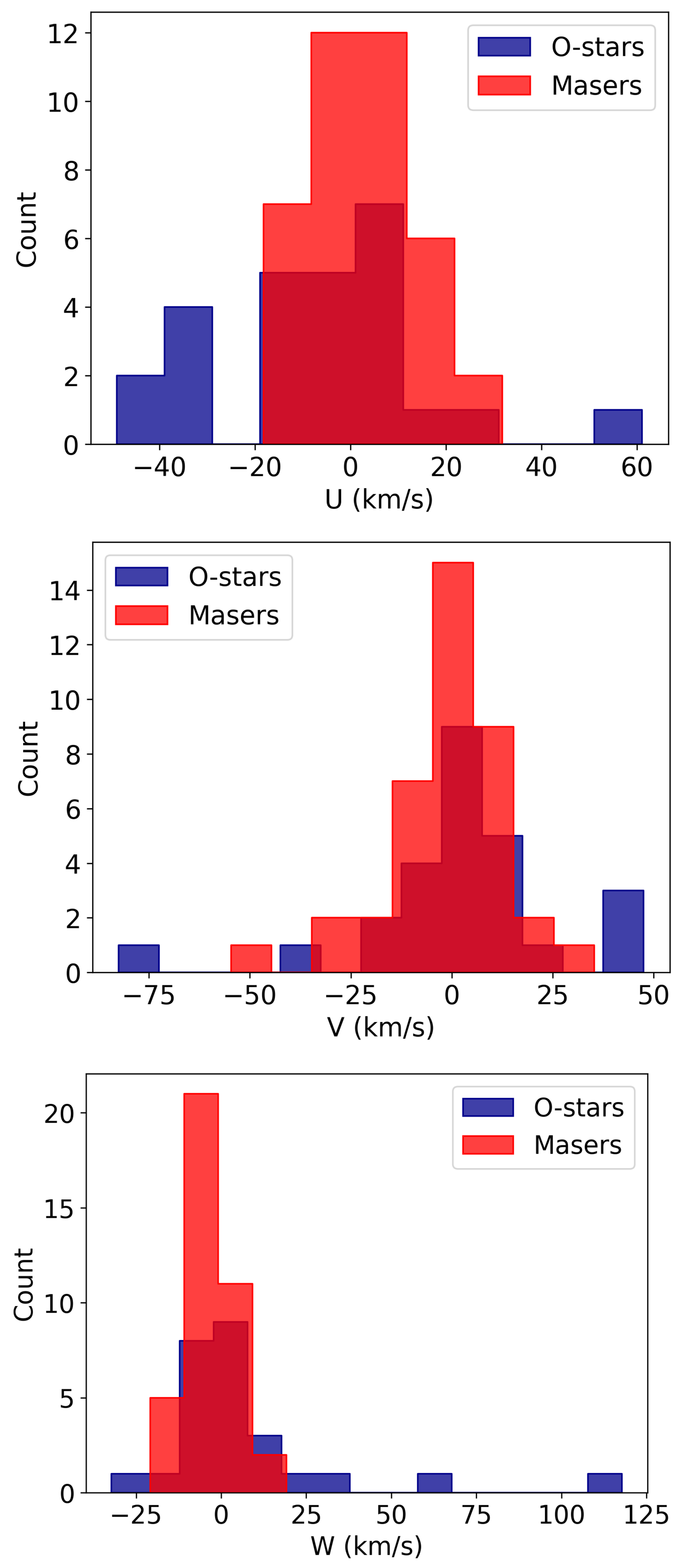

Figure 2 Histograms for the peculiar motions of the stars and star-forming regions after removing Galactic rotation. The left panel shows U motion (towards the Galactic center), the middle panel V motion with the Galactic rotation subtracted (in direction of Galactic rotation), and the right panel W motion (towards the Galactic North Pole).

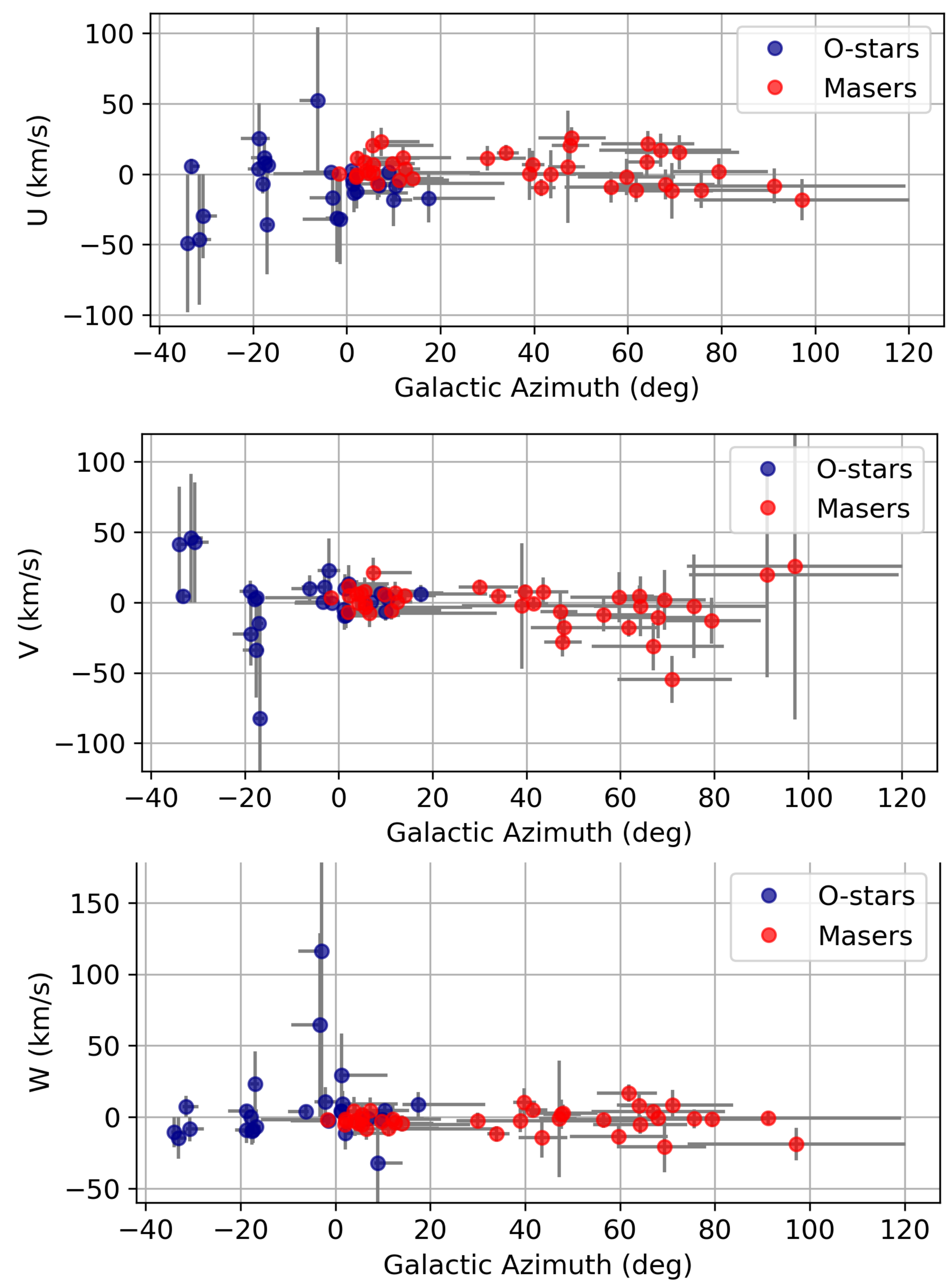

Figure 3 The peculiar motions of the stars and star-forming regions versus Galactic azimuth (zero towards the Sun, increasing with Galactic rotation).