

POSITION-VELOCITY DIAGRAMS AS A PROBE OF THE BAR IN EDGE-ON GALAXIES

The Face-on View of our Galaxy

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Analyses of the distribution of far infrared point sources in the Galactic bulge have suggested that from a face-on perspective the bulge has a bar like shape. Here, we investigate how a rotating bar-like bulge affects the global gas dynamics in a disk and compare the longitude-velocity (LV) maps from selfgravitating hydrodynamical simulations¹ with observed maps of neutral hydrogen and carbon monoxide in the Galaxy. We found that the features on the numerical LV maps depend strongly on four factors: the pattern speed of the bar, the position angle of the Sun, the strength of the bar potential and the ratio of the gas mass to total dynamical mass. We conclude that our Galaxy has a rotating, weak, bar-like bulge ($a/b \sim 0.8$) observed from nearly end on ($\theta_p < 20^\circ$). The allowed range of pattern speed of the bar is surprisingly narrow ($\sim 20 \text{ km s}^{-1} \text{ kpc}^{-1}$) and is consistent with recent observations of bulge stars. Selfgravity of the interstellar matter is needed to account for some of the observations.

We can also apply the presented method to the studies of external edge-on galaxies. For example, the well-studied nearby edge-on disk galaxy NGC 891 also has a central high velocity component and a molecular ring on its observed HI and CO². The present study suggests that NGC 891 is quite similar to our Galaxy not only from the edge-on view, but also the face-

on view. Note that our Galaxy and NGC 891 are not necessarily ‘barred’ galaxies but are ordinary spiral galaxies classified as Sb \sim Sc in the classification scheme of Hubble. Our Galaxy and NGC 891 should look like NGC 309 (Sc) which has a weakly-distorted bar with two open spiral arms in the infrared light but shows very rich star forming regions in the disk³.

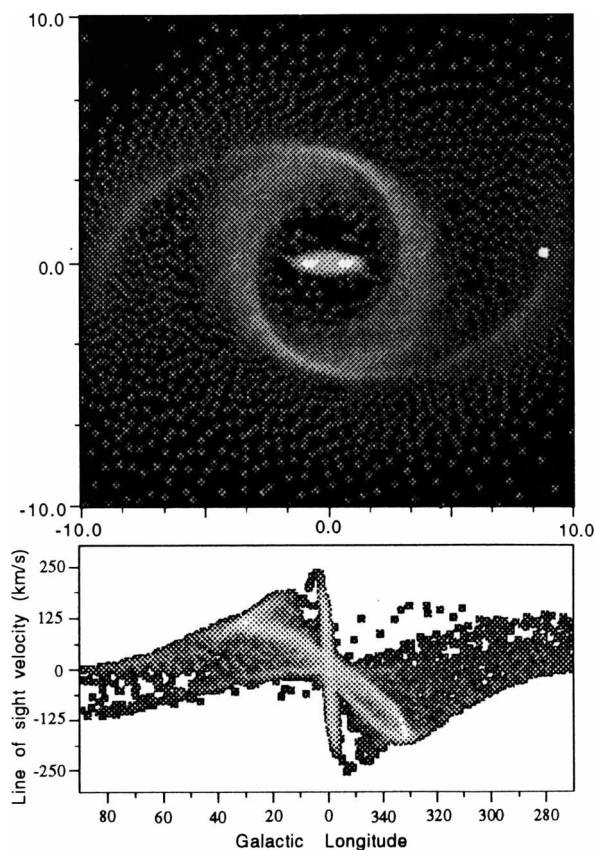


Figure 1. (Top) Gas density distribution of our Galaxy. The most probable position of the LSR is shown by a white filled circle. (Bottom) Position-Velocity diagram from the LSR.

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References

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