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The Galactic rotation curve from red clump stars

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Abstract. We use line-of-sight velocities of more than 4000 red clump stars observed from MMT/Hectospec to derive the Galactic rotation curve between 8 and 13 kpc in Galactocentric radius to better than 10 $\mathrm{km\,s^{-1}}$. A three-component (bulge+disk+halo) with an additional massive ring of $1.66\times10^{10}\,\mathrm{M_\odot}$ at about 11.6 kpc provides an excellent fit with the observation.

Keywords. Galaxy: disk, Galaxy: kinematics and dynamics, Galaxy: structure

1. Introduction

The rotation curve is a powerful tool to map the mass distribution of the galactic disk (Sofue & Robin 2001). In particular, it is broadly used to detect the dark matter halo around a galaxy. In this work, we use red clump stars, one of the standard candles, in the disk to derive the rotation curve in the outer disk.

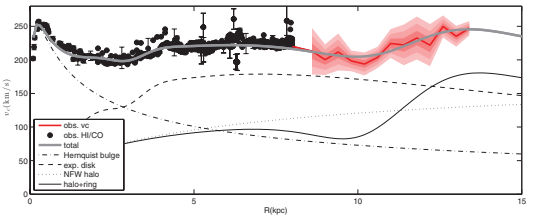

Figure 1. The re-derived rotation curve is shown as the thick red curve with shadows indicating the 1-, 2-, and 3-sigma error. The black filled circles are HI/CO sources (Sofue *et al.* (2009)).

We use the line-of-sight velocities of about 4000 red clump stars observed from MMT/Hectospec to measure the rotation curve. The stars are located at $l = 100°$–$180°$ and $b = 0°$. The mean azimuthal velocities, mean radial velocities and their dispersions at each Galactic radius are estimated from line-of-sight velocities spanned in a broad range of Galactic longitude. Subsequently, the rotation curve is directly estimated from Jeans equation.

Fig 1 shows the derived rotation curve (red line) combined with the HI/CO sources (Sofue *et al.* (2009)) under the assumption that the local circular speed is $220\,\mathrm{km\,s^{-1}}$. A three-component (Hernquist bulge, exponential disk, and NFW halo) model alone cannot describe the rotation curve, but adding a massive ring of $1.66\times10^{10}\,\mathrm{M_\odot}$ at around $R = 11.6\,\mathrm{kpc}$ provides a perfect fit.

References

Sofue, Y. & Robin, V. 2001, *ARA&A*, 39, 137
Sofue, Y., Homma, M., & Pmodaka, T. 2009, *PASJ*, 61, 227