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The RAVE survey: Using the local escape velocity to determine the mass of the Milky Way

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Abstract. The RAdial Velocity Experiment (RAVE) is currently measuring radial velocities, metallicities and abundance ratios for many thousands of stars in the southern hemisphere. Although the project is still in its early stages, the catalogue already contains over 100,000 stars. We present an analysis of the high velocity RAVE stars, revisiting the seminal work of Leonard & Tremaine (1990) in order to better constrain the local Galactic escape speed. Clearly, with the vast number of high precision radial velocities, the RAVE survey is ideally suited to this task and enables us to determine the escape velocity to unprecedented accuracy. By inspecting cosmological simulations we show that previous analyses may be subject to bias due to the underlying assumptions regarding the shape of the tail of the velocity distribution. We correct for this bias and conclude that $497 < v_{\rm esc} < 612$ kms^{-1}(90% confidence). This measurement of the local escape velocity pins down the potential at the solar radius and can be combined with a chosen halo profile to provide an estimate of the total halo mass. Although the resulting mass determination is model dependent, we find that there is good agreement between various halo models with values ranging from $1.01^{+0.70}_{-0.37} \times 10^{12} M_{\odot}$ to $1.45^{+1.08}_{-0.52} \times 10^{12} M_{\odot}$ (90% confidence).

Key words. Galaxy: kinematics and dynamics, Galaxy: fundamental parameters

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