Astrophysics > Cosmology and Extragalactic Astrophysics

Orbit-Based Dynamical Models of the Sombrero Galaxy (NGC 4594)

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We present axisymmetric, orbit-based models to study the central black hole, stellar mass-to-light ratio, and dark matter halo of NGC 4594 (M104, the Sombrero Galaxy). For stellar kinematics, we use published high-resolution kinematics of the central region taken with the Hubble Space Telescope, newly obtained Gemini long-slit spectra of the major axis, and integral field kinematics from the SAURON instrument. At large radii, we use globular cluster kinematics to trace the mass profile and apply extra leverage to recovering the dark matter halo parameters. We find a black hole of mass M_{\bullet}=(6.6 +/- 0.4) x 10^8 M_{\odot}, and determine the stellar M/L_I=3.4 +/- 0.05 (uncertainties are the 68% confidence band marginalized over the other parameters). Our best fit dark matter halo is a cored logarithmic model with asymptotic circular speed V_c=376 +/- 12 km/s and core radius r_c= 4.7 +/- 0.6 kpc. The fraction of dark to total mass contained within the half-light radius is 0.52. Taking the bulge and disk components into account in our calculation of \sigma_e puts NGC 4594 squarely on the M-\sigma relation. We also determine that NGC 4594 lies directly on the M-L relation.

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