# Galileo Gravity Results and the Internal Structure of Io

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Using the Galileo spacecraft's 2.3 GHz (13 cm) transmitted carrier wave, the National Aeronautics and Space Administration's Deep Space Network generated radio Doppler data around the time of Jupiter arrival, including the Io flyby on 7 December, 1995. Near the time of Io closest approach at an altitude of 897 km, these data reveal a clearly detectable gravity signal. The signal's source is a triaxial gravity field characterized by spherical harmonics $J_2$ and $C_{22}$. Our measured value of $C_{22}$ exceeds the expected nonhydrostatic value by a factor of 25 or more. Therefore, it provides a useful boundary condition on interior models. Assuming that Io is a body in tidal and rotational equilibrium, we conclude it has a large metallic core. If the core is a eutectic mixture of iron and iron sulfide (Fe-FeS core), it comprises 20.2 ± 7.4 percent of Io's total mass ($8.932 \times 10^{22}$ kg). Alternatively, if the core is pure iron (Fe core), it comprises 10.5 ± 3.75 percent of the total mass. The corresponding radius for the Fe-FeS core is 942 ± 118 km, or about 52 percent of Io's mean radius (1821.3 km). The radius for the alternate Fe core is 651 ± 79 km, or about 36 percent of the mean radius. We also report improved masses for Io, Europa, and Jupiter. The new mean densities for Io and Europa are 3529.4 ± 1.3 and 2984 ± 46 kg m$^{-3}$, respectively. The research described in this paper was carried out by the Jet Propulsion Laboratory, California Institute of Technology, and was sponsored by the Galileo Project through an agreement with the National Aeronautics and Space Administration.

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