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TALK: Does the Sun Have a Dark Disk?

Wednesday, July 3, 2024 3:00 PM (45 minutes)

The Sun's oblateness has been measured using optical observations. Its gravitational quadrupole moment has been deduced through helioseismology and measurements of its gravitational effects on Mercury's orbit. The distribution of mass within Mercury's orbit would only impact the orbital determination, suggesting that discrepancies among various types of assessments may indicate the possible existence of a non-luminous mass. For the first time, we have developed a method to combine these differing measurements to yield new, highly sensitive constraints on the mass distribution within Mercury's orbit. In this talk, we will show that the most precise measurements indicate the existence of a non-luminous disk within Mercury's orbit, with a mass significantly heavier than the modeled mass for the circumsolar dust ring observed by the Solar TErrestrial RElations Observatory (STEREO) mission. This suggests a substantial dark matter contribution. Furthermore, the long-standing inconsistency between the element abundances determined from the spectroscopy of the Sun's surface, and those inferred from its interior through helioseismology, can be reconciled if the Sun formed within a protoplanetary disk. We will discuss how our findings limit the presence of a dark disk or a spherical halo near the Sun and highlight the potential of future orbital measurements of Mercury and near-Sun asteroids to refine these constraints further.

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