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Spin-Orbit Misalignment of Multi-Planet Systems

We analyze the causes of spin-orbit misalignment in multiplanet systems via two-planet-system KOI-89. By fitting KOI-89's 17 long cadence quarters of *Kepler* photometry, we show that the 85-day-orbit and 208-day-orbit planets are misaligned from the host star's rotation axis by $72^\circ \pm 3^\circ$ and $73^{+11}_{-5}^\circ$, respectively. Via dynamic stability tests, we find that the angular momentum vectors of the two orbits are likely within 20° of each other, implying relative coalignment between them. From these results, we limit KOI-89's causes of spin-orbit misalignment to star-disk binary interactions, disk warping via planet-disk interactions, or planet-planet scattering. This work provides new insight into the dynamic nature of n-body systems and the formation process of spin-orbit misaligned planets.