Spins of asteroids: The tale of the long tail

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The Asteroid Belt and the Kuiper Belt are relics from the formation of our solar system. Understanding the size and spin distribution of the two belts is crucial for a deeper understanding of the formation of our solar system and the dynamical process that govern it. In this paper, we investigate the effect of collisions on the evolution of the spin distribution of asteroids and KBO's.

We find that the power law nature of the impactors' size distribution leads to a Lévy distribution of the spin rates. This results in a power law tail of the spin distribution, in stark contrast to the usually quoted Maxwellian distribution. Comparing our analytical predictions to the observed spin rates of large asteroids ($R > 50$ km), we find that the spins of large asteroids, peaking at $\sim$1–2 revolutions per day, are dominated by a primordial component that reflects the formation mechanism of the asteroids. We also find that the Kuiper Belt has undergone virtually no collisional spin evolution and that the observed spin rates of KBO's are primordial in nature.