Anisotropic outgassing from comets exerts a torque sufficient to rapidly change the angular momentum of the nucleus, potentially leading to rotational instability. Here, we use empirical measures of spin changes in a sample of comets to characterize the torques and to compare them with expectations from a simple model. Both the data and the model show that the characteristic spin-up timescale, $\tau$, is a strong function of nucleus radius, $r$. Empirically, we find that the timescale varies as $\tau \sim 100 \, r^2$, where $r$ is expressed in kilometers and $\tau$ is in years. The fraction of the nucleus surface that is active varies as $f_A \sim 0.1/r^2$, giving $f_A = 1$ at $r = 0.3$ km. We find that the dimensionless moment arm of the torque is widely scattered, with a median value $k_T = 0.004$ (i.e. about 0.4% of the escaping momentum torques the nucleus), and weak (<3σ) evidence for a size dependence, $k_T \sim 0.001 \, r^2$. Sub-kilometer nuclei have spin-up timescales comparable to or less than their orbital periods, confirming that outgassing torques are quickly capable of driving small nuclei towards rotational disruption. Torque-induced rotational instability likely contributes to the paucity of sub-kilometer short-period cometary nuclei, and can account for the pre-perihelion destruction of sungrazing comets. Outgassing torques on small active asteroids can rival YORP torques, even for unobservably small (<1 g/s) mass loss rates. Finally, we discuss the important roles played by detection, spectroscopic and survival biases in the measured distributions of $\tau$, $f_A$ and $k_T$.

A full description is published at Jewitt, D. Astronomical Journal, 161:262 (12pp) (2021).
Figure 1: Published determinations of nucleus radius vs. spin-up timescale for short-period comets, most with perihelia in the 1 to 2 AU range. A strong size dependence is evident. The solid line indicates a power law with index 2. From Jewitt (2021).