Search for Bennu-like Main Belt Asteroids

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Future space missions may use resources embedded in asteroids for fuel, water or oxygen. Carbon-based asteroids are suspected to contain water; therefore, NASA sent the OSIRIS-REx spacecraft to study the asteroid Bennu to confirm this hypothesis. Indeed, the spacecraft found Bennu is rich with water-ice and ejects particles as was never seen before on asteroids. While the ejection rate is higher for comets, a possible speculation can link these two phenomena, suggesting that local evaporation of ice allows particle ejection. This research aims to look for Bennu-like asteroids within the main belt. Bennu is a B-type asteroid, therefore the research is focused on known B-type asteroids as a possible indication for water-rich composition. The shape can hint for the asteroid's structure. Bennu has a circular, spinning-top like shape, with an equatorial ridge formed by material sliding to its equator, due to a fast spin. Such slides might expose local ices that vaporize and free grains for ejection. Using photometric data collected with a 0.7m telescope at the Wise Observatory in Israel, I measured the brightness change of 16 B-type asteroids in order to search for those with Bennu-like lightcurve amplitude, a proxy for the shape. I found that 50% of the observed asteroids have an amplitude equal or lower than Bennu's value, meaning their shape is approximately circular. The ratio of spherical B-type asteroids is 2.5 times higher than this value within the entire asteroid population, suggesting the shape and the spectral type are indeed linked, as suspected. Since ~1/35 of main belt asteroids is a B-type, ~1/70 might be a Bennu-like, thus they might have a pseudo-comet behavior, and they might contain water-ice that can be used as a mining resource for future space missions