Abstract Type	Invited or Contributed research Paper (including Dissertation Talks)
Participation Preference	In-Person
Presentation Type	Poster
First Category	Outer Irregular Satellites
Second Category	Other Icy Satellites
Dissertation Abstract?	No
Student Status	Not a student
Newsworthy	No
Special Requests/Sorting Instruction	Will likely not get funded for the whole week, thus it would be good to be scheduled Tue, Wed, or Thu.

Irregular Moons of the Giant Planets: Potential for Observations by Spacecraft

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While the first Irregular moon of a giant planet has been found on photographic plates in 1899 (Phoebe), and another ten (also through photography) until 1975, the vast majority of discoveries (now with CCDs) started no earlier than 1997, with big advances in the early noughties (almost 100 moons) and again since 2017 (well over 100 objects). Ground-based observations are important for discoveries and the determination of orbital elements and physical properties like brightness (size) and colors. However, there are geometric limits – mainly the restriction to low phase angles (<12° at Jupiter; <2° at Neptune) and to observations from within the ecliptic plane (cause of the 180°-longitude ambiguity issue). Furthermore, most of these objects have low albedos, are small, and are far away and thus of very low apparent brightness (mostly darker than 20 mag, often even >25 mag), which requires large telescopes difficult to access over long periods of time.

With spacecraft orbiting a giant planet, i.e. at distances at the order of 10e7 km to the Irregulars, long-duration observations to obtain lightcurves can be performed for numerous objects. Even with just one observation session over many hours and a bit of luck, a synodic rotation period at the accuracy of minutes may be deduced. With multiple observations, sidereal periods at millisecond-accuracy level, unambiguous pole solutions, and low-order convex-shape models might be obtained. Furthermore, phase curves up to >50° phase angle (for some objects even >100°, on particularly favorable geometries) can be measured. This is possible because a giant-planet orbiter revolves inside the orbits of the Irregular moons, and the Solar phase angles may in principle reach any value from 0° to 180°.

Such an Irregular moons campaign has been performed for the first time with Cassini's Narrow Angle Camera while in orbit around Saturn (Denk & Mottola 2019, *Icarus*), providing 24 new rotation periods of Saturnian Irregulars and about a dozen sidereal periods, pole solutions, shape models, and phase curves. A similar campaign is under consideration for the Juice mission with the JANUS camera, which has the potential for an even larger sample of Jovian Irregulars. The poster will discuss the options and limits for spacecraft-based observations of Irregular moons while orbiting Jupiter or another giant planet.

Beyond unresolved observations, upcoming missions to the gas and ice giant planets should also attempt close flybys of an Irregular moon, as has been done by Cassini at Phoebe in 2004. Best opportunities might occur prior to orbit insertion or during the first (large) orbits.

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