THE ORIGIN OF ASTEROID 162173 (1999 JU3). Humberto Campins[1], Julia de León[2], Alessandro Morbidelli[3], Javier Licandro[4,5], Julie Gayon[2], Marco Delbó[2] and Patrick Michel[2]
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Near-Earth asteroid 162173 (1999 JU_3; henceforth JU_3) is a potentially hazardous asteroid and the target of the Japanese Aerospace Exploration Agency's Hayabusa-2 sample return mission. JU_3 is also a backup target for two other sample return missions: NASA's OSIRIS-REx and the European Space Agency's Marco Polo-R. We use dynamical information to identify an inner-belt, low-inclination origin through the n_6 resonance. Within this region we identify three possible sources, the Erigone and Polana families, and a background population of low-albedo and low-inclination asteroids.

Our conclusions are based on the following results. a) Dynamical evidence favors strongly (~ 100% probability) an inner-belt, low-inclination origin through the n_6 resonance; i.e., 2.15 AU < a < 2.5 AU and i < 12 degrees. b) The geometric albedo of JU_3 is 0.07 ± 0.01, and this inner-belt region contains three well-defined low-albedo asteroid families: Erigone, Polana and Sulamitis. c) Using the distribution of absolute magnitudes with semi-major axis for Erigone and Polana family members we infer that both families have delivered objects the size of JU_3 into the n_6 resonance. However, this is not the case for the Sulamitis family. d) A population of low-inclination and low-albedo inner-belt asteroids outside the families is another possible source because it can also deliver small asteroids (JU_3-sized) to the n_6 resonance. e) For the Yarkovsky effect to move objects from the inner-belt into the n_6 resonance, they have to have retrograde spin and the spin of JU_3 is retrograde. f) The best visible spectrum of JU_3 is compatible with at least one member of each of the three possible sources.