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Interior and gravity characterization of the C-type asteroid (52246) Donaldjohanson seen by NASA's Lucy flyby

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NASA's Lucy [1] successfully flew by the C-type asteroid (52246) Donaldjohanson [2] on April 20, 2025 [3]. The asteroid exhibited unique topographic and geological features [4-6]. While the imaged area was limited to the illuminated hemisphere at the time of the flyby, L'LORRI [7] and TTCAM [8] images reveal the asteroid's elongated and contact binary shape [4, 9]. The asteroid has a highly elongated shape, about 8 km long, with a greater than 2:1 axis ratio [4].

We apply a mission-developed shape model [9] to investigate Donaldjohanson's surface gravity field and structural properties. Due to its complex shape, escape speeds are low and vary along the body. The slow rotation does not contribute significantly to surface acceleration. We expect the interior to be dominated by compression, but the asteroid's irregular topography makes the stress field complex. Given its slow spin period, our analysis is expected to be almost independent of the rotational effect.

The presentation will discuss Donaldjohanson's structural and gravitational environment and the implications for its formation and evolution scenarios.

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[1] Levison et al. (2025), PSJ, 2:171, doi:10.3847/PSJ/abf840.

[2] Marchi et al. (2025), PSJ, 6:59, doi:10.3847/PSJ/adb4f4.

[3] Levison et al. (2025), this conference.

[4] Bierhaus et al. (2025), this conference.

[5] Scully et al. (2025), this conference.

[6] Nichols-Fleming et al. (2025), this conference.

[7] Weaver et al. (2023) SSR 219, doi:10.1007/s11214-023-01028-z.

[8] Bell et al. (2023) SSR 219, doi:10.1007/s11214-023-01030-5.

[9] Mottola et al. (2025), this conference.