



(52246) Donaldjohanson and the Architecture of Bilobed Small Bodies

Keith Noll¹, Harrison Agrusa², Olivier Barnouin³, Edward Bierhaus⁴, Richard Binzel⁵, Masatoshi Hirabayashi⁶, Harold Levison⁷, Simone Marchi⁷, Raphael Marschall², Stefano Mottola⁸, John Spencer⁷, Thomas Statler⁹, Jessica Sunshine¹⁰, and the Lucy Team

¹NASA, GSFC, Greenbelt, MD, USA (keith.s.noll@nasa.gov)

²Observatoire de la Côte d'Azur, CNRS, Nice, France

³JHU Applied Physics Laboratory, Laurel, MD, USA

⁴Lockheed Martin Space, Littleton, CO, USA

⁵Massachusetts Institute of Technology, Cambridge, MA, USA

⁶Georgia Institute of Technology, Atlanta, GA, USA

⁷Southwest Research Institute, Boulder, CO, USA

⁸Institute of Space Research, DLR, Berlin, Germany

⁹NASA Headquarters, Washington, DC, USA

¹⁰University of Maryland, College Park, MD, USA

The Lucy spacecraft flew by the Main Belt asteroid (52246) Donaldjohanson, hereafter DJ, on April 20, 2025. Images obtained during the flyby show DJ to be an elongated object, about 8 km long with an axis ratio greater than 2 to 1, consisting of two distinct lobes connected by a narrow neck. A detailed shape model [1] will be required to further quantify this structure.

Similarly shaped small bodies have been directly observed among Near Earth Objects [2-4], the Main Belt [5], comets [6-9] and in the Kuiper Belt [10]. Many more elongated/bilobed objects can be inferred from lightcurve observations [11]. DJ is a potentially valuable addition to understanding these objects because it resides in the Main Belt and is part of a collisional family of known age [12].

We compile estimated lobe dimensions and apparent orientations in a variety of small bodies of similar size to DJ and discuss observable trends. We compare results to expected behavior in collisional systems and accretion models [13-18].

Acknowledgement: The Lucy mission is funded through the NASA Discovery program on contract No. NNM16AA08C

References: [1] Mottola et al., *this meeting*, [2] Fujiwara et al., *Science*, 312, 5778, 1330–1334, 2006. [3] Hu, *Acta Astro. Sinica*, 60, 5, 46, 2019. [4] Benner et al. in *Asteroids IV*, 2015, pp. 165–182. [5] Levison et al. *Nature*, 629, 8014, 1015–1020, 2024. [6] Keller et al., *A&Ap*, 187, 807–823, 1987. [7] Boice et al., *EM&P*, 89, 301–324, 2002. [8] A'Hearn et al., *Science*, 332, 1396, 2011. [9] Sierks et al., *Science* 347, 6220, 2015. [10] [1] Stern et al. *PSJ* 4, 9, 176, 2023. [11] Cannon, *MNRAS* 538, 4, 2311–2329, 2025. [12] Marchi et al., *PSJ* 6, 3, 59, 2025. [13] Schwartz et al., *Nature Astronomy* 2, 379–382, 2018. [14] Jutzi and Benz, *A&Ap* 597, A62, 2017. [15] Jutzi, *P&SS* 177, 104695, 2019. [16] Jutzi and Asphaug, *Science* 348, 6241, 1355–1358, 2015. [17] Hirabayashi and Scheeres, *Icarus* 317, 354–364, 2019. [18] Scheeres, *Icarus* 436, 116563, 2025.