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# Shape Model, Pole Solution Implications, and Refined Rotational Period of (155140) 2005 UD

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(155140) 2005 UD is a Near-Earth Asteroid in a companion orbit with (3200) Phaethon, an active asteroid in a highly-elliptical orbit thought to be responsible for the Geminid meteor shower. Evidence points to a genetic relationship between these two objects (Devogèle et al. 2020), but we have yet to fully understand how 2005 UD and Phaethon could have separated into this associated pair. Notably, 2005 UD is the extended mission target for the Japanese Aerospace Exploration Agency DESTINY+ mission scheduled to launch in 2024. Presented herein are new observations of 2005 UD using the Lowell Discovery Telescope, Nordic Optical Telescope, and TRAPPIST-North motivated by access to a previously unseen viewing geometry in October-November 2019. Lightcurve inversion using our new data, archival lightcurve data from an advantageous apparition in late 2018, and data from an epoch in late 2005 were used to derive a shape model of 2005 UD. Results pertaining to 2005 UD's mass loss from additional analyses involving these new data will also be discussed. We also determined a retrograde spin state, largely consistent with a previous thermophysical analysis, and a refined sidereal rotational period of $P_{sid}$ = 5.2338 ± 0.0040 hours. Although a precise shape model is at present infeasible due to remaining gaps in lightcurve data at critical viewing aspects, we were able to leverage our results to help limit the range of formation scenarios and the link to Phaethon in the context of non-gravitational forces and timescales associated with the physical evolution of the system.