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Early Observations of New Active Asteroid 2025 VZ_8

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ABSTRACT

We report observations of main-belt asteroid 2025 VZ_8 using multiple telescopes from UT 2025 November 24 to UT 2025 December 23 that confirm the presence of visible comet-like activity. These observations were motivated by online reports that an abrupt brightening event may have led to the object's discovery on UT 2025 November 9. In all observations reported here, the object displays a tapered tail approximately 3″ long aligned with the antisolar direction. The object has an asteroidal Tisserand parameter value with respect to Jupiter ($T_J = 3.371$), and is thus considered an active asteroid. We measure an average apparent r'-band magnitude of $m_r \sim 21.6$ mag over the reported observing period. Due to the sudden appearance of activity far from perihelion, we suggest that the activity is more likely due to an impact or rotational destabilization, rather than sublimation.

Keywords: Active asteroids — Main belt asteroids

1. INTRODUCTION

Active asteroids are small solar system bodies that are dynamically asteroidal yet display comet-like activity (D. Jewitt & H. H. Hsieh 2024). They consist of main-belt comets (MBCs), which exhibit sublimation-driven activity (H. H. Hsieh & D. Jewitt 2006), and disrupted asteroids, whose activity is produced by other processes such as impacts or rotational destabilization.

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2. DISCOVERY AND OBSERVATIONS

2025 VZ_8 has a semi-major axis of $a = 2.614$ au, eccentricity of $e = 0.092$, inclination of $i = 12.127°$, and Tisserand parameter value with respect to Jupiter of $T_J = 3.371$, making its orbit unambiguously asteroidal. It was discovered by the Wide Field Survey Telescope (T. Wang et al. 2023) on UT 2025 November 9 at a heliocentric distance of $r_h = 2.795$ au, geocentric distance of $\Delta = 2.026$ au, and true anomaly of $\nu = 142.1°$ (J. D. Giorgini et al. 1996).

2025 VZ_8's potential activity was first reported by P. VanWylen, who determined that it was too bright when

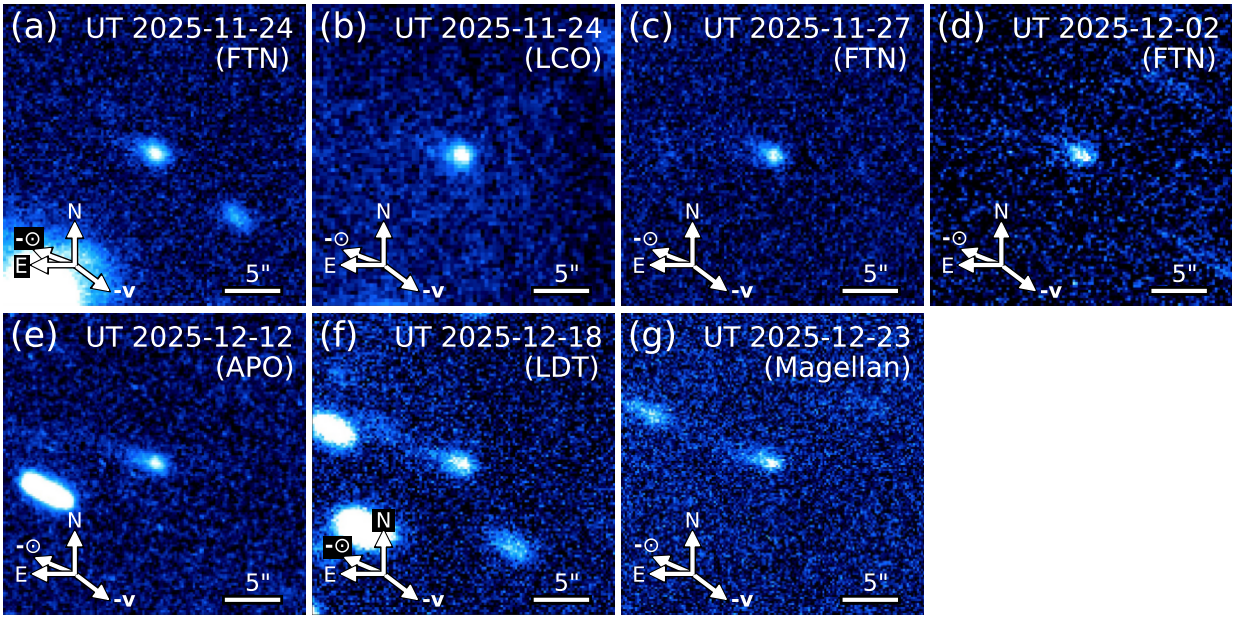

Figure 1. Composite images of 2025 VZ8 (centered in each panel) obtained between UT 2025 November 24 and UT 2025 December 23. North (N), East (E), and the antisolar ($-\odot$) and negative heliocentric velocity ($-v$) directions are labeled.

discovered to have been missed in earlier observations[15]. Further analysis by S. Deen[16] determined that it likely brightened significantly between a non-detection on UT 2025 November 8 and its discovery a day later.

To investigate further, we observed 2025 VZ_8 using the 2.0 m Faulkes Telescope North (FTN), one of the Las Cumbres Observatory (LCO) 1 m telescopes (K93) in South Africa, the Astrophysical Research Consortium 3.5 m telescope at Apache Point Observatory (APO), the 4.3 m Lowell Discovery Telescope (LDT), and the 6.5 m Magellan-Baade telescope. Stacked images are shown in Figure 1.

3. ANALYSIS

In all observations, 2025 VZ_8 displays a tapered tail $\sim 3''$ long aligned with the antisolar direction, and has FWHMs measured perpendicular to the direction of its non-sidereal motion that are $\sim 10\%$ larger compared to nearby field stars measured in the same direction.

Using the ATLAS refcat2 catalog (J. L. Tonry et al. 2018) for absolute photometric calibration, we measure an average apparent r'-band magnitude of $m_r \sim 21.6$ over our observing period.

2025 VZ_8's activity and asteroidal orbit qualify it as an active asteroid. The apparent rapid onset of activity in a single day and activity far from perihelion suggest that its activity is more likely due to an impulsive disruptive process (e.g., an impact or rotational destabilization event) than sublimation.

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Software: `astropy` (T. P. Robitaille et al. 2013), `ccdproc` (M. Craig et al. 2023), `JPL Horizons` (J. D. Giorgini et al. 1996), `L.A.Cosmic` (P. G. van Dokkum 2001), `Matplotlib` (J. D. Hunter 2007), `PyRAF` (P. Greenfield & R. L. White 2000; Science Software Branch at STScI 2012), `RefCat2` (J. L. Tonry et al. 2018), `SAOImageDS9` (W. A. Joye & E. Mandel 2003), `sbpy` (M. Mommert et al. 2019), `uncertainties` (v3.0.2, E. O. Lebigot)

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