LARGE-GRAINED DUST IN THE COMA OF 174P/ECHECLUS. J. M. Bauer[1], Y-J. Choi[1,5], P. R. Weissman[1], J. A. Stansberry[2], Y. R. Fernández[3], H. G. Roe[4], B. J. Buratti[1], and H-I. Sung[5], [1]Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, MS 183-501, Pasadena, CA, USA 91109 (correspondence: *bauer@scn.jpl.nasa.gov*), [2] University of Arizona, Steward Observatory, 933 N. Cherry Ave., Tuscon AZ 85721, [3] University of Central Florida, Dept. of Physics, P.O. Box 162385, Orlando, FL 32816-2385, [4] Lowell Observatory, 1400 W. Mars Hill Road, Flagstaff, AZ 86001, [5]Korea Astronomy and Space Science Institute 61-1 Hwaam-dong, Yuseong-gu, Daejon 305-348, South Korea.

Introduction: On December 30, 2005, Choi and Weissman[1] discovered that the formerly dormant Centaur 2000 EC98 was in strong outburst. Previous observations spanning a 3-year period indicated a lack of coma down to the 27 mag/sq. arcsec level[2]. We present Spitzer Space Telescope MIPS observations of this newly active Centaur - now known as 174P/Echeclus (2000 EC98) or 60558 Echeclus - taken in late February 2006, and the final results of their analyses[3].

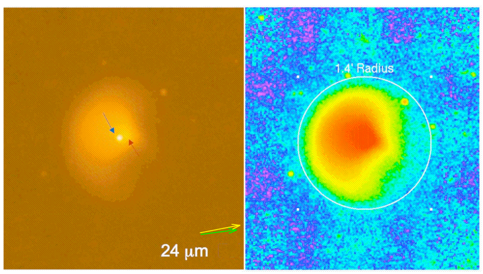

Figure 1: 24µm Spitzer image obtained on Feb 24 at 6" resolution, in low-contrast (left) and false-color high contrast (right). Left Panel: The central condensation of the coma (red arrow) is barely resolved apart from the Centaur (blue arrow), while the Sun-Comet sky-plane vector (yellow arrow) is offset only ~3° from the sky-plane motion (green arrow). The upper bound on the extent of the coma is demarcated by the white circle in the right panel.

MIPS Observations: The images show strong signal at both the 24 and 70 µm bands, and reveal an extended coma about 2 arcmin in diameter. Analyses yield estimates of the coma signal contribution that are in excess of 90% of the total signal in the 24-µm band.

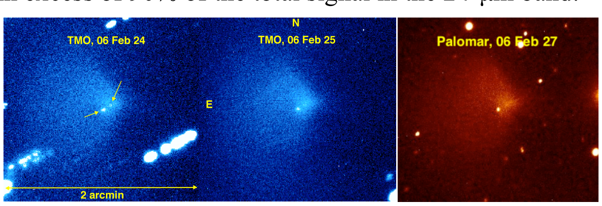

Figure 2: R-band image from TMO's 0.6m telescope taken simultaneously with the SST MIPS observations (left and center), and an RI-band image (right panel) from the Palomar 200-inch telescope taken 2 nights after the observations (similar scales and orientations).

Ground-Based Data: Simultaneous visible-wavelength observations were also obtained with Palomar Observatory's 200-inch telescope, the 1.8-m Vatican Advanced Technology Telescope, the Bohyunsan Optical Astronomy Observatory(BOAO) 1.8-m telescope, and Table Mountain Observatory's 0.6-m telescope, revealing a coma morphology nearly identical to the mid-IR observations. Dust production estimates ranging from 1.7-4.2 × 10^2 kg/s are on the order of 30 times that seen in other Centaurs, assuming grain densities onteh order of water-ice.

Discussion: Combined ground-based and SST photometry reveals several characteristics of Echelus' activity. The nucleus and coma were resolved in the visual and IR data sets. Separation between the nucleus and coma brightness peaks was ~6 arcsec on the plane of the sky. The coma extended out ~ 1 arcmin or greater in our visual and IR images, more than 500,000 km in projected distance from Echeclus' nucleus; this extent is approximately constant over timescales of weeks in February 2006 and over a large range of wavelengths. The surface brightness profiles suggest that the coma is generated by steady-state, isotropic, or nearly isotropic, outflow. In both of the observed IR bands, the coma accounts for > 90% of the observed signal.

Visual and IR dust production estimates indicate a dust particle size distribution similar to that generated by typical cometary activity, as seen by the Stardust spacecraft,'s encounter with 81P/Wild 2, for example. The particle size distribution is far less comparable to that generated by an impactor, as implied by the fluxes seen at varying wavelengths from the Deep Impact encounter with 9P/Tempel 1. The grain size distribution derived from the data yields a log particle mass power-law with a slope that is consistent with steady cometary activity, such as that observed during the Startdust spacecraft's encounter at 81P/Wild 2, and not with an impact-driven event, such as that caused by the Deep Impact experiment. Estimates of mass loss exceed production estimates of other Centaurs and Jupiter family comets.

References:[1] Choi & Weissman (2006) *IAU Circ. 8656,* 1151–1154. [2] Rousselot et al. (2005) *Icarus 176*, 478–491. [3] Bauer et al. (2008) *PASP, in press.*

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