COMETS

Hello from the other side

Astron. J. (in the press); preprint available at https://arxiv.org/abs/1903.02260

The record for the most distant discovery of an active comet belongs to comet C/2010 U3 (Boattini), observed by astronomer Andrea Boattini on 31 October 2010 at a heliocentric distance $r_H = 18.4$ au. It turns out that the Canada–France–Hawaii Telescope observed it back in 2005, at pre-perihelion ($24.6 \leq r_H \leq 25.8$ au), with an asymmetric coma and short tail. Within 5 au of the Sun, cometary activity is driven by the sublimation of water ice, but at great distances where it is colder, different mechanisms are at play. To understand its activity, Man-To Hui and co-workers investigate the photometric and dynamical properties of C/2010 U3.

The team observed C/2010 U3 using the Keck I 10-m telescope (2011–2012) and WIYN 0.9-m telescope (2016–2018). The only way to fit the measured tail morphology is by including a Lorentz force on the dust particles, which is generally swamped by the Sun's radiation pressure for closer comets. As for surface activity, the dust grains are at least 10 μm in radius, ejected at speeds less than 50 m s^{-1}, and consistent with sublimation of CO and/or CO_2, in agreement with the comet's low temperatures. However, amorphous water ice could be present and, upon heating, could crystallize in an exothermic reaction, releasing trapped gases. Based on an *N*-body integration analysis of 5,000 clones, the authors conclude that C/2010 U3 is a dynamically old Oort cloud comet and its last perihelion passage dates to 1.96 ± 0.04 Myr ago. That is too far in time for the comet to retain any heat from its last visit, dispelling any connection between cometary activity and dynamical history.

May Chiao

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