C/2010 U3 (Boattini): A Bizarre Comet Active at Record Heliocentric Distance

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We report an identification of long-period comet C/2010 U3 (Boattini) active at a new record inbound heliocentric distance of $r_H \approx 26$ au. Two outburst events around 2009 and 2017 were observed. The dust morphology of the coma and tail cannot be explained unless the Lorentz force, solar gravitation, and solar radiation pressure force are all taken into account. Optically dominant dust grains have radii of $\sim 10$ μm and are ejected protractedly at speeds $\leq 50$ m s$^{-1}$ near the subsolar point. The prolonged activity indicates that sublimation of supervolatiles (e.g., CO, CO$_2$) is at play. Similar to other long-period comets, the colour of the cometary dust is redder than the solar colours. We also observed potential colour variations when the comet was at $10 < r_H < 15$ au, concurrent with the onset of crystallisation of amorphous water ice, if any. Using publicly available and our refined astrometric measurements, we estimated the precise trajectory of the comet, propagated it backward to its previous perihelion, and found that the comet visited the planetary region $\sim 2$ Myr ago at perihelion distance $q \approx 8$ au. Thus, C/2010 U3 (Boattini) is almost certainly a dynamically old comet from the Oort cloud, and the observed activity cannot be caused by retained heat from the previous apparition. The detailed study is presented in Hui et al. (2019, AJ, 157, 162).