

Bulletin of the AAS • Vol. 54, Issue 8

Dust Activity & Gas Emission in 7P/Pons- Winnecke

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Published on: Oct 20, 2022

URL: <https://baas.aas.org/pub/2022n8i412p02>

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While observations of comet nuclei are difficult to make without an orbiter, the nucleus composition and overall activity level can be explored by studying the gas and dust composition of the comet's coma. Spectroscopic observations of 7P taken in 1989 showed no detectable gas, specifically CN emission, indicative of low overall activity, (Cochran *et al.* 2012). Recent NEOWISE observations of 7P, however, indicate CO/CO₂ emission during its 2015 and 2021 apparitions. Similarly, narrowband observations from Lowell Discovery Telescope and TRAPPIST-North & -South detected a factor of ~2-4 more CN during 7P's 2021 apparition than the 1989 upper limits measured by Cochran *et al.* (2012). Further, the LCO Outbursting Objects Key (LOOK) Project collaboration detected several small outbursts within 60 days from perihelion, (Lister *et al.* 2022). In this work, we investigate both the overall activity of 7P as well as which gas species may be driving that activity. We find 7P exhibits a high ratio of CO₂ to water production compared to other Jupiter Family comets (JFCs). We speculate a possibly CO₂-driven outburst event between 1989 and 2021 may be the cause for the subsequent increase in total activity since 1989. Observations and analysis like those presented in this work could be extended to the other three low-activity comets (96P, 108P, and 125P) identified by Cochran *et al.* (2012) to begin to explore whether they represent a population of low-activity, CO₂-dominated JFCs and what processes in their evolutionary histories may cause their observed behavior.