

# **Time-sensitive Keck/NIRSPEC observations of the Rosetta target 67P/Churyumov- Gerasimenko during its favorable 2021 apparition**

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67P/Churyumov-Gerasimenko is the best-studied comet to date because of the unprecedented detail and insights provided by the Rosetta mission during 2014-2016. The comet has been placed in the carbon-chain-depleted taxonomic class based on ground-based observations of fragment coma species. However, previous apparitions, including in 2015, have been unfavorable for in-depth ground-based observations focused on native volatiles. The 2021 apparition of 67P provided excellent observing geometry, was the first perihelion passage since Rosetta, and was the most favorable one until at least the mid-2030s. With this motivation, a high-resolution, near-infrared spectroscopic observing campaign during October – December 2021 utilized the complementary strengths of the NASA IRTF (Gibb et al. presentation in this meeting) and the W. M. Keck Observatory.

We present results from long-slit spectroscopy with the NIRSPEC spectrograph at the Keck 2 telescope, which offered maximum sensitivity for ground-based long-slit infrared measurements. We report gas rotational temperatures, production rates or stringent upper limits, and compositional relative abundances for C<sub>2</sub>H<sub>2</sub>, C<sub>2</sub>H<sub>6</sub>, HCN, NH<sub>3</sub>, CH<sub>3</sub>OH, H<sub>2</sub>CO, and H<sub>2</sub>O. The spatial distributions of species with brighter emissions are also included. These recent ground-based studies of 67P are essential to better place the unique Rosetta results into the context of global coma measurements in comets studied as a population with remote sensing techniques.

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