

Circular depressions on 67P/Churyumov-Gerasimenko observed by the OSIRIS instrument

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Abstract

Since its close encounter with comet 67P/Churyumov-Gerasimenko (67P) in August 2014, the OSIRIS instrument [1] on-board the Rosetta Spacecraft has imaged the surface of the nucleus with unprecedented resolution. From its global morphology description, numerous circular depressions of different sizes and shapes have been observed [2, 3]. Few of these circular depressions, also called pits, have shown sign of activity with the detection of faint jet-like features originated most likely from their walls [4]. The mechanism responsible for the formation of these morphological features is not yet well understood, although different hypotheses have been raised such as the collapse of a ceiling above internal voids [4]. These voids could either be due to primordial structure of the comet's interior, or they could have been created with subsequent evolution of the nucleus. In both case, these features provide important constraints on the formation and evolution of cometary nucleus. Follow-up observations of the OSIRIS instrument should both confirm the nature of the activity (i.e., sporadic vs. regular) and the number of active depressions.

In this analysis, we provide a thorough identification and description of the circular depressions on the surface of the comet nucleus. These circular depressions exhibit different shapes, from pits to alcoves, with sizes varying from tens to hundred of meters, and ultimately with different texture on their walls (i.e., with fractures and polygons, or not). The accumulation of boulders at the bottom of some of these depressions indicates that whatever is creating these features, they are changing and evolving significantly through time. These variations may reflect different formation mechanisms, or/and time of formation and evolution, and also probably internal heterogeneities below the comet's surface.

References

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