

Seasonal colors cycling on 67P/CG nucleus and coma

G. Filacchione, M. Ciarniello, A. Raponi, F. Capaccioni, M. C. De Sanctis, M. T. Capria,
G. Rinaldi, S. Erard, D. Bockelee-Morvan, C. Leyrat and VIRTIS team

A quantitative analysis of seasonal color changes occurring in the coma and nucleus of 67P/CG has been conducted by means of a systematic processing of the entire Rosetta-VIRTIS-M-VIS channel dataset. Integrated radiance, wavelength of the radiance peak and visible spectral slopes in the comet's coma are derived from January 2015 (in-bound orbit, heliocentric distance 2.55 AU), encompassing perihelion passage (August 2015, 1.24 AU) up to May 2016 (outbound orbit, 2.92 AU). These quantities are measured on the coma within an annulus defined by a tangent altitude between 1 and 2.5 km around the nucleus. On average, in this time-frame the dust colors and radiance changed significantly approaching the perihelion passage: the wavelength of the radiance peak has increased from 0.45 μm in January 2015 to about 0.55 μm few weeks after perihelion to decrease again to 0.45 μm in May 2016. Around perihelion the trend of the colors in coma dust particles and surface appear anti-correlated, with the surface showing on average bluer and the coma redder colors. On 16 equatorial areas of the nucleus, for which we have continuous time-coverage during the entire Rosetta mission, we observe a systematic bluening of the surface, with a reduction of the spectral slope up to 50%. During the pre-perihelion period we interpret these changes as a consequence of the progressive loss of the ice fraction in the coma dust grains which makes them more red. At the same time the nucleus' surface becomes bluer following the exposure of more pristine subsurface layers and the removal of surface dust caused by the gaseous activity. After perihelion, as soon as activity begins to settle, the progressive accumulation of dehydrated dust on the surface makes it redder again. The study of coma's and surface's color time-series observed by VIRTIS seems to indicate the presence of a similar seasonal cycle.