EPSC Abstracts
Vol. 6, EPSC-DPS2011-667, 2011
EPSC-DPS Joint Meeting 2011

The dust activity of the "transition" cometary object P/2010 C1 (Scotti)

E. Mazzotta Epifani (1), D. Perna (1), J. Licandro (2,3), M. Dall'Ora (1), P. Palumbo (4), E. Dotto (5), M.A. Barucci (6), J.R. Brucato (7), G.P. Tozzi (7)
(1) INAF - OAC, Napoli, Italy, (2) Instituto de Astrofísica de Canarias, TF, Spain, (3) Departamento de Astrofisica, Universidad La Laguna, TF, Spain, (4) Università Parthenope, Napoli, Italy, (5) INAF - OAR, Roma, Italy, (6) LESIA/Obs. de Paris, Paris, France, (7) INAF - OAAr, Firenze, Italy (epifani@na.astro.it/ Fax: +39-081-298384)

Abstract

We report on the cometary activity of the minor body P/2010 C1 (Scotti), an active Centaur observed at 5.51 AU. The long-term dynamical behavior of this target is characterized by a close encounter with Saturn, which in 1877 drastically decreased its perihelion distance and semi-major axis to present values. It is probably a "transition" active object, moving towards the inner part of the Solar System, on its way to become a "classical" Jupiter Family comet. P/2010 C1 (Scotti) has a reddish coma (V - R = 0.498 ± 0.049, R - I = 0.665 ± 0.061), characterized by an intermediate cometary activity (R-*Afρ* 39 ± 1 cm). Its present quite distant perihelion distance (q = 5.24 AU) makes it interesting for the more general debate on comet-like activity in the region beyond 5 AU, where there is no more significant H_2O sublimation to sustain a classical water-driven coma.

1. Introduction

In the region of the Solar System between Jupiter's and Neptune's orbits, several minor bodies transit around their aphelion (the Jupiter-Family comets) and several others move on highly chaotic and dynamically unstable orbits (usually called Centaurs). Centaurs are considered "transition" objects from the inactive Kuiper Belt to the inner Solar System, populated by active objects. A few Centaurs (~ 10% of the sample) show a sustained, though variable, cometary-like dust coma [1]. The existence of another group of "transition" active minor bodies has been recently postulated [2]. The long term behavior of these transition objects, as well as that of many of the newly discovered active Centaurs, has been perturbed by a close encounter with Saturn, which "injected" the body in the inner part of the Solar System: some of them became classical Short-period comets, with perihelion distance close to the Sun, some others are dynamically classified as active Centaurs.

P/2010 C1 (Scotti) [3] was discovered in February 2010 and provisionally identified and named as a short-period comet. A quite close Saturn encounter drastically decreased its perihelion distance and semi-major axis to the present values of q = 5.235 AU and a = 7.065 AU, respectively. It is therefore a "transition" object, orbiting on an unstable orbit that is driving it through the Solar System, towards the inner region.

2. Observations

P/2010 C1 (Scotti) was observed on March 1st, 2011, with the 3.52 m Telescopio Nazionale Galileo (TNG) at the Observatorio del Roque de los Muchachos (La Palma, Canary Islands), when it was at the heliocentric distance of r = 5.51 AU and the geocentric distance of Δ = 4.64 AU. The images were obtained with the TNG-DOLORES (Device Optimised for the LOw RESolution) instrument, equipped with the broadband filters BVRI of the Johnson-Cousin system. Despite the quite large heliocentric distance, P/2010 C1 (Scotti) was easily identifiable and appeared active in each single image, for each filter. It appeared as an object with a central condensation and an extended sharp tail-like structure, oriented at P.A. = 285°, i.e. close to the solar direction (perspective anti-tail). Fig. 1 shows the co-added image (total exposure time t = 3000 s) obtained in the R filter.

3. Observational results

Despite its large heliocentric distance at the time of observation, P/2010 C1 (Scotti) appears to be a quite active object. The data obtained during the

observations allow us to perform an analysis of the coma colors of the target. The dust color of the coma is redder than the Sun: at the photometric aperture of φ = 1.0" (this aperture minimizes the effects of sky background, remaining within the "end" of the apparent visible coma), we obtained $V - R = 0.498 \pm 0.049$ and $R - I = 0.665 \pm 0.061$. The normalized reflectivity spectrum (derived from coma photometry) is presented in Fig. 2.

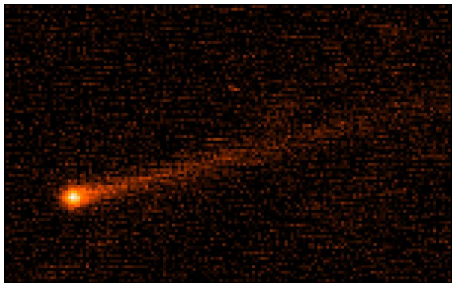

Figure 1: Co-added image of the "transition" object P/2010 C1 (Scotti) (active Centaurs) in the R filter. The linear scale is 1.25×10^5 km $\times$ 8.45×10^4 km. N is up, E is left.

The $Af\rho$ value [4], where A is the average grain albedo, f the filling factor in the aperture field of view, and ρ the linear radius of the aperture at the comet, i.e., the sky-plane radius, is usually used as a proxy for the cometary dust production. For P/2010 C1 (Scotti) we measured a R-$Af\rho$ = 39 ± 1 cm (for the reference aperture φ = 1.0"). This value depicts a scenario of an intermediate dust activity: it is greater than the average (of the few available values) at similar heliocentric distances for Short-Period comets [5], but lower than the values measured for more active Centaurs like e.g. Chiron, 29P/S-W and P/2004 A1 (LONEOS) at similar heliocentric distances [6].

4. Summary and future perspectives

Observations presented in this poster have been collected in the framework of a Long Term Program aimed at searching for comet-like activity in several targets in the region outside Jupiter's orbit, to clarify which is the real fraction of active Centaurs in the group. In this poster, we present a portrait of the most active target of the first sample of 6, whose cometary activity is evident and confirmed.

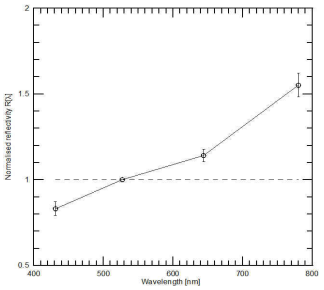

Figure 2: Normalized reflectivity spectrum of P/2010 C1 (Scotti), derived from coma photometry at $\rho = 3.4 \times 10^3$ km and normalized to 1 at λ= 527 nm (V band center). The horizontal dashed line represents dust with perfectly solar color.

P/2010 C1 (Scotti) presented an extended sharp tail-like structure, oriented at P.A. = 285°, i.e. close to the solar direction (perspective anti-tail). The dust colors of the coma are $V - R = 0.498 \pm 0.049$ and $R - I = 0.665 \pm 0.061$ (in the photometric aperture of φ = 1.0"). The R- $Af\rho$ value is 39 ± 1 cm (for the reference aperture φ = 1.0").

References

[1] Jewitt D.C., 2009, The active Centaurs, AJ, 137, 4296-4312, 2009

[2] Hahn G. & Lagerkvist C.-I., 2010, P/2008 T1 (Boattini): another comet under transition from Saturn to Jupiter, Astron. Nachr. 331, 7, 692

[3] Scotti J.V., 2010, IAU Circ. 9116.

[4] A'Hearn, M.F., Schleicher, D.G., Feldman, P.D., Millis R.L., and Thompson, D.T.: Comet Bowell 1980b, AJ, 89, 579-591, 1984.

[5] Mazzotta Epifani E., Palumbo P., Capria M.T., Cremonese G., Fulle M., Colangeli L., 2008, The distant activity of Short Periodo Comets - II, MNRAS 390, 265

[6] Mazzotta Epifani E., Dall'Ora M., Perna D., Palumbo P., Colangeli L., 2011, MNRAS *in press*.