EPSC Abstracts
Vol. 6, EPSC-DPS2011-1489, 2011
EPSC-DPS Joint Meeting 2011

Long term photometric monitoring of comet 103P/Hartley2 with the new robotic TRAPPIST telescope

E. Jehin, J. Manfroid, D. Hutsemékers, M. Gillon, and P. Magain
Institut d'Astrophysique de l'Université de Liège, Belgium (ejehin@ulg.ac.be / Fax: + +32(0)43669737)

Abstract

We report on a long term monitoring of comet 103P/Hartley2 with six cometary narrow band filters using the TRAPPIST 0.60m telescope installed recently at the ESO La Silla observatory in Chile. This new robotic telescope is dedicated to exoplanet and solar system research. The comet was observed with the cometary filters during 4 months, from Oct. 29 to Feb. 22. Since then the monitoring continues but only through the BVRI filters and about two times per week. Those observations allowed us to make a detailed light curve of the comet after its perihelion passage and derive production rates of the 4 main species (OH, CN, C_2, C_3) as well as the dust production rate (Afρ) over that period. The high sampling of our monitoring allowed us to find a periodicity in the gaseous light curves and to deduce a rotation period of 18.4h early November, slowing down to about 19h by the end of December.

1. Introduction

TRAPPIST (TRAnsiting Planets and PlanetesImals Small Telescope) is a new project driven by the Department of Astrophysics, Geophysics and Oceanography (AGO) of the University of Liège (Belgium), in close collaboration with the Observatory of Geneva (Switzerland). Mostly funded by the Belgian Fund for Scientific Research (FNRS) with the participation of the Swiss National Science Foundation (SNF), TRAPPIST is devoted to the detection and characterization of planets located outside our solar system (exoplanets) and to the study of comets, asteroids and other small solar system bodies [1]. It consists of a 60cm robotic telescope that has been installed in 2010 at the ESO La Silla Observatory in Chile.

A large part of the science time of TRAPPIST is used for photometric and astrometric survey of comets. The telescope is equipped with large (5x5cm) high quality cometary narrow band filters. Those filters are on loan from the Lowell Observatory (Flagstaff, USA) and were built by the NASA for the observing campaign of comet Hale-Bopp [2,3]. Those filters isolate small spectral regions where cometary species are mostly emitting (emission bands), as well as nearby continuum regions (dust reflected solar spectrum).

Figure 1: The new robotic 0.6m TRAPPIST telescope installed by the Liège University (Belgium) in La Silla observatory (ESO, Chile).

For relatively bright comets (V ≤ 13) we measure two or three times a week the gaseous production rates and the spatial distribution of several species, OH, CN, C_2 , C_3 as well as the ions CO^+ and H_2O^+.

The dust continuum and production rate (Afρ) is estimated from two dust continuum windows in the blue (the so called filter “BC”) and close to the C_2 bands (GC filter). These observations will allow us to determine the composition of the Southern comets and the chemical class to which they belong (for instance C-chain rich or depleted comets as defined by [3]), possibly revealing the origin of those classes. Indeed with about 10 expected comets to be observed each year, this program will provide a good statistical sample after a few years.

Faint comets (down to mag ~18) are also observed but only with standard Cousin BVRI filters and the AFρ value is computed from the R filter.

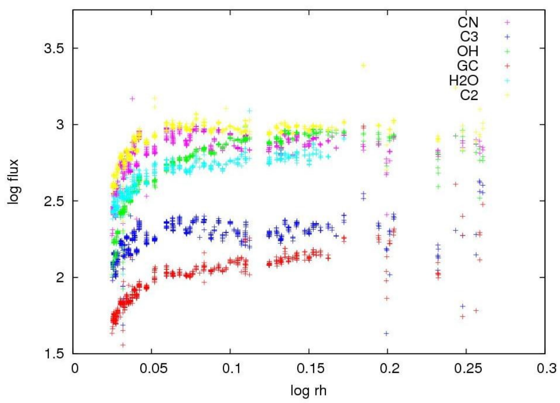

Figure 2: CN, C_3, C_2, OH, GC, H_2O^+ and continuum light curves of 103P/Hartley2 from Oct. 29 to Feb 22. The data have been corrected for the heliocentric and geocentric distances.

2. Observations of 103P/Hartley2

The first cometary target of TRAPPIST was comet 103P/Hartley2. This Jupiter-family comet did a very close approach to the Earth (0.12 AU) in October 2010 and was the target of a worldwide observing campaign [4]. On November 4th, the EPOXI mission (former Deep Impact spacecraft) imaged its nucleus and provided in-situ IR spectroscopy [5]. Between Oct. 29 and Feb. 22, we collected on 69 nights a total of 3967 frames using six different filters. The flux of five gaseous species (CN, OH, H_2O^+, C_2, C_3) and the dust continuum (via the continuum filter, GC) was measured in a 26" aperture. Periodic variations of the gas species are observed, superimposed on the long-term trend, with CN showing the strongest variations (0.4-mag amplitude). The dust light curve is nearly flat. No gas or dust outburst has been detected during the above period of observation, although CN and OH show a slow flux increase with respect to other species during several days in early November.

3. Rotation period

A period search based on the first two weeks of data gave a smooth phase diagram assuming a period of 18.4 +/- 0.3 hours. These observations are in good agreement with the period reported from Arecibo radar observations of the nucleus (18.1 +/- 0.3 hours on Oct. 24-27 [6]). Including two more weeks of data, it became clear that the period was increasing. A change from about 18.2 to 19 hours was derived that is most probably related to a change of the rotation period of the nucleus of the comet of about 2 hours in 100 days [7]. Such a rapid slowing down is in agreement with rotation values reported before perihelion (16.6 +/- 0.5 hr on Aug. 13-17 [8]).

Acknowledgements

TRAPPIST is a project funded by the Belgian Fund for Scientific Research (FRS-FNRS) with the participation of the Swiss National Science Fundation (SNF). J.M is Research Director FNRS, E.J and M.G. are Research Associate FNRS, D.H is Senior Research Associate FNRS.

References

[1] http://www.ati.ulg.ac.be/TRAPPIST/Trappist_main/

[2] Farnham, T. L.; Schleicher, D. G.; A'Hearn, M. F. : Icarus 147, 180, 2000.

[3] A’Hearn, M. F. et al. : Icarus 188, 223, 1995

[4] Meech, K. et al.: ApJ 734, L1, 2011.

[5] A’Hearn, M. et al.: Science, in press, 2011.

[6] Harmon, J.K. et al.: IAUC 9179, 2010.

[7] Jehin, E. et al.: CBET 2589, 2010.

[8] Knight, M. et al.: IAUC 9163, 2010.