ALL-SKY CAMERAS DETECTION AND TELESCOPE FOLLOW-UP OF THE 17P/HOLMES OUTBURST

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Introduction: Cometary outbursts are not completely understood. We have performed a continuous coverage of the recent 17P/Holmes outburst in order to learn more about the processes that generate an outburst of this magnificence. During the last 6 years we have also monitored the comet 29P/Schwassmann-Wachmann 1 that is usually considered the archetype of comets exhibiting unusual changes in their coma appearance and brightness [1].

The role of crystallization of water ice as a driver of cometary outbursts was pointed out previously by several authors [2, 3]. The absence of splitting in comets 29P and 17P is suggesting that this mechanism would be very efficient. Due to the energy driven by explosive activity μm-sized grains are able to leave the surface forming a typical fan, that is detectable even by using medium telescopes (Fig. 2). The brightness of the coma during the massive release of dust, and gas increases significantly.

As part of the continuous monitoring program of the night sky performed by the all-sky CCD cameras of the Spanish Meteor and Fireball Network (SPMN) we detected the increase in magnitude of comet 17P/Holmes. SPMN all-sky cameras are reaching a limiting stellar magnitude of +10 in the zenith, and are excellent instruments for detecting unexpected bursts in the magnitude of astronomical objects [4]. Thanks to these images, we were able to measure the evolution of this outburst detected on Oct. 24.067, 2007 [5]. Additionally, we used medium aperture telescopes, and a standardized method for a 10 arcsec aperture in order to obtain the coma photometry in the V, R, and I filters of the Johnson-Kron-Cousins system.

Methods: All-sky photometry was performed by measuring the number of counts for 17P, and comparing this to the counts and magnitudes of selected stars near the vicinity of the comet. We used USNO A2.0 "R" stars having an uncertainty of 0.2 magnitudes.

In order to study the nature of the outburst, we performed a photometric coverage of the magnitude of the comet in the B, V, R, and I filters with different instruments ranging from 0,3 to 1.5 m in diameter. Photometry was standarized to an aperture of 10 arcsec, but also obtained for other apertures. By using that approach we plan to study the evolution and fragmentation of the dust after the outburst, and how its expansion is contributing to the decay in the coma's magnitude.

Results and discussion: The detection of the outburst with SPMN all-sky cameras allowed us to reconstruct the evolution of the outburst (Fig. 1). Altought all-sky images were unfiltered, the camera used is mainly sensitive in the visual range [4], so these can be considered V magnitudes.

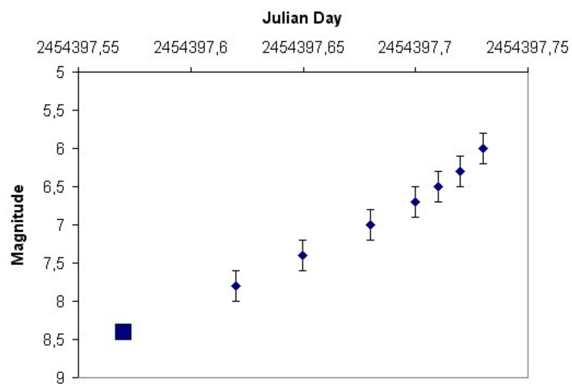

Figure 1. The magnitude of 17P/Holmes measured from all-sky CCD images. The big square marks the first point of the discovery made by A. Henriquez Santana [5]

Since the discovery of the 17P outburst we have performed a continuous coverage of the comet by using different instruments since Oct. 25 (see Fig.2). From the false nucleus an asymmetric distribution of the coma was visible, together with a bright fan of material extending from the nucleus in p.a. 220 deg. Such bright structure nearby the false nucleus suggested a possible fragmentation of the nucleus. In order to clarify this, we used images taken with the 1.5-m Carlos Sanchez Infrared Telescope (IAC, Tenerife) [6]. We found that the bright feature was produced by a bright jet with two bright blobs separated by a clear gap that were unobservable with smaller instruments. Both features expanded at an approximate velocity of about 600 m/s few days after the outburst. A fan extends from the false nucleus in p.a. 220 deg, and the outer coma diameter on those images was 4'.1, or 285000 km. These bright features expand rapidly from the false nucleus, suggesting a massive release of material from a very active region of the cometary surface. Those expanding blobs are not seen in filtered B, V, R, and I images taken with the 0.8-m IAC80 Telescope (IAC, Tenerife) or other smaller telescopes. These instruments show a diffuse and expanding "cloud" that initially was behaving as a "secondary" nucleus. The outer shell of the coma continues expanding on Oct. 30.1 images taken with the 0.8-m IAC80 Telescope; the coma keeps its general asymmetric shape and quite uniform brightness, but its diameter has increased to 7'.1 or 505000 km (Fig. 3). Once this bright feature expanded, the inner structure became visible. A Larson-Sekanina algorithm applied to 17P/Holmes images revealed several arc-like structures probably produced from active jets (Fig. 4). The sequence of Figures 2-4 is showing the outwards expansion of the dust released during the outburst.

References: [1] Trigo-Rodríguez J.M., et al. (2007) *A&A*, submitted. [2] Prialnik D. and Bar-Nun (1990) *Ap.J.* **363**, 274-282. [3] Gunnarsson M. (2003) *A&A* **398**, 353-361. [4] Trigo-Rodríguez J.M., et al. (2004) Earth, Moon and Planets 95, 553-567. [5] Green D.W.E. et al. (2007) *IAU Circ* **8886**. [6] Trigo-Rodríguez J.M. et al. (2007) *CBET* **1118**, IAU.

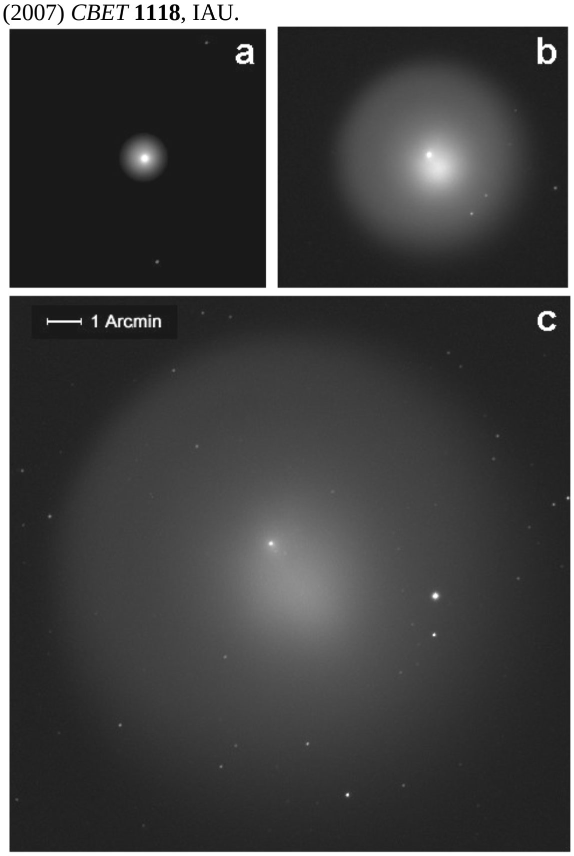

Figure 2. R filter images obtained from Gualba Observatory (MPC 442) with identical instrument, and scale (SC 36.0 f/6, and ST9). Images taken on: a) Oct. 25.01, b) Oct. 27.86, c) Nov. 1.01.

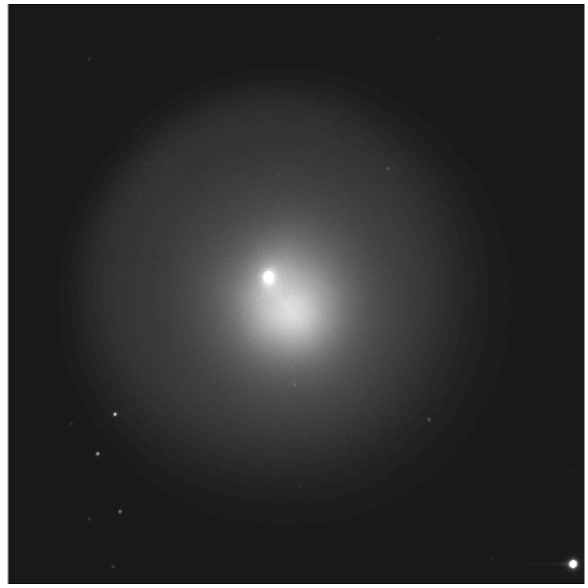

Figure 3. Image taken on Oct. 30.1 with the IAC80 telescope of the 17P/ inner coma showing the bright fan nearby the false nucleus.

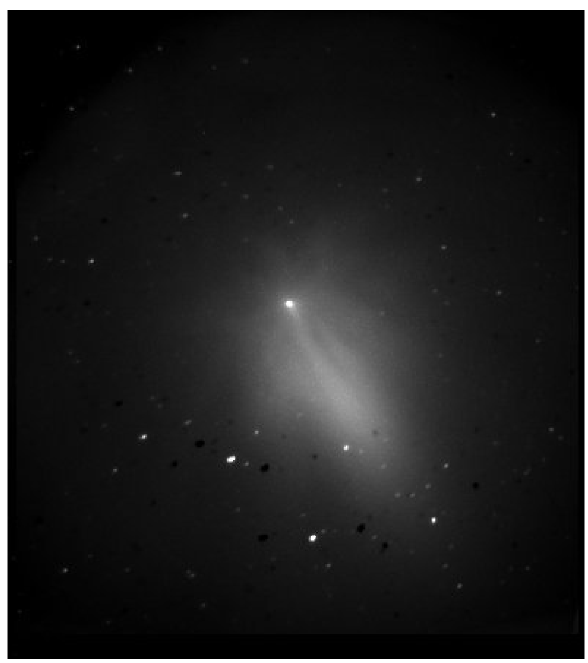

Figure 4. A Larson-Sekanina algoritm applied to an image taken on Oct. 30.1 from MPC442 shows several jets radiating from the false nucleus.