Characterization of the Nucleus Fragment 73P/Schwassman–Wachmann 3-C from Hubble Space Telescope Observation in 2001 and 2006

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We unambiguously detected fragment C of comet 73P/SW3 (73P/SW3-C) with the *HST* WFPC2 on 26 November 2001 when it was at heliocentric and geocentric distances of respectively 3.26 AU and 2.34 AU [1]. It was still highly active, but we used Hubble's superior spatial resolution to separate the light from the nucleus and the coma, employing a technique that has already been successfully applied to over two dozen comets [2]. From images obtained during two consecutive orbits, we determined an effective radius of 0.68±0.04 km for fragment C, assuming a spherical shape and standard values for the albedo and the phase function. The volume of this fragment is therefore only ~ 25% of the total volume of the pre-breakup nucleus, and we estimated that the detected fragments A, B, C, D, E comprise at most ~ 30% of this volume, implying that ~ 70% of the original mass is probably in the form of a large number of small debris with radii smaller than ~ 200 m, which were too faint to be detected in our WFPC2 images.

We re-observed fragment C on 10 April 2006, this time with the *HST* ACS/HRC, taking advantage of the exceptional close encounter of the comet with Earth. The heliocentric and geocentric distances were respectively 1.24 AU and 0.29 AU. Six *HST* orbits spread over 21 hrs allowed us to obtain multi-color images (BVR) but only a poorly sampled light curve. Applying various period searching techniques, we determined a possible synodic rotational period in the range 3.5 – 4 hr (Fig. 1). The mean magnitude of the light curve leads to an effective radius of 0.39±0.02 km for fragment C (assuming the same standard values for the albedo and the phase function as used for the 2001 observation) and its amplitude, to a minimum axial ratio of 1.8±0.3. Our deep exposures did not reveal any subfragment in the vicinity of the main C fragment. Our program further included near-infrared broadband spectroscopy with NICMOS SST. We will discuss different possible scenarios to explain the decrease of the size of the C fragment which apparently took place between 2001 and 2006.

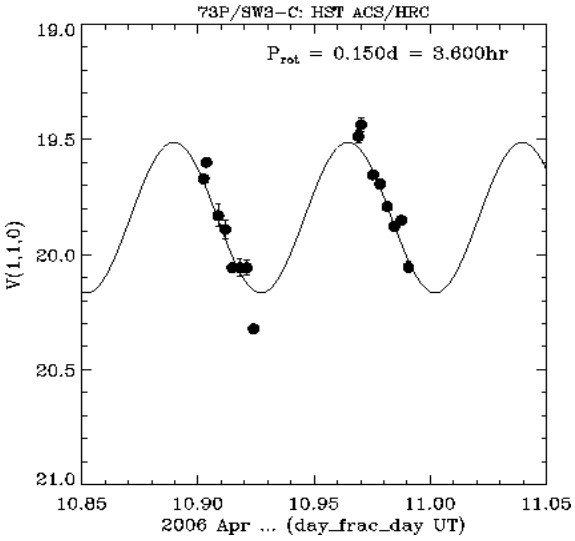

Fig.1: Normalized magnitudes V(1,1,0) of 73P/SW3-C from HST observations in April 2006. The simple sinusoidal fit corresponds to a rotational period of 3.6 hr.

References: [1] Toth, I. et al. (2005) Icarus 178, 235. [2] Lamy, P., et al. (2004) in Comets II, Arizona Press.