HUBBLE SPACE TELESCOPE OBSERVATIONS OF MAIN-BELT COMETS. D. Jewitt[1], H. Weaver[2], J. Agarwal[3], M. Mutchler[4], S. Larson[5] and M. Drahus[1], [1]UCLA (jewitt@ucla.edu), [2]Johns Hopkins Applied Physics Laboratory, [3]University of Potsdam, [4]Space Telescope Science Institute, [5]University of Arizona.

We have used the Hubble Space Telescope (HST) to examine three main-belt comets (a.k.a. active asteroids). The high angular resolution afforded by HST's WFC3 instrument (0.04 arcsec/pixel) reveals fine structure that is, at best, dimly glimpsed in lower-resolution data obtained from telescopes on the ground. The fine structure, in turn, traces extremely low velocity (<< 1 m / s) material launched from these bodies and sets diagnostic constraints on the origin of the activity. We find different causes for the activity in different objects. For example, we find that mass loss from 110 km diameter (596) Scheila is unambiguously due to the impact of a ~30 m scale projectile, while activity on P/2010 A2 is caused either by an impact (with a comparatively tiny, meter-scale projectile) or by rotational break-up of the 100 meter sized parent body under the action of radiation forces. (300163) P/2006 VW139 exhibits prolonged, low velocity emission that is compatible with, but which does not uniquely establish, a sublimation-driven source.

Mass loss by sublimation of buried ice will be potentially important in connection with questions regarding the origin of terrestrial planet volatiles, some of which were likely derived from the outer asteroid belt. Mass loss by impact will be crucial in allowing us to assess the current erosion and dust-production rates from the asteroids, and will reveal the hypervelocity impact process at scales that cannot be accessed in the laboratory. Future observations may show that rotational breakup dominates impact destruction for bodies as small as P/2010 A2. We will discuss the HST data and our current understanding of the active asteroid/main-belt comet phenomenon.

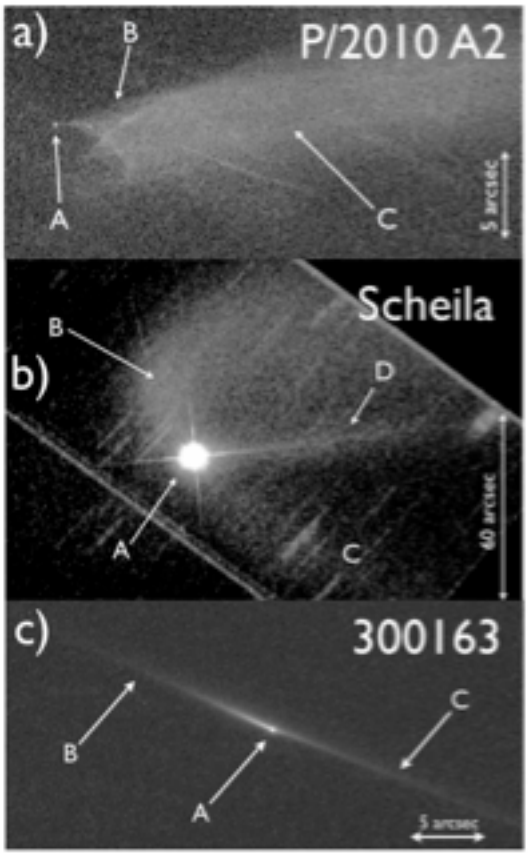

Figure 1: Hubble Space Telescope images of a) P/2010 A2 [1] showing the leading 100-m scale nucleus "A" and trailing dust structures "B" and "C" b) (596) Scheila [2] with 110 km nucleus "A", a two-armed ejecta pattern "B" and "C" and a large-particle tail "D" and c) (300163) P/2006 VW139 [3], showing "A", the 3 km nucleus and vertically confined dust sheets leading "B" and trailing "C" in the orbit of the asteroid. Figures are from Jewitt et al. Nature 467

[1] D. Jewitt, H. Weaver, J. Agarwal, M. Mutchler and M. Drahus (2010). Nature, 467, 817-819.

[2] D. Jewitt, H. Weaver, M. Mutchler, S. Larson and J. Agarwal (2011). Ap. J. Lett., 733, L4

[3] D. Jewitt, H. Weaver, M. Mutchler, S. Larson and J. Agarwal (2012). In preparation.