Ice aggregates in the coma of Hartley 2

M. Kelley[1] and L. Kolokolova[1]

[1]Department of Astronomy, University of Maryland, College Park

Comet 103P/Hartley 2 is a hyperactive comet: the comet's total water production rate implies almost the entire surface is strongly active. Surprisingly, flyby images of this comet from Deep Impact instead show many discrete locations of activity, similar to images of other "normal-activity" comets like 9P/Tempel 1 and 81P/Wild 2. However, Hartley 2 does possess a coma rich in water ice, even at 1.1 au, and rich in very large particles, with sizes of order centimeters and greater. These latter properties present a possible solution to Hartley 2's hyperactivity: icy particles, whether large or small, increase the total sublimating surface area yielding an effectively high water production rate for the nucleus size. However, the analyses of the large particles by Kelley et al. (2013) and of the ice by Protopapa et al. (2014) only account for a few percent of the comet's total water production rate, leaving over 90 % to come directly from the nucleus. Both investigations necessarily assume grain sublimation rates based on spherical ice grains, even though their analyses suggest the grains around Hartley 2 are aggregates. We are investigating whether aggregates of water ice can provide the sublimation rates necessary to solve the problem of comet Hartley 2's hyperactivity. By combining observations of Hartley 2's icy particles (total brightness, color, 1- to 3-micron spectra) with models of light scattered by icy aggregates, we seek to constrain their sizes, albedos, temperatures, and compositions, allowing us to better estimate the coma's total water production rate. In this presentation, we use the T-matrix method to simulate light scattering by aggregates of water ice, taking the results of Protopapa et al. (2014) as an initial guide, and compare our results to spectra of Hartley 2's ice taken by Deep Impact.

Acknowledgements: This work is supported by the NASA Planetary Mission Data Analysis Program, award number NNX13AQ10G.

References: Kelley, M.S. et al. 2013, Icarus 222, 634-652.; Protopapa, S. 2014, Icarus, submitted.