

PARTICLE SIZES IN THE COMA OF COMET 45P/HONDA-MRKOS-PAJDUŠÁKOVÁ AS OBSERVED BY THE ARECIBO OBSERVATORY PLANETARY RADAR SYSTEM. Alessondra Springmann^{1,*}, Ellen S. Howell¹, Walter M. Harris¹, Cassandra Lejoly¹, Patrick A. Taylor^{2,3}, Edgard G. Rivera-Valentín^{2,3}, Anne Virkki^{2,4}, Luisa F. Zambrano-Marin^{2,4}, Betzaida Aponte-Hernandez^{2,3}, Sriram S. Bhiravarasu^{2,3}, Beatrice E. A. Mueller⁵, Nalin H. Samarasingha⁵, John K. Harmon⁶, Carolina Rodriguez Sanchez-Vahamonde^{2,7}

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Introduction: The size frequency distribution of comet coma grains can help constrain the mass loss rates of material from a comet nucleus, as well as the near-nucleus dust and particle environment. Between 2017 and 2018, three ~ 1 km comets will pass within 60 lunar distances of Earth, allowing for high spatial and temporal resolution studies of the inner coma regions of these objects without dedicated in situ space missions. The close approaches of these objects to Earth enables measurement of the dust particle sizes in visible and radar wavelengths from ground based telescopes. Visible wavelength observations provide size information for micron-scale particles in the coma; radar observations can place size constraints on the distribution of particles larger than ~ 1 cm in diameter, as well as determine the total cross sectional area of the inner coma solid material.

Observations: In spring 2017, comets 41P/Tuttle-Giacobini-Kresak and 45P/Honda-Mrkos-Pajdušáková were observed in visible, radio, and radar wavelengths as part of a coordinated multiwavelength campaign. The Arecibo Observatory planetary radar system transmitted a continuous wave of polarized radio waves with wavelength $\lambda \sim 12.6$ cm at the comets to study their nuclei and comae.

Comet 41P showed no evidence of a polarized coma signature in the radar echo, implying a lack of particles larger than the Rayleigh criteria (~ 2 cm) in the coma. Comet 45P radar observations showed both polarized coma echo and 15% depolarization of the returned coma echo (Figure 1), consistent with scattering off of 2 cm and larger non-spherical particles in the coma.

Discussion: We will present results from modeling of the radar signal reflected off the coma to constrain the sizes of 45P's coma particles and better understand the coma's particle velocity distribution and orientation relative to the Sun. We will also discuss upcoming observations of comet 46P/Wirtanen in 2018–2019, the final target of this campaign, and ways ground-based observers can contribute to coordinated observation efforts. After early 2019, we expect no comets passing close to Earth similarly well-positioned

for groundbased study for 30 years, barring the apparition of a long-period comet.

Studying the sizes of particles in the near-coma environment of comets allows for better characterization of the science goals and also risks inherent in future sample return missions to comets.

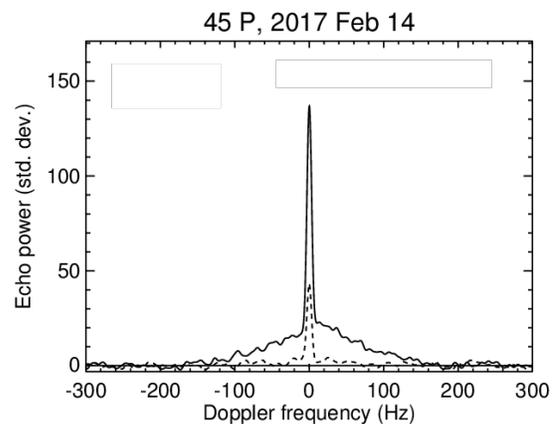


Figure 1: Arecibo Observatory radar observations of comet 45P/Honda-Mrkos-Pajdušáková taken on February 14, 2017. Visible is a high SNR returned radar signal from the coma (the central spike) and an asymmetrical coma “skirt” of material (the surrounding feature with lower SNR). The solid line is returned radar echo polarized in the opposite sense of the transmitted signal; the dotted line is depolarized signal. The coma skirt echo is 15% depolarized, consistent with a population of irregular particles larger than 2 cm.