A Day in The Life of a Cometary Molecule

Bio: Dennis Bodewits is an associate professor of Physics at Auburn University. Born in Hoogezand-Sappemeer, the Netherlands, I studied experimental physics and astronomy at the University of Groningen. I got my Ph.D. after writing a dissertation on charge exchange emission from solar wind ions interacting with cometary atmospheres at the Center for Advanced Radiation Technology (KVI-CART) at the University of Groningen. Being awarded a NASA Postdoctoral Program fellowship I moved to Washington DC and started observing comets and asteroids with the Swift space telescope at the Goddard Space Flight Center. Between 2010 and 2018 I was a member of the Small Body Group at the University of Maryland, where I got involved in the comet fly-bys of the Deep Impact and Stardust-NEXT missions, and in the Rosetta mission that orbited comet 67P/Churyumov-Gerasimenko for over two years. I joined the Physics Department at Auburn University in 2018. The IAU honored me by assigning asteroid 10033 the formal name 'Bodewits' in 2017. Fun fact: I am one out of a dozen people who ever flew a man-powered helicopter (the University of Maryland's Gamera II).

Dr. Dennis Bodewits

Abstract:
In this seminar, I will provide a review of radiative processes in cometary atmospheres spanning a broad range of wavelengths, from radio to X-rays. I focus on spectral modeling, observational opportunities, and anticipated challenges in the interpretation of new observations, based on our current understanding of the atomic and molecular processes occurring in the atmospheres of small, icy bodies. Close to the surface, comets possess a thermalized atmosphere that traces

the irregular shape of the nucleus. Gravity is too low to retain the gas, which flows out to form a large, collisionless exosphere (coma) that interacts with the heliospheric radiation environment. As such, cometary comae represent conditions that are familiar in the context of planetary atmosphere studies. However, the outer comae are tenuous, with densities lower than those found in vacuum chambers on Earth. Comets therefore provide us with unique natural laboratories that can be understood using state-of-the-art theoretical treatments of the relevant microphysical processes. Radiative processes offer direct diagnostics of the local physical conditions, as well as the macroscopic coma properties. These can be used to improve our understanding of comets and other astrophysical environments such as icy moons and the interstellar medium.