STEREO/WAVES Science Nugget
January 20, 2015

**Planetary Effects on Nanodust in the Solar Wind**

Dust particles provide an important part of the matter composing the interplanetary medium; their mass flux at 1 AU is similar to that of the solar wind. Dust grains of nanometer size-scale, which lie between bulk matter and molecules, can be detected using electric antennas because they move at very high speed. This detection is made possible by the interaction between nanodust and the interplanetary plasma and magnetic field, which accelerate the nanoparticles. Since their discovery in the interplanetary medium at 1 AU by the WAVES experiment on the twin STEREO spacecraft, nanodust particles have been routinely measured.

The nanodust flux observed by S/WAVES is highly variable and some periodic patterns are seen. The most significant pattern is explained by the dynamic behavior of the nanodust and the large-scale interplanetary magnetic field configuration, which was focusing the nanoparticles to the Heliospheric current sheet between 2007 and 2010. During this time, STEREO has crossed this large-scale neutral line every half-rotation, as expected based on simulations of the dynamics of interplanetary nanodust. After 2010, the interplanetary magnetic field changes to a defocusing configuration, pushing the nanodust away from the ecliptic, therefore preventing their observation by STEREO.

Three other periodic patterns are observed around the Venus orbital period, the Mercury orbital period, and the Mercury's rotation period. They represent clues of either interaction between the inner planets and the nanodust (or the dust particles responsible for the observed nanodust). A simple explanation could be the perturbation of cometary trails crossing these planets' orbits, which leads to a higher local collision rate, which in turn produces more nanoparticles. The Mercury rotation period pattern observed may be due to hot spots on the surface of Mercury releasing dust into the interplanetary medium.

G. Le Chat, A. Zaslavsky, N. Meyer-Vernet, K. Issautier, S. Belheouane, F. Pantellini, M. Maksimovic, I. Zouganelis, S. D. Bale, and J. C. Kasper. *Interplanetary nano dust detection by STEREO/WAVES LFR.* Solar Physics, 286: 549-559, 2013.

N. Meyer-Vernet, I. Mann, G. Le Chat, P. Schippers, S. Belheouane, K. Issautier,A. Lecacheux, M. Maksimovic, F. Pantellini, and A. Zaslavsky, *The physics and detection of nanodust in the solar system.* Plasma Physics and Controlled Fusion, 57, 014015, 2015.

G. Le Chat, K. Issautier, A. Zaslavsky, F. Pantellini, N. Meyer-Vernet, S. Belheouane, and M. Maksimovic. *effect of the Interplanetary Medium on Nanodust Observations by the Solar Terrestrial Relations Observatory.* Solar Physics, in press, 2015.

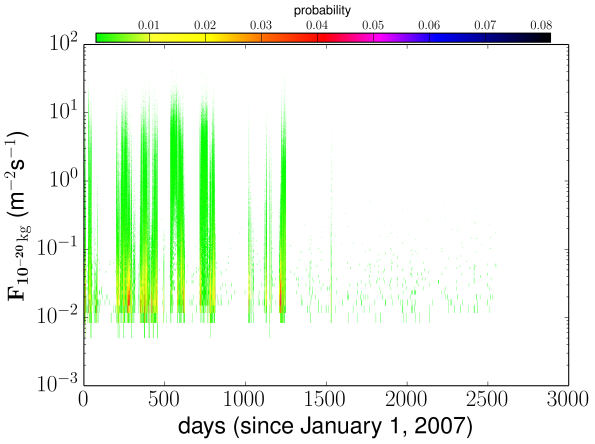


Figure 1: Variation with time of the cumulative flux of particles of mass greater than $10^{-20}$ kg measured by STEREO-A/WAVES LFR between 2007 and 2014.

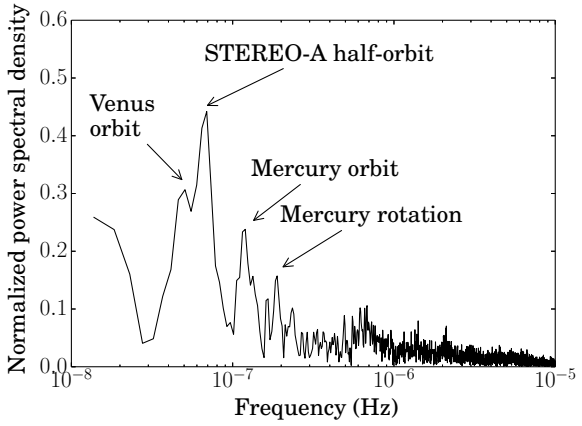


Figure 2: Periodogram of the cumulative flux of particles heavier than $10^{-20}$ kg measured by STEREO-A/WAVES LFR. Note the log-scale on the X-axis.