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In situ optical measurement of the interplanetary dust concentration from Earth's orbit

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The amount of interplanetary dust impacting the Earth's atmosphere is still not well estimated, in terms of total mass, size distribution, and concentration of particles. We propose to apply the counting techniques used in the Earth's atmosphere for determining the concentration of liquid and solid aerosols, to the detection of these interplanetary particles. The main differences with the Earth's atmosphere measurements are the very low concentrations, the high speed of the particles (at least several km/s) and the space conditions.
We have developed recently an innovative design of aerosols counter, called LOAC, which provides the concentrations for 19 size classes of particles in the 0.2-50 micrometer range, and also an estimate of their typology (or their light absorbing properties). The particles are injected through a laser beam via a pumping system, and two photodiodes record the light scattered. This instrument combines the measurements at two different angles, the first at around 15° being insensitive to the refractive index and porosity of the particles, and the second one around 60° being very sensitive to the nature of the particles. LOAC is used in routine since 5 years on the ground and from all kinds of balloons for the troposphere (mainly pollution) and stratosphere monitoring, and is also involved in various international campaigns.
An updated version of LOAC is in development for space applications, essentially for in situ measurements planetary atmospheres. LOAC can also be modified for the detection of high velocity particles, by using a light source of several cm long instead of a laser beam. No pump is needed, since the particles will cross an open cell oriented at a constant angle from the motion of the instrument. This instrument could perform measurements in Earth orbit, onboard a micro-satellite or on the International Space Station.
We will present this new concept of instrument, and how the measurements can be used to better constrain the nature and flux of the incoming interplanetary material.