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MicroMED: a dust particle counter for the characterization of airborne dust close to the surface of Mars

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Monitoring of airborne dust is very important in planetary climatology. Indeed, dust absorbs and scatter solar and thermal radiation, severely affecting atmospheric thermal structure, balance and dynamics (in terms of circulations).
Wind-driven blowing of sand and dust is also responsible for shaping planetary surfaces through the formation of sand dunes and ripples, the erosion of rocks, and the creation and transport of soil particles.
Dust is permanently present in the atmosphere of Mars and its amount varies with seasons. During regional or global dust storms, more than 80% of the incoming sunlight is absorbed by dust causing an intense atmospheric heating. Airborne dust is therefore a crucial climate component on Mars which impacts atmospheric circulations at all scales. Main dust parameters influencing the atmosphere heating are size distribution, abundance, albedo, single scattering phase function, imaginary part of the index of refraction.
Moreover, major improvements of Mars climate models require, in addition to the standard meteorological parameters, quantitative information about dust lifting, transport and removal mechanisms. In this context, two major quantities need to be measured for the dust source to be understood: surface flux and granulometry. While many observations have constrained the size distribution of the dust haze seen from the orbit, it is still not known what the primary airborne dust (e.g. the recently lifted dust) is made of, size-wise.
MicroMED has been designed to fill this gap. It will measure the abundance and size distribution of dust, not in the atmospheric column, but close to the surface, where dust is lifted, so to be able to monitor dust injection into the atmosphere. This has never been performed in Mars and other planets exploration.
MicroMED is an Optical Particle Counter, analyzing light scattered from single dust particles to measure their size and abundance. A proper fluid-dynamic system, including a pump and a sampling head, allows the sampling of Martian atmosphere with embedded dust. The captured dust grains are detected by an Optical System and then ejected into the atmosphere.
MicroMED is a miniaturization of the instrument MEDUSA, developed for the Humboldt payload of the ExoMars mission. An Elegant Breadboard has been developed and tested and successfully demonstrates the instrument performances. The design and performance test results will be discussed.