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# Development and realisation of an instrument for terrestrial and extraterrestrial dust collection in the stratosphere.

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The project foresees the development and realization of an instrument dedicated to particles collection and retrieval: an impactor able to collect aerosols once carried in the high stratosphere (30-40 km) by a balloon-borne platform.

Main characteristics for the instrument are:

- autonomous operations for few tens of hours onboard a stratospheric platform as an independent payload, with low-cost and repeatable missions;
- resources minimization in terms of mass and operational requirements;
- working environment compatible with Earth upper stratospheric conditions (mainly, T>-60 ˚C, pressure range $3 < p < 12$ hPa);
- instrument recoverable and re-usable with minimum refurbishment;
- particle collection in the range $> 0.1$ micron;
- particle collected onto substrates suitable for different laboratory analysis, in order to minimize sample manipulation and contamination.

The instrument is designed to be flown as additional payload in stratospheric flight with large payloads or onboard small technological or demonstration missions. It is aimed at bringing back aerosol samples to laboratories where abundance, size distribution, composition and mineralogy will be measured for each class of materials collected. A sampling of the stratosphere will invariably include particles from different sources with relative contributions that vary as a function of time, altitude, and possibly geographic location. At any time the stratosphere contains extraterrestrial dust, dust from natural terrestrial sources (volcanic dust, wind-blown dust, biomass burning) and dust related to anthropogenic activities. Dust will be collected by direct deposition on holey-carbon thin films supported by Transmission Electron Microscopy (TEM) grids and smooth Pt substrates feasible for different types of direct analyses avoiding particles manipulation, thus minimizing contamination by extraneous dust. The collected dust will be analyzed by Scanning and Transmission Electron Microscopy (SEM, TEM), Analytical Electron Microscope (AEM), X-Ray Fluorescence (XRF), Fourier Transform InfraRed (FTIR) spectroscopy, and Secondary Ions Mass Spectrometry (SIMS).

Dust collection/analysis will contribute to the following studies: global climate circulation; chemistry of the stratosphere; stratospheric ozone depletion; Solar System and extra-Solar dust. Aerosol direct sampling will provide ground-truth for the composition of silica-rich polymerized aerosols. Finally, data will be used to calibrate remote sensing measurements and models of aerosol exchange across the UT/LS transition zone and the transport between the lower to upper stratosphere regions.