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GENTNER – a miniaturised LIBS/Raman instrument for the comprehensive in situ analysis of the Martian surface

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We propose a novel instrument to determine rapidly and with relatively high sensitivity (down to 10 ppm) the concentrations of many elements in many Martian rock, coarse fine and soil samples. At the same time the instrument will provide information on possible organic components as well as mineralogical information. The detection of the life-related elements like H, C, N, O, P, S and Fe and the investigation of their lateral and vertical distributions as well as their occurrences in the various Martian materials may be indicative of biological activity.

The proposed instrument in its baseline configuration is a combination of Laser Induced Breakdown Spectroscopy (LIBS) and Raman Spectroscopy. It is named GENTNER honouring the german physicist and cosmochemist Wolfgang Gentner (1906 – 1980). GENTNER meets the requirements concerning advanced in situ analytical tools, like short measurement duration, high sensitivity, high repetition rate, high reproducibility, low mass, size and resource needs and high flexibility with respect to type, shape and size of sample material.

This innovative instrument, the combination of LIBS with Raman, greatly profits from synergetic effects, sharing e.g. the optical spectrometer, the lasers, and onboard data reduction facilities. It also gains from recent developments in miniaturisation and from front-line laser research.

The basic GENTNER concept consists of one or more small, light-weight Sensor Heads mounted on an arm and/or near the tip of a drill, and an Instrument Module (pump lasers, spectrometer, electronics, etc.) installed on a rover. Optical fibres con-

nect Sensor Heads and Instrument Module. An essential feature is the non-prerequisite of sample preparation.

GENTNER will perform hundreds of individual chemical and mineralogical analyses of all sample types within reach at all geologic sites visited. It also will obtain information on possible organic constituents in Martian surface and subsurface drill core samples. In addition, distant geologic units are accessible through the analysis of wind- and impact-transported individual coarse fines (approx. 1 mm) samples. These analyses will not be obstructed by dust coverage since the instrument allows depth profiling for up to 2 mm. At the same time GENTNER shall serve to grossly characterise samples prior to GC-MS and isotopic studies in order to pre-select interesting samples for these experiments.