

Gas emission centers on Mars surface: structures, morphologies and relations to subsurface fluid circulation

The up-coming ESA EXO-Mars program, which includes two different missions to be launched in 2016 and 2018 respectively, have the main aim of detecting and tracing biosignatures of possible martian life. The first mission is composed by a Trace Gas Orbiter (TGO) and an Entry Descent and landing Demonstrator Module (EDM), which will reach the surface on Meridiani Planum; the second mission will deliver a rover specifically equipped for the search sign of life on Mars. The only imaging instrument on board TGO is the Colour and Stereo Surface Imaging System (CASSIS), an high resolution camera whose main scientific objectives are: (1) to characterize sites which have been identified as potential sources of trace gases, (2) to investigate dynamic surface processes (e.g. sublimation, erosional processes, volcanism) which may help to constrain the atmospheric gas inventory, and (3) to certify potential future landing sites by characterizing local (down to ~10 m) slopes.

The PhD project should focus mainly on (1) and (2) themes. In particular, several authors have recently observed the presence of gas hydrates in Martian atmosphere in different concentrations (e.g. Geminale et al., 2008; Mumma et al., 2009). However, their geochemical or biochemical origin is still unclear and still debated are the possible release mechanisms. Whatever the possible origin could be, the short permanence time of methane in Martian atmosphere (Komatsu et al., 2011) suggests a nowadays active subsurface exchange with the atmosphere.

The main objective of the research is to find possible gas emission centers related to subsurface circulation and understand the mechanisms of gas release. On these bases potential landing sites for Exo-Mars rover should be proposed and characterized.

The research will be carried out by using past and present imaging and spectral data of martian surface integrating them with DTMs in order to recognize and map the most promising sites defining their morphology, structural character and composition.

The PhD student will be dynamically involved in the CASSIS team activities and will have the opportunity to work on priority data acquired by the camera from mid 2017 onwards. It is expected that the PhD student will also interact for his/her research with astro-biologists of the Exo-Mars mission.

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References:

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- Mumma, M.J. et al., 2009. Strong release of methane on Mars in northern summer. *Science* 323, 1041–1045