Geophysical Research Abstracts, Vol. 9, 04938, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-04938

Planetary microscope design concepts

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The performance of current planetary optical microscopes with respect to both spatial and spectral resolution is limited compared to standard laboratory microscopes: Essentially, the MER Microscopic Imagers show the view through a magnifying glass, provide only little colour information and cannot influence the illumination conditions. Other space qualified microscopes (Beagle 2 Microscope, Rosetta/CIVA and upcoming MAHLI/MSL) offer increased spatial resolution and multiple colour channels through their own illumination system. Still, standard techniques on Earth (such as polarized light microscopy) have never been applied in planetary remote sensing and thus offer a lot of potential to improve scientific results from planetary microscopes.

We describe the evolution of microscopes for lander missions and discuss the development of a more capable - yet still very lightweight and robust - planetary optical microscope (MicrOmega, as part of the ExoMars mission) and give a summary of its features and the potential drawbacks. We also present measurements of terrestrial samples and Martian meteorites for illustration and to show, what we gain scientifically from these new techniques.