Development of thermal conductivity sensors for lunar and planetary regoliths

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The thermal conductivity of planetary near surface layers is a key parameter for describing the energy balance of many solar system bodies like airless moons, asteroids, and comets. These bodies are often covered by so-called regolith layers, which are known to be very good thermal insulators. The best-known example is the surface of our moon, which is until now the only extraterrestrial body where some *in situ* measurements have been done, although only a few and in a rather crude way.

For future planetary lander missions accurate thermal conductivity measurements are of high interest. However, due to the very low conductivity values to be expected routine methods available "off the shelf" (like e.g. the standard "thin wire" method) are not directly applicable, respectively need further development and modification.

We present some ideas and preliminary calculations how the thin wire method could be used to measure these extremely low conductivities accurately. In particular we discuss possible solutions to improve the contact between a sensor needle and a surrounding medium without changing the properties of the medium. Another problem that needs to be solved is how to avoid that the needle itself acts as a heat pipe and in this way masks the real conductivity of the medium. We present possible novel designs and results from model calculations, and consider the application of such sensors for thermal measurements in the lunar regolith and in asteroid surface layers.