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HP3-RAD: A Compact Radiometer Design for In-Situ Exploration

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Many processes on planetary bodies are driven by their respective surface energy balance, and while planetary climate is influenced by the dynamics of the atmospheric boundary layer, surface radiation drives the Yarkovksy and YORB effects on small airless bodies. In addition, insolation governs cometary activity and drives the dust cycle on Mars. The radiative flux received and emitted at the surface of solar system bodies is thus a fundamental quantity, which is driven by the reception of solar radiation in the visible wavelength band, while re-radiation primarily occurs in the thermal infrared. Knowledge of the relevant radiative fluxes enables studies of thermo-physical surface properties, and radiometers to measure surface brightness temperatures have been payloads on many missions. Starting with the Thermal Mapper (TM) of the MUPUS probe onboard the Rosetta Lander Philae, DLR has developed a series of radiometers for planetary missions, many of which designed for in-situ exploration. The latest instrument is the HP3 Radiometer for use on the InSight Mission to Mars with 6 detectors covering 3 spectral bands in different viewing directions. The 120 grams device comprises integrated electronics as well as a mechanized cover to protect the sensors against dust thrown up during landing and to be used as a calibration target.
Concept and implementation of the design will be described as well as the instrument calibration results are discussed.