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**Radar package for a direct observation the asteroid's structure from deep interior to regolith:**

**Review of objectives and status of the instruments**

**Alain Herique<sup>(1)</sup>, Dirk Plettemeier<sup>(2)</sup> and instrument teams**

<sup>(1)</sup>*Univ. Grenoble Alpes, CNRS, CNES, IPAG, F-38000 Grenoble, France, [alain.herique@univ-grenoble-alpes.fr](mailto:alain.herique@univ-grenoble-alpes.fr)*

<sup>(2)</sup>*Technical University Dresden, 01187 Dresden, Germany*

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**ABSTRACT**

Despite some highly successful space missions to NEO's, their internal structure remains largely unknown: there is some evidence that an aggregate structure covered by regolith is very common for medium size bodies, but there is no direct observation. The size distribution of the constitutive block is unknown: is it fine dust, sand, pebbles or larger blocks? The observed spatial variability of the regolith is not fully explained and the mechanical behavior of granular materials in a low gravity environment remains difficult to model. Direct measurements are needed to answer these questions, which are of main interest for planetary defense. So modeling of regolith structure and its mechanical reaction is crucial for any interaction of a spacecraft with a NEO and especially for a deflection mission. Regolith vertical structure is needed to model thermal behavior and thus Yarkowsky and YORP accelerations. Determination of the global structure is a way to test stability conditions and evolution scenarios.

Radar is the most mature technique capable of achieving these objectives for the benefit of both science and planetary defense.

Which radar concepts and requirements should achieve these science objectives? A monostatic radar configuration and a bistatic one should be considered. Such radar package has been embedded in the payload of the AIM mission (ESA) to answer these open questions. This package is now understudy to instrument Juventas CubeSat for Hera and has been proposed for missions in the frame of Cosmic Vision ESA program.

This paper reviews the objectives and requirements for planetary defense and then presents the status the instruments development.

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