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Geant4 as Simulation Toolkit addressed to interplanetary manned missions studies: required developments and improvements

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The study of the effects of space radiation on astronauts is an important concern of space missions for the exploration of the Solar System. The radiation hazard to crew is critical to the feasibility of interplanetary manned missions.

To protect the crew, shielding must be designed, the environment must be anticipated and monitored, and a warning system must be put in place.

A Geant4 simulation has been developed for a preliminary quantitative study of vehicle concepts and Moon surface habitat designs, and the radiation exposure of crews therein. This project is defined in the context of the European AURORA programme, whose primary object is to study solutions for the robotic and human exploration of the Solar System, with Mars, the Moon and the asteroids as the most likely objects.

This study intends to evaluate whether the energy range typical of the radiation environment of interplanetary missions is adequately treated in Geant4 physics packages, for all the major types of particles involved, identifying the availability of appropriate electromagnetic and hadronic physics models and verifying the status of their validation. Recommendations for further Geant4 developments or improvements and of further validation tests, necessary for the interplanetary manned missions, are issued as a result of this study.

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