Automated Core Drilling of Planetary Surfaces for future In-situ and Sample Return Missions

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Sample return missions will be the ultimate goal of planetary exploration in the upcoming decades as numerous scientific questions related to the formation and evolution of planetary bodies can be addressed. There are various methods of acquiring samples like scoops, penetrators, grinders, drill, etc. Drilling of planetary sub-surfaces and acquiring continuous core sample is complex but superior to the other sample acquisition methods. The stratigraphy is preserved in a core and they can be crushed to desired sizes onboard planetary rover during in-situ missions or in laboratory during sample return missions. In addition, the precious volatiles that escape during drilling can be preserved in the core samples. Further, the drill holes produced after core extraction can be used to incorporate downhole instruments for heat flow measurements and stratigraphic observations. In view of these, an automated core drilling system is required to drill and acquire cores from a planetary subsurface. Gas flushing can be used to remove drilled cuttings from the hole within fixed time intervals. A flexible tube inside the drill pipe can wrap consolidated as well as unconsolidated cores of definite length and deliver them to a sample tray or container. Laboratory, simulated environment and field tests are critical in developing a versatile automated core drilling system which can drill cores in unknown formations with minimal power requirements.

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