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Science Case for Planetary Exploration with Planetary CubeSats and SmallSats

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Nano-spacecraft and especially CubeSats are emerging as viable low cost platforms for planetary exploration. Increasing miniaturization of instruments and processing performance enable smart and small packages capable of performing full investigations. While these platforms are limited in terms of payload and lifetime, their form factor and agility enable novel mission architectures and a refreshed relationship to risk. Leveraging a ride with a mothership to access far away destinations can significantly augment the mission science return at relatively low cost. Depending on resources, the mothership may carry several platforms and act as telecom relay for a distributed network or other forms of fractionated architectures.

In Summer 2014 an international group of scientists, engineers, and technologists started a study to define investigations to be carried out by nano-spacecrafts. These applications flow down from key science priorities of interest across space agencies: understanding the origin and organization of the Solar system; characterization of planetary processes; assessment of the astrobiological significance of planetary bodies across the Solar system; and retirement of strategic knowledge gaps (SKGs) for Human exploration.

This presentation will highlight applications that make the most of the novel architectures introduced by nano-spacecraft. Examples include the low cost reconnaissance of NEOs for science, planetary defense, resource assessment, and SKGs; in situ chemistry measurements (e.g., airless bodies and planetary atmospheres), geophysical network (e.g., magnetic field measurements), coordinated physical and chemical characterization of multiple icy satellites in a giant planet system; and scouting, i.e., risk assessment and site reconnaissance to prepare for close proximity observations of a mothership (e.g., prior to sampling).

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