Opportunistic Comet Close Approach Mission (OCCAM)

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OCCAM introduces a new, low-cost mission concept that leverages previous NASA investment in CubeSat flight systems for rapid response to an opportunistic celestial event. It is an aggressive mission to observe details of comet at perihelion. The target is 46P Wirtanen, which will pass Earth at a distance of less than 0.1AU in December 2018. Wirtanen's dynamical properties make it an accessible candidate for future missions. In fact Wirtanen was the original target for the Rosetta mission. OCCAM provides reconnaissance to increase our understanding of comet surface properties and add Wirtanen to the list of potential targets for a future comet surface sample return mission, highlighted in the NRC Planetary Science Decadal Survey.

Science objectives include characterization of Wirtanen's physical properties (rotation, morphology at all scales, geology) and evolution of its dust coma as it progresses toward perihelion. Mission parameters at the encounter are similar to EPOXI at Hartley 2. The projected resolution performance is <10 m/pixel thanks to OCCAM's RASOR (Remote Automated Science Operations and Reconnaissance) camera. RASOR is a highly integrated "smart camera" payload that incorporates many features that have proven valuable on previous missions. These include a very high sensitivity CMOS sensor, large data storage, modular interfaces and the ability to incorporate sophisticated image processing within the camera electronics. Integrated, intelligent software is necessary to alleviate communication latency, limited data bandwidth, limited power, and constrained cost. The utility of onboard image processing for planetary exploration has been proven in several instances, such as WATCH ("Image processing onboard spacecraft for autonomous plume detection"), on the Mars Exploration Rovers, which identified and selectively transmit images containing dust devils. RASOR also leverages software modules developed for the IPEx mission, which first demonstrated image processing on a CubeSat. These examples demonstrated the viability of onboard processing for selecting and returning the most highly desired science images and information without overwhelming other mission resources, such as the available data rate.

OCCAM embodies the vision of the "spacecraft in your garage" that has been expressed in recent forums to enable responsive, frequent access to comets and near Earth objects. Hence it is a pathfinder for reactive exploration at low cost, reaping the fruits of recent NASA's investment into cutting edge CubeSat technologies.