Survey of Ensemble Physical Properties of Cometary Nuclei

Principal Investigator: Yanga R Fernandez
Institution: University of Central Florida
Electronic mail: yan@physics.ucf.edu
Co-Investigators: Carey Lisse, Johns Hopkins University Applied Physics Laborator
William Reach, Caltech/SSC
Humberto Campins, University of Central Florida
Michael A'Hearn, University of Maryland, College Park
Karen Meech, University of Hawaii
James Bauer, NASA/Jet Propulsion Laboratory
Javier Licandro, Instituto de Astrof?sica de Canarias
Stephen Lowry, Queen's University Belfast
Harold Weaver, Johns Hopkins University Applied Physics Laboratory
Philippe Lamy, Laboratoire d'Astrophysique de Marseille
Imre Toth, Konkoly Observatory
Olivier Groussin, University of Maryland

Science Category: Solar System: comets
Observing Modes: MIPS Photometry, IRS Peakup Image
Hours Requested: 105.4
Proprietary Period(days): 365

Abstract:
We propose to make an albedo and radius survey of 100 cometary nuclei using IRS PU and MIPS imaging. We focus on Jupiter family comets (JFCs), which have dynamical and evolutionary connections to other Solar System groups: transneptunian objects (TNOs), Centaurs, Trojan asteroids, and extinct comet candidates. However, among these groups, the nuclei of JFCs remain the _only_ group not yet the subject of a detailed mid-infrared survey. Understanding the evolution of comets since formation is crucial for unlocking their secrets about the thermophysical and compositional environment of the protoplanetary disk. An important way to do this is to study comparisons and contrasts among comets, and between comets and related dynamical groups.

To this end, we propose a mid-IR survey of JFCs. Our scientific goals are as follows. 1) Measure the thermal emission from the JFC nuclei to calculate their effective radii. 2) Use complementary ground-based visible-wavelength observations to derive the nuclei's geometric albedos. Note that simultaneity for these observations is not needed. 3) Compare the cometary albedo distribution with those of Centaurs, TNOs, Trojans, and extinct comet candidates to gauge the effects of surface evolution. The glaring albedo difference between TNOs and Centaurs versus other groups needs to be explained. 4) Test for correlations between cometary albedos and other properties of the nuclei, such as composition and dynamical age. 5) Resolve once and for all the long-standing question of just how safe it is to assume an albedo for a cometary nucleus. 6) Use these radii to derive a completely new and independent estimate of the current JFC size distribution that will resolve the ongoing debate between several groups. The number of targets in our sample is driven by the need to test recent indications that the size distribution is truncated at radii smaller than 2 km. In such a case, ours would be the definitive study of the JFC size distribution.