EPSC Abstracts
Vol. 13, EPSC-DPS2019-756-2, 2019
EPSC-DPS Joint Meeting 2019

EPSC
EPSC-DPS Joint Meeting 2019
15–20 September 2019 | Geneva, Switzerland

Comet Science with NEOCam

James Bauer (1), Amy Mainzer (2), Emily Kramer (2), Yan Fernandez (3),Tommy Grav (4), Joseph Masiero(2), Charles Schambeau(4), Tim Spahr(5), Eva Lilly(4), Roc Cutri(6), Ned Wright (7) and the NEOWISE Team. (1) Dept. Of Astronomy, University of Maryland, (2) Jet Propulsion Laboratory, California Institute of Technology, (3) Dept. of Physics and Florida Space Inst., University of Central Florida, (4) Planetary Science Institute, (5) NEO Sciences, (6) IPAC, (7) Dept. of Physics and Astronomy, UCLA.

Abstract

NEOCam will provide an unprecedented sample of comet observations in the infrared (IR). This dataset, acquired over a 5-year interval, will create a basis for understanding the comprehensive populations of long-period and short-period comets (LPCs and SPCs). The detection of dust and nucleus thermal emission, gas emission lines in the IR, and the regular sampling of regions of sky, unencumbered by atmospheric variations and with improved single-exposure sensitivity relative to the WISE mission, will allow for debiased assays of LPC and SPC sub-populations and their behaviors.

1. Introduction

NEOCam, the next-generation space mission Near-Earth Object (NEO) survey, is currently in extended Phase A study by NASA. The IR-optimized 50-cm aperture space-based telescope platform has a single instrument, a dual-channel imaging infrared camera which surveys the sky at 4-5.2 and 6-10μm, respectively, and is presently planned for a cadence that allows for 150s coadded exposures, facilitating observations for objects down to ~20m in size [1,2]. In addition to providing several hundred thousand diameters of NEOs, and millions of main belt asteroid diameters, NEOCam will detect well in excess of a few thousand comets in the IR, providing an unprecedentedly large sample of these bodies at unique wavelengths. These observations will enable an array of physical measurements for dynamical and observational sub-classes of these active bodies throughout much of their perihelion approaches, down to solar elongations of 45^{o} and with re-visits on ~8-hour and ~11-day interval scales.

2. An Array of Comet Science

On November 14, 2009, the Wide-field Infrared Explorer (WISE) mission was launched into a polar orbit, surveying the sky at near 90 degree elongation geometries. The planetary component of the mission, NEOWISE [4], serves as a science pathfinder for the NEOCam mission, and has supplied the largest sample of asteroid diameters to date [5]. Surveying the sky in 3.4, 4.6, 12 and 22 μm bandpasses (denoted W1-W4), NEOWISE has yielded a rich array of comet measurements of size, dust and gas emission (cf. Fig 1). The NEOCam bandpasses are designed to give the highest sensitivity to NEOs in the two bandpasses (denoted NC1 and NC2), but also are similar to the WISE bandpasses with the most significant solar system science yield, analogous to W2 and W3. NC1 contains two strong gas emission lines, CO at 4.67μm, and the CO_2 line at 4.23μm, common hyper-volatile species. NC2, similar to W3, will measure the thermal signatures of cometary dust and nuclei. In combination, NEOCam's comet science yield will provide:

(1) CO and CO_2 combined emission measurements,

(2) dust coma, tail, and trail morphologies,

(3) dust photometry in reflected-light and thermal emission, and

(4) nucleus size distributions.

All of these capabilities have been demonstrated with the NEOWISE data [5-7], but NEOCam will provide greater sensitivity at a superior cadence. While there will be increased sensitivity, the NEOWISE results are used to inform the NEOCam survey planning [8]. The superior sensitivity of NEOCam relative to NEOWISE will also allow for these measurements to be acquired for more distant cometary populations such as main-belt comets and the active Centaurs [9]. We will describe in detail the populations that will be accessible to characterization by NEOCam, and the properties that will be constrained.

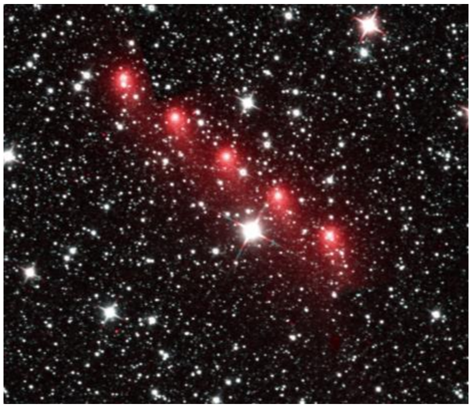

Figure 1: NEOWISE image of comet C/2013 US10. Like NEOWISE, NEOCam will be sensitive to CO+CO2 emission, and the dust and nucleus thermal signal from comets.

4. References

[1] Mainzer A., 2017, JGR (Planets), 122, 789.

[2] Mainzer et al. 2019, LPSC, 3186.

[3] Mainzer et al. 2014. ApJ 792, 30.

[4] Masiero et al. 2017. AJ 154, 168.

[5] Bauer et al. 2017, AJ, 154, 53.

[6] Kramer et al. 2017, ApJ, 838, 58.

[7] Bauer et al. 2015, ApJ, 814, 85.

[8] Kramer et al. 2019. *This meeting.*

[9] Fernández et al. 2019. *This meeting.*