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TITLE: Comet C/2012 S1 (ISON): Observations of the Dust Grains from SOFIA and of the Atomic Gas from NSO Dunn and McMath-Pierce Solar Telescopes

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ABSTRACT BODY: Comet C/2012 S1 (ISON) is unique in that it is a dynamically new comet derived from the Oort cloud reservoir of comets with a sun-grazing orbit. Infrared (IR) and visible wavelength observing campaigns were planned on NASA's Stratospheric Observatory For Infrared Astronomy (SOFIA) and on National Solar Observatory Dunn (DST) and McMath-Pierce Solar Telescopes, respectively. We highlight our

early results.

SOFIA (+FORCAST [1]) mid- to far-IR images and spectroscopy (~5–35 μm) of the dust in the coma of ISON are to be obtained by the ISON-SOFIA Team during a flight window 2013 Oct 21-23 UT (r_h≈1.18 AU). Dust characteristics, identified through the 10 μm silicate emission feature and its strength [2], as well as spectral features from cometary crystalline silicates (Forsterite) at 11.05–11.2 μm, and near 16, 19, 23.5, 27.5, and 33 μm are compared with other Oort cloud comets that span the range of small and/or highly porous grains (e.g., C/1995 O1 (Hale-Bopp) [3,4,5] and C/2001 Q4 (NEAT) [6]) to large and/or compact grains (e.g., C/2007 N4 (Lulin) [7] and C/2006 P1 (McNaught) [8]). Measurement of the crystalline peaks in contrast to the broad 10 and 20 μm amorphous silicate features yields the cometary silicate crystalline mass fraction [9], which is a benchmark for radial transport in our protoplanetary disk [10]. The central wavelength positions, relative intensities, and feature asymmetries for the crystalline peaks may constrain the shapes of the crystals [11]. Only SOFIA can look for cometary organics in the 5–8 μm region.

Spatially resolved measurements of atoms and simple molecules from when comet ISON is near the Sun (r_h< 0.4 AU, near Nov-20—Dec-03 UT) were proposed for by the ISON-DST Team. Comet ISON is the first comet since comet Ikeya-Seki (1965f) [12,13] suitable for studying the alkalai metals Na and K and the atoms specifically attributed to dust grains including Mg, Si, Fe, as well as Ca. DST's Horizontal Grating Spectrometer (HGS) measures 4 settings: Na I, K, C2 to sample cometary organics (along with Mg I), and [O I] as a proxy for activity from water [14] (along with Si I and Fe I). State-of-the-art instruments that will also be employed include IBIS [15], which is a Fabry-Perot spectral imaging system that concurrently measures lines of Na, K, Ca II, or Fe, and ROSA (CSUN/QUB) [16], which is a rapid imager that simultaneously monitors Ca II or CN. From McMath-Pierce, the Solar-Stellar Spectrograph also will target ISON (320-900 nm, R~21,000, r_h<0.3 AU). Assuming survival, the intent is to target ISON over r_h<0.4 AU, characteristic of prior Na detections [12,13,17,18,19].

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INDEX TERMS: 6015 PLANETARY SCIENCES: COMETS AND SMALL BODIES Dust, 6023 PLANETARY SCIENCES: COMETS AND SMALL BODIES Comets: dust tails and trails, 6005 PLANETARY SCIENCES: COMETS AND SMALL BODIES Atmospheres, 6008 PLANETARY SCIENCES: COMETS AND SMALL BODIES Composition.

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