NEOWISE CO+CO2 Observations of Active Centaurs: A Statistical Sample.

J. M. Bauer[1], A. K. Mainzer[2], E. A. Kramer[2], T. Grav[3], J. R. Masiero[2], Y. R. Fernandez[4], M. S. Kelley[1], S. Protopapa[5], T. Spahr[6], K. J. Meech[7], C. M. Lisse[8], R. M. Cutri[9], D. Milewski[10], E. L. Wright[11] and the NEOWISE Team. [1]Dept. Of Astronomy, University of Maryland, [2]Jet Propulsion Laboratory, California Institute of Technology, [3]Planetary Science Institute, [4]Dept. of Physics, University of Central Florida, [5]Southwest Research Institute, [6]NEO Sciences, [7]Univ. of Hawaii, Institute for Astronomy, [8]Applied Physics Laboratory, John Hopkins University [9]IPAC, [10]Dept. of Earth, Planetary, and Space Sciences, University of California, Los Angeles (UCLA), [11]Dept. of Physics and Astronomy, UCLA.

Introduction: Since their discovery in 1977, the number of identified Centaurs has grown to 365 at this date (we use the standard definition here that a Centaur's semi-major axis is <30.1 AU and perihelion distance >5.2 AU). Of these, 29 have been found to have evidence of activity, a rate of approximately 8%. In addition to the dynamical evidence, then, the centaur population has the largest fraction of objects with confirmed activity relative to other populations, besides those of actual comet populations (e.g. JFCs and LPCs). Neither main-belt asteroids nor near-earth objects approach the fraction of active bodies (main belt comets and near-earth comets) embedded within their dynamically defined populations that the centaurs do. This fact alone provides a firm link between the members of the centaur population and comets, and the link suggests compositional and evolutional relationships that can be confirmed by observational relationships.

The pattern of behavior of active centaurs varies with each centaur, but one factor is generally shared by all the active centaurs, i.e that their activity occurs outside heliocentric distances where direct sublimation is the main driver of activity. However, the centaurs do reside in the region of the solar system where CO and CO2 sublimation may be the main driver. Furthermore, the presence and quantity of CO or CO2 may constrain the primordial composition of the centaur population as well as the thermal history of particular bodies.

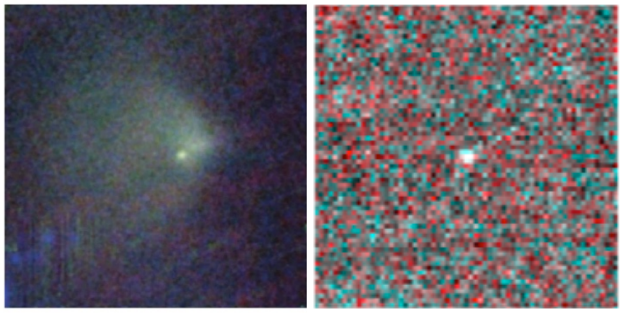

Figure 1: The active Centaur 60558 Echeclus during its outburst in December 2006-February 2007 (Left, Bauer et al. 2008) and during a period of less activity in July of 2016, as viewed by NEOWISE.

NEOWISE Data: The WISE spacecraft was launched on December 14, 2009, and from January 20 through August 4 of 2010, during the "fully-cryogenic" phase of the WISE mission, the spacecraft surveyed the entire sky simultaneously at four wavelengths: 3.4, 4,6, 12, and 22 □m. Over the course of the prime survey conducted in 2010 and 2011, over 52 Centaurs and SDOs were detected, providing flux measurements that yielded values of CO+CO2 production, dust production, and comet nucleus sizes for the majority of comets observed [1]. In November of 2013, the WISE spacecraft was re-activated, renamed NEOWISE, and began again to survey the sky at roughly 6-month intervals. Now in its 5th year of the reactivated mission, the survey continues to the present as it continues through its 10th coverage of the sky in the WISE spacecraft's two shortest wavelength channels, and the reactivated NEOWISE spacecraft has detected over 150 active bodies, approaching a comparably large census number as the prime mission. The reactivated mission data differs in several key aspects from the kind of comet data provided over the course of the cryo phases of the prime mission, notably that the fraction of the detections that provide constraints on CO+CO2 production is larger [3,4].

We will provide an overview of the reactivated mission comet CO+CO2 production rate analyses, with focus on the statistical sample of active Centaurs, correlating some ground-based observations with NEOWISE measured production rates.

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References: [1] Bauer et al. 2013. Apj, .733, 22. [2] Mainzer et al. 2014. ApJ 792, 30. [3] Rosser et al. 2018, AJ 155, 164. [4] Bauer et al. 2015. ApJ, 814, 85.