THE SODIUM TAILS OF NEAR-SUN COMETS. G. H. Jones[1,2], H. Osborn[3], Y. Ramanjooloo[1,2], K. Battams[4] [1]Mullard Space Science Laboratory, University College London, Holmbury St. Mary, Dorking, Surrey RH5 6NT, UK (ghj@mssl.ucl.ac.uk), [2]The Centre for Planetary Sciences at UCL/Birkbeck, London, UK [3]Department of Earth Sciences, University College London, UK [4]Naval Research Laboratory, Washington, DC, USA.

Introduction: Images of comet C/1995 O1 (Hale-Bopp) obtained with a wide-field imager, CoCam, on La Palma revealed that in addition to the usual dust and ion tails, it possessed a tail composed of sodium atoms accelerated anti-sunward by radiation pressure [1]. Although sodium had been detected in comets decades before Hale-Bopp, e.g. [2], the observation of a distinct sodium tail had only been reported in one other comet, Mrkos, in 1957, and the latter observation had not been widely publicized.

Hale-Bopp's discrete sodium tail was found to be accompanied by a more diffuse sodium component apparently originating at the comet's dust tail. Other atoms, such as those of lithium, should also form distinct tails, but sodium appears to be the only easily-accelerated atom that is also relatively abundant and easily observed in the visible range. The presence of a neutral iron tail has also been proposed for C/2006 P1 (McNaught) [3].

The discovery of Hale-Bopp's sodium tail prompted several studies of the origin of this feature. Sodium is known to be a very strong contributor to sungrazing comets' emission spectra [4]. Although it is known that there are at least two sodium sources, one in the vicinity of the nucleus, and another, extended one in the dust tail, to date, no clear solution to the ultimate source of the sodium has been identified. The study of more comets' sodium tails would greatly aid the understanding of the source of this material, and in turn, the composition of comets and the nature of their dust particles.

Results We present the results of our survey of the sodium tails of several comets observed by the Solar and Heliospheric Observatory spacecraft, SOHO, using its LASCO coronagraph. The LASCO C3 instrument views a region 15 degrees wide centered on the Sun, at a scale of 15"/pixel. We report in particular detail on the morphology and brightness of the tails of the bright, non-Kreutz group comets C/1996 B2 (Hyakutake), C/2002 V1 (NEAT), and C/2006 P1 (McNaught), and the results of our photometric analysis to estimate their relative sodium production rates.

In addition, we attempt to simulate the observed tails using a Monte Carlo model. The simulation of the tails' morphologies and appearances is not straightforward. The anti-sunward acceleration of sodium atoms is a strong function of the atoms' radial velocity, due to the dependence of the acceleration on the strength of the Doppler-shifted Fraunhofer sodium absorption lines in the solar spectrum in the atoms' reference frame. We discuss the implications our results for our understanding of near-Sun comets' composition and origins.

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