OBSERVING PROGRAM "T3": FINDING COMETS IN THE ASTEROID POPULATION

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An observing program to search for cometary features among the asteroidal population is presented. No additional instruments other than those normally used for minor planet observations are necessary. The involved observers periodically receive an observing planner by email and the observing results are shared over the internal mailing list. Once confirmed, results are communicated to the professional community.

The "T3" project is an observing program with the main purpose of discovering cometary objects "hidden" in the asteroidal population. Specifically, we direct our attention to objects having a Tisserand parameter respect to Jupiter (Tj) less than 3. Accordingly with Levison (1996), Tj = 3 is approximately the boundary between asteroidal and cometary orbits; minor bodies with Tj < 3 are under the Jupiter's gravitational influence and are possibly cometary nuclei of the Jupiter Family Comet class.

The goal of this project is to observe nearly all the objects having Tj < 3 but reported as asteroidal in appearance at the time of discovery. Most of the surveys looking for minor planets cannot readily detect low levels of cometary activity. G. Masi serves as principal investigator of this project.

As soon as the program was started, it provided a positive result. On 7 and 29 Dec. 2005, CCD images of asteroid 2005 SB216, obtained and checked by S. Foglia, showed that the object, listed in a preliminary database of "T3" targets, showed a full-width at half-maximum (FWHM) larger than that of nearby stars. On 4 Feb. 2006, L. Buzzi confirmed the observations, as well as – a few days later - F. Bernardi, D. Tholen, J. Pittichova (IfA, University of Hawaii), who used the 2.24-m telescope of the University of Hawaii. The following day, IAUC no. 8668 and MPEC no. 2006-C48 were issued with what was the first discovery of the "T3" observing team The latter result was officially presented at the Meeting on Asteroids and Comets in Europe (MACE), held in May, 2006 in Wien.

The evaluation of the FWHM of candidates against that of the stars in the same field-of-view is a promising technique, which has been intensively used by G. Masi over the last few years (see, for example, IAUC no. 8104) and during his PhD work. Thanks mainly to S. Foglia, a special software routine has been developed to extract all the objects with Tj < 3 from the MPCOrb.dat file, with some constraints on their magnitude and elongation from the Sun. A text-format file is created including all the data of interest for each object (see below) and sent through a special mailing-list (hosted at the Geneva Observatory by R. Behrend) by the coordinator (L. Buzzi). Thus, observers can choose which targets are suitable for their equipment and locations.

Objects listed on the Minor Planet Center's Near Earth Object Confirmation Page (NEOCP) are suitable to be T3 targets. Usually on a daily basis, a message is sent to the mailing-list by S. Foglia with the NEOCP objects possibly on a cometary orbit. In these cases, the discovery of cometary features is a time-critical event because usually an object does not stay too long on the NEOCP and a MPEC is issued by the MPC as soon as a reasonable orbit is obtained from the available observations. If a cometary signature is found, these findings are included in the IAUC.

Observing Planner

Usually twice a month (sometimes more frequently) the Observing Planner (OP) as text-format file is distributed over the mailing list by the coordinator. It contains the following information: asteroid catalog number, name or designation; the orbit code according to the MPC (that reveals the dynamical type of orbit); an observing status flag that will be equal to 1 if no cometary feature was detected in the last two week, 2 if no cometary feature was detected in the last month, 3 if no cometary feature was detected previous to last month, 9 if there are special notes (listed at the end of the OP) about the possible cometary feature. This flag is maintained by the coordinator in the "T3" database using feedback from observers about their positive or negative observations. Thanks to A. Morbidelli (Observatoire de la Cote d'Azur, France) it is possible to also include in the OP the sum of 'Outer Main Belt' and 'Jupiter Family' NEO's source region probability (Bottke W. F. Jr et al 2002). Perihelion date, Tj, number of observed oppositions, semi-major axis, eccentricity, inclination, current sky position and magnitude, apparent motion, geocentric and heliocentric distances, elongation from Sun are also reported in the OP. Thank to G. Matarazzo and R. Serpilli (Italy) the OP also includes the Minimum Orbital Intersection Distance (MOID) with Jupiter.

Observing Technique

One must take at least two or more series of images for each object (under good seeing for the observer's location) in order to obtain the highest signal-to-noise ratio (SNR) possible (at least 10, the more the better), in order to avoid false detections, always possible with the average seeing at many amateur observing sites. Also, it is important to choose the right integration time, to limit the trailing effects, which would make the final images difficult to judge. All the good, collected frames have to be calibrated (with

bias and dark frames subtraction and flat-field normalization), and then (using Astrometrica, CCDsoft and similar software) stacked according to the apparent motion of the object. If the cometary appearance is not obvious by visual inspection of the resulting images, it is necessary to measure the FWHM of the object. If its value is at least 25% greater than that of stars (obviously stacked with a zero motion) of similar SNR and possibly close to the target - to limit optical effects – then it is a probable detection of a coma. Obviously, in order to make reliable assumptions about the presence of this feature, the results from the different series of images must be very similar. We're also testing different approaches to reveal cometary features to be used as possible, independent confirmation techniques of the FWHM measurement.

Astrometry for every observed object must be obtained in the traditional way and sent, as usual, to the MPC. In case a cometary feature is found, the observer must send a message to MPC and CBAT and also send a message to the mailing list for independent confirmation in a short time period (if the cometary feature is suspicious, one must send an e-mail only to the mailing-list); a copy of the measures, together with the FWHM of the object, FWHM of the comparison stars and the SNR of the object should be reported. The last step is taken by the coordinator: once confirmation is received a definitive report is sent to the MPC. Confirmed negative reports are similarly important.

Interested observers will find additional information on the T3 Pogram and how to join at the following URL:

http://asteroidi.uai.it

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HIGH-SPEED PHOTOMETRIC ANALYSIS FOR MINOR PLANETS 1586 THIELE, 4246 TELEMANN, (10662) 3201 T-2, AND (49880) 1999 XP135

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Photometric observations of 1586 Thiele, 4246 Telemann, (10662) 3201 T-2, and (49880) 1999 XP135 were performed in September and October of 2005. The periods and amplitudes found were: 1586 Thiele 3.086 ± 0.038 h, 0.136 ± 0.011 mag; 4246 Telemann 8.960 ± 0.038 h, 0.109 ± 0.027 mag; (10662) 3201 T-2, 3.072 ± 0.038 h, 0.151 ± 0.04 mag; and (49880) 1999 XP135, 11.111 ± 0.038 h, 0.102 ± 0.035mag.

High-speed photometry of asteroids, with the aim of accurately determining rotation periods, is an ongoing research project involving undergraduate students from Delaware Community College. Students are involved in the data collection, reduction, and analysis.

The observations of 1586 Thiele, 4246 Telemann, 10662 (3201 T-2), and (49880) 1999 XP135 were obtained over two consecutive nights at Mount Cuba Astronomical Observatory (MCAO) in Greenville Delaware. 1586 Thiele was chosen as a target since it was reported to have a short period of 3.37 hr. While preparing the finder charts for 1586 Theile, we found that several additional asteroids brighter than 18th magnitude could be included in the