IDENTIFICATION OF SPECTRO-DYNAMICAL ASTEROID FAMILIES. S. J. Bus, University of Hawaii, Institute for Astronomy, 640 N. Aohoku Place, Hilo, HI 96720, sjb@ifa.hawaii.edu.

Introduction: Dynamical asteroid families are identified as concentrations of objects with similar proper orbital elements. These families are thought to have formed through the collisional disruptions of once larger parent bodies, and as such, the members of each family should be genetically related. Recent studies of asteroid families have revealed a tendency for members from each family to be spectrally similar (Bus [1], Cellino et al. [2], Izenvic et al. [3], Mothe-Diniz et al. [4]). As the amount of spectral data for asteroids increases, particularly from current and anticipated all-sky surveys such as the Sloan Digital Sky Survey (SDSS), Pan-Starrs and GAIA, this tendency for spectral homogeneity among family members could be exploited in future searches for asteroid families.

Data: Bus [1] first proposed a method of searching for "spectro-dynamical" asteroid families by combining both orbital and spectral information as part of the clustering algorithm. That work was based on visible wavelength spectra for 465 asteroids obtained during the second phase of the Small Main-belt Asteroid Spectroscopic Survey (SMASSII, Bus and Binzel [5]) and focused on asteroid families located between 2.7 and 2.8 AU, yielding 19 spectro-dynamical clusters.

This approach is now applied to the entire main belt, from 1.8 to 3.3 AU utilizing two larger, independent datasets. The first dataset used in the present study contains 2,074 visible-wavelength spectra obtained during SMASSI (Xu et al. [6]), SMASSII and the Small Solar System Objects Spectroscopic Survey (S3OS2, Lazzaro et al. [7]). The spectra from these three surveys have been combined into a single, coherent dataset spanning the wavelength interval from 0.50 to 0.92 μm. The second dataset to be examined is based on four broad-band colors from the third release of the SDSS Moving Object Catalog (Ivezic et al. [8]). A cutoff in the acceptable uncertainties in the SDSS photometry leads to a dataset consisting of 21,124 asteroids with the highest quality measurements.

Methodology: Early efforts to identify spectro-dynamical families used the algorithm described in Bus [1], which made use of two separate metrics: one describing the difference in mean orbital velocity between each pair of asteroids, and a second that quantifies the spectral differences between each pair. Because these two metrics cannot be easily combined into a single measure that accurately relates both the orbital and spectral differences between a pair of objects, a strategy was developed for identifying clusters using the Hierarchical Clustering Method (HCM) on subsets of objects whose spectral dissimilarities fell below a certain threshold level.

This clustering method has now been modified to use a nearest neighbor approach. In a multi-step procedure, the spectral colors of each asteroid are compared to those of its *n* nearest neighbors to determine the likelihood that it is a member of a spectro-dynamical cluster, or if it can be rejected as a background, non-family object. Those asteroids identified as likely family members are then clustered together hierarchically based on the number of shared nearest neighbors. One of the advantages of this technique is that during the clustering phase, not all objects are linked (outliers are discarded), so that cluster boundaries are more clearly defined.

Results: The final stages of this cluster analysis are underway, with the only remaining refinement being the determination of the best value for *n* (the number of nearest neighbors). Comparing results from the two datasets (the higher-resolution spectroscopy and the SDSS colors) show very similar results in terms of the families found, and are both in good agreement with recent dynamical searches (such as Zappala et al. [9] and Nesvorny et al. [10]). In no case have we found evidence for different lithologies within one family that might suggest remnants of a differentiated body.

This method for combining both orbital and spectral information as part of the search for asteroid families has several advantages over previous studies: the boundaries of known families can be more accurately determined, close or overlapping families in orbital element space can be separated, interlopers can be identified, and older, more diffuse families that might otherwise be missed can now be recognized.

Final results from this work, including the family determinations derived from both datasets, will be presented.

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