SEARCHING FOR V-TYPE AND Q-TYPE MAIN-BELT ASTEROIDS BASED ON SDSS COLORS.
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Introduction: The Sloan Digital Sky Survey (SDSS) Moving Object Catalog (MOC) provides a resource for preliminary estimates of asteroid colors, helping to pinpoint promising targets for further investigation. We use the SDSS five color band measurements for 43,000 asteroids (SDSS MOC Third Release) [1] as input for identifying possible V-type and Q-type asteroids in the main belt. V-types are of interest because of their possible mineralogical connection to basaltic achondrite (HED) meteorites [2]. While V-types are found to be abundant in the vicinity of Vesta [3], we are particularly interested in finding possible basaltic signatures in other parts of the main belt. Q-types are of interest because of their possible connection to the most common meteorites, ordinary chondrites [4]. While Q-types are common among small asteroids in near-Earth space [5], they remain elusive to telescopic spectral surveys of the main belt.

Method Overview: We utilize 149 asteroids measured in common between the Small Main-Belt Asteroid Spectroscopic Survey (SMASS) [6] and SDSS in order to form a translation between major asteroid taxonomic classes (e.g. S-, C-, V-, and Q-types) and SDSS colors. For example, the known S-type asteroids within SDSS are averaged together to form a reference set or "standard" for what an S-asteroid (defined by the SMASS taxonomy [7]) looks like within SDSS colors. We thus form a "standard S", "standard C", "standard V", and "standard Q" asteroid within SDSS colors. For each of the 43,000 SDSS asteroids, a residual is calculated that evaluates the fit of the five color bands with respect to each class represented by a "standard asteroid." For example, an SDSS asteroid that gives the lowest residual with respect to the "standard V asteroid" would be assigned to the V-class, if it also meets a strict rejection criterion such that the residual value is also less than a selected threshold. With this method, we are able to make taxonomic assignments to 90% of the 43,000 SDSS objects [8]. These assignments include V-type and Q-type asteroids distributed throughout the main asteroid belt.

Results: We do not consider the taxonomic assignments based on Sloan colors to be definitive. Rather, they are suggestive of targets that merit detailed follow-up spectroscopy over visible and near-infrared wavelengths. We report results of dedicated visible wavelength spectroscopic investigations performed with the New Technology Telescope (NTT) of the European Southern Observatory and target-of-opportunity observations performed with the NASA Infrared Telescope Facility. An example of our results appears in Fig. 1. Our SDSS target selection method and observations reveal (21238) 1995 WV7 to be a V-type asteroid, an interesting discovery because of its main-belt location at 2.54 AU (beyond the 3:1 resonance). It is unlikely to be related to Vesta as the ejection velocity required is ~1.8 km/sec. While we pursued our identification and observations of asteroid 21238 independently, our results represent a confirmation of other teams who obtained observations prior to or commensurate with ours, also using SDSS colors as a basis for target selection [9, 10]. We will present our latest results for other V-type as well as Q-type candidates within the main asteroid belt.

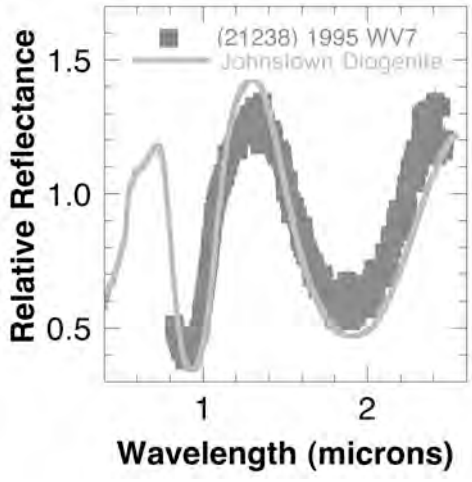

Figure 1: Comparison of main-belt asteroid (21238) 1995 WV7 with respect to the basaltic achondrite (diogenite) meteorite Johnstown [11]. This asteroid was selected as a spectroscopy target based on its SDSS colors suggesting a possible V-type. Located beyond the 3:1 resonance at 2.54 AU, it is unlikely to be dynamically linked to Vesta. This asteroid may represent a new but still rare example of basaltic asteroids in the outer main belt, of which 1459 Magnya (at 3.1 AU) is a previously known [12] but probably also unrelated example.

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