Physical Characterization of First Triplet Near-Earth Asteroid (153591) 2001 SN_{263}. V. Reddy[1], M. J. Gaffey[2], M. Schaal[3], and D. Takir[2], [1]Department of ESSP, University of North Dakota, Grand Forks, USA. Vishnu.kanupuru@und.nodak.edu, [2]Department of Space Studies, University of North Dakota, Grand Forks, USA. [3]Department of Physics, University of North Dakota, Grand Forks, USA.

Introduction: Binary asteroid systems are now known to exist in all classes of small bodies from the inner Solar System to the outer reaches of the Kuiper belt. A majority of these systems have been discovered using photometric and radar techniques. Among large main belt asteroids (diameters >80 km) the fraction binary systems is ~2% [1], while in near-Earth (NEAs) and small main belt asteroids (diameter <10 km) there seems to be an abundance of binaries (15±4%) [2].

Triplet asteroid systems are known to exist in the main belt [3, 4] and outer solar system [5], but were unknown in the NEA population. In February, 2008 [6] reported the discovery of the first NEA triplet system, (153591) 2001 SN_{263}, based on Arecibo radar delay-Doppler images (2380 MHz, 12.6 cm) on Feb. 12. The system consists of a primary with a diameter of 2 km and two smaller components of 1 and 0.4 km, respectively. Discovery of triplet NEA system has important implications not only for impact hazard assessment but also for their formation mechanism. Preliminary spectroscopic survey of binary NEAs by our group suggests the formation mechanism to be independent of the parent body composition [7].

Observation/Data Reduction: Near-IR spectroscopic observations of (153591) 2001 SN_{263} were obtained onsite using the SpeX spectrograph [8] at the NASA Infrared Telescope Facility on Mauna Kea, Hawai'i, on Feb. 27, 2008 UT. All SpeX data were subsequently reduced using IRAF and the PC-based SpecPR spectral processing program [9]. Using methods developed by [10] and based on the Standard Thermal Model, the albedos of these objects were estimated using thermal excesses at 2.4 µm, phase angles and heliocentric distance at the time of observation.

Analysis: Figure 1 shows the average spectrum of (153591) 2001 SN_{263} obtained on Feb. 27, 2008. Apart from the residual atmospheric water vapor features at 0.9-, 1.1-, 1.4- and 1.9-µm, the spectrum is essentially featureless with an overall blue slope (-0.29). Sharp rise in reflectance beyond 2.0 µm is due to thermal emission. Assuming a linear continuum, the estimated mean value of thermal excess at 2.4 µm is ~16±1% given the scatter in the data. Using Standard Thermal Model the estimated lower limit albedo for the object using the thermal flux calibration curve given the uncertainties is 5±1%. Assuming an *H* magnitude (MPC) of 16.5, and an albedo of 5±1% from the thermal model, the estimated system diameter of (153591) 2001 SN_{263} is 2.97±0.35 km. Since thermal emissions from individual components of the system could not be resolved from the data obtained, it is difficult to estimate their individual diameters or albedos.

Meteorite Analogs: The lack of diagnostic features in the near-IR spectrum could be due to the presence of an opaque phase (carbon) which leads to low albedo. Some carbonaceous chondrites like Grosnaja (CV3) have a blue slope with an albedo range of 5-10% [11]. While we are not speculating on the causes for the observed blue slope, it would not be unreasonable to suggest Type 3 carbonaceous material as a possible analog for 2001 SN_{263}.

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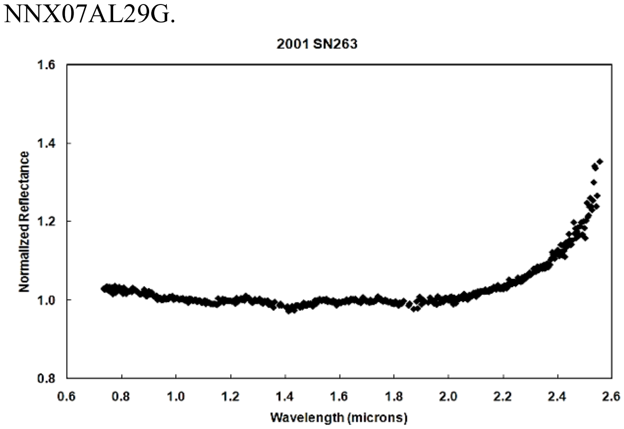

Figure 1: Near-IR spectrum of triplet near-Earth asteroid (153591) 2001 SN_{263} obtained using the SpeX instrument on NASA IRTF on Feb. 27, 2008.