FROM TNOS TO CENTAURS: THE THERMAL CONNECTION. G. Sarid[1] and D. Prialnik[2], [1]Department of Geophysics and Planetary Sciences, Tel-Aviv University, Tel-Aviv, Israel, galahead@post.tau.ac.il, [2] Department of Geophysics and Planetary Sciences, Tel-Aviv University, Tel-Aviv, Israel, dina@planet.tau.ac.il.

Introduction: The outer Solar System hosts a vast population of small icy bodies, considered to be primitive remnants from the planetary formation epoch [1]. These are generally divided into sub-populations, according to their dynamical properties. One such primal division is between Trans-Neptunian Objects and Centaurs. The former occupy the region of phase space with q>30 AU, while the latter are on planet-crossing orbits between Jupiter and Neptune [2]. These two populations are considered to be of the same origin, the Centaurs being objects that have been ejected and scattered inward [3]. The dynamical evidence for this connection is strengthened by observations, as these populations appear to be similar in colors and spectra characteristics [4].

The above mentioned connection between the TNOs and Centaurs suggests that they share a common thermal and compositional history. Internal evolutionary models of representative TN and Centaur objects could help determine what primitive properties can still be found today and how icy bodies evolve in the outer Solar System region.

Modeling Issues: The icy bodies in question are considered to be porous aggregates of ices and dust [5]. Modeling the internal evolution of such bodies takes into account various heat sources, such as insolation, crystallization, collisional effects and radioactive decay. In terms of composition, these models deal with a composition of refractory solids, amorphous and/or crystalline water ice and a mixture of volatiles, either in solid or gaseous state. The equations that govern the structure and evolution are those of mass and energy conservation, for a 1-D spherical body [6]. Negligibility of self-gravity, compared to the material strength, is amply justified for small bodies. Thus a prescribed density profile usually replaces the demand for momentum conservation. However, large bodies (~100 km and larger) do not necessarily comply with this rule, at least not as a whole. In our models, we employ a hydrostatic scheme to the body as a bulk, in concomitant with the temperature, density, fraction of volatiles and pressure evolution.

We combine in our models the thermal processing of ices, due to radionuclide decay (predominantly 26Al and 60Fe, which are the most potent for the evolution timescales), insolation (may be negligible for surface compositions in the outer Solar System and Trans-Neptunian region) and crystallization of amorphous to crystalline ice (as a triggered source of internal energy).

Preliminary Results: Considering some various conjectures, regarding the compositional and structural properties of TNOs and Centaurs, we show that hydrostatic balance may play an important role in the evolution of internal structure in large bodies, affecting compaction and the continuous re-distribution of pore sizes. Some of our results describe the internal structure and composition of our model TNOs, in terms of temperature profile, volatile ices abundances, transition of amorphous to crystalline ice, possible water retention and porosity and stratification structures.

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(More results of this research will be presented in future papers and in the following website: ***http://geophysics.tau.ac.il/personal/gal_sarid/****)*