INTRODUCTION

The ability of a material to resist changes in temperature is called the thermal inertia. Determination of this quantity can give clues as to the physical properties of the surface of an asteroid, such as composition and the presence of a regolith (Muller 2007). Thermal inertia is proportional to the square root of the thermal conductivity, which may take on a large range of values among asteroid surfaces. In general, bare rock surfaces have a higher thermal conductivity and thus correspond to a large thermal inertia while the presence of small grains will decrease the bulk thermal conductivity and lower the thermal inertia. Compositionally speaking, metals have a much higher thermal conductivity than other materials that may exist on asteroid surfaces (e.g., silicates) and may yield relatively higher thermal inertia values.

The presence of asteroid regolith has been hypothesized to be the effect of surface impacts throughout the lifetime of an object (House & Wilkening 1982). A series of impacts could not only generate regolith particles, but also pulverize existing regolith into smaller particles. Larger asteroids have a higher surface gravity and also longer collisional lifetimes (Bottke et al. 2005), so it is expected that small particle regolith is more abundant on larger-sized bodies due to their longevity and impact frequency.

Thermal inertia has been measured for large solar system bodies, such as the Moon (Spencer et al. 1989) and Mercury (Emery et al. 1998), and also a few dozen small bodies by (Delbo & Tanga 2009) using data from the Infrared Astronomical Satellite. An inverse relationship between diameter and thermal inertia was found by (Delbo & Tanga 2009) over diameters ranging four orders of magnitude, which supports the theory of regolith generation via impacts. However, the thermal inertia of many asteroid surfaces remains to be determined. The thermal inertia for a large set of asteroids could reveal trends among or between dynamical and compositional groups. Such information will lead to a better understanding of the impact history within in the inner solar system.

OBSERVATIONS

- Wide-Field Infrared Explorer (WISE)
- Moving object catalog (NEOWISE)
  (Mainzer et al. 2011)
- 157,000 solar system objects found
- 12 and 22µm bands
- Dominated by thermal emission

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DISCUSSION/FUTURE WORK

The thermal inertia calculated for 270 Anahita is typical for other main belt asteroids of the same size, as found in Delbo & Tanga (2009). An inverse relationship between diameter and thermal inertia was found by Delbo & Tanga (2009) which suggests that larger objects have a more developed regolith (figure 4).

This method can be used on hundreds of objects in the WISE catalog to compute thermal inertia values for asteroids with and without known spin pole solutions but with known rotation periods. In doing so, we can effectively constrain the spin pole orientation and because of this, it is possible to discern between two degenerate spin pole solutions for objects with intermediate thermal inertia.

With thermal inertia constraints on many objects, a better understanding of regolith evolution on asteroids can be achieved. A more sophisticated thermophysical model will be used in future work to better understand the regolith properties on asteroids.

REFERENCES
