# RAISING THE ALBEDO OF 2010 GY6: FITTING ATPM TO WISE DATA

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**Introduction:** Near-Earth Asteroid 462775 (2010 GY6) is in the Apollo orbit-family with a 1.46 year orbital period. 2010 GY6 was measured by WISE and fitted with NEATM, yielding NEATM model parameters of D=1.1 km, pv=0.028 and eta=2.3 [1]. The NEATM-derived geometric albedo of 2010 GY6 is lower than the surface of comet 67P/C-G [2]. The eta value is considerably higher than typical for its phase angle of 33˚ [3], indicating a cooler surface due to non-zero thermal inertia and/or surface roughness are important. If the thermal inertia and surface roughness are constrained by fitting the Advanced Thermophysical Model (ATPM [4]) to the WISE data, what would the resulting geometric albedo? We find pv=0.06–0.08, in the same range as B- or C-type NEAs like Bennu or JU3.

**ATPM fits to the WISE data:** The WISE SEDs are fitted with ATPM (Fig. 1). The best-fit coupled parameters {Diameter (D), Bond Albedo (A), thermal inertia (Γ), and surface roughness (area fraction)} include A=0.025, surface roughness=1, and Γ≈900. For a 2-sigma 95% confidence level, Γ ≥500; the chi-sq surface for the coupled parameters {A, Γ} is in Fig. 1 (*right*). NEATM is {A, Γ}=[0, 0.025]. The Diameter (D) is correlated with {A, Γ, surface roughness} so additional constraints on A are needed; the constraints for A come from the visible light absolute magnitude (H), which depends on 1–A.

**Phase curve analyses:** The phase curve fitted with the H-G1,G2-relation varies depending on the geometric albedo pv; pv=A/q where A is the thermal model input and q is the integral under the phase curve. We fitted phase curve from MPC data using G1,G2=(0.8228, 0.10938) for C-type [5], yielding H=19.05 mag, q=0.359, pv=0.07.

**Conclusions:** We combine the constraints from ATPM fits and phase curve analysis (Fig. 2) [5]. 2010 GY6 is characterized by ATPM: Bond Albedo A=0.025, Diam = $0.850^{-0.08}_{+0.02}$(km), and $\Gamma = 900^{-400}_{+>100}$ J $m^{-2}$ $K^{-1}$ $s^{-0.5}$, surface roughness fraction 0.5; phase curve fitting yields H=19.05 mag using C-taxonomy's G1,G2 slope parameters [5]. If $A=0.021^{+0.005}_{-0.001}$, the geometric albedo is $pv=0.058^{+0.14}_{-0.02}$ so $D=0.850^{-0.08}_{+0.02}$(km).

**Interpretation:** 2010 GY6's Bond albedo (A~2.5%), thermal inertia (Γ >400) and geometric albedo pv~0.06 are similar to 1999 JU3, so by inference 2010 GY6 is C-taxonomy [6], also consistent with its phase curve. Modeling thermal inertia of NEA surfaces in terms of the spacing between surface regolith grains implies a grain size of >~20 mm for Γ ≈1000 J $m^{-2}$ $K^{-1}$ $s^{-0.5}$ [7], which is reminiscent of the 'gravelly' surface of Itokawa [8]. ATPM modeling of other low pv and high eta NEAs in the WISE data, akin to 2010 GY6, also may reveal albedos nearer 0.05 and thermal inertias nearer 1000 [SI units].

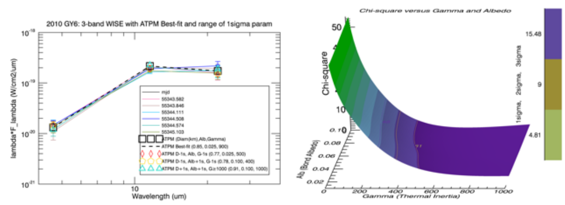

**Figure 1.** (*Left*) 2010 GY6 ATPM model fits to WISE. (*Right*) ATPM Chi-square surface for correlated parameters {Γ, A}, with 1 σ contour Γ=500 to >1000 [SI units] and A=0.025, labeled 4.81 or '.81' at the left boundary of dark purple.

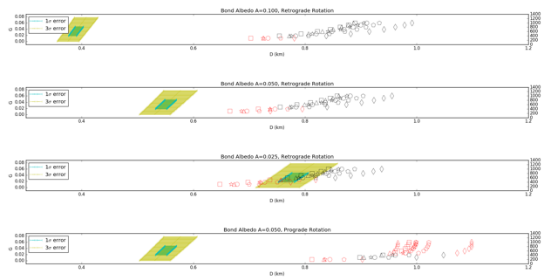

**Figure 2.** Best diameter constraints for ATPM and H are $D=0.850^{-0.08}_{+0.02}$(km), shown in the third panel (Bond A=0.025) where the green-yellow parallelogram overlaps with the ATPM diameters; G (left y-axis) and Γ (right y-axis).

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**References:**

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