Download and read the article "Asteroid 1950 DA's Encounter with Earth in 2880: Physical Limits of Collision Probability Prediction" from the Astro 301 website.

0) Determine V_{esc} from the surface of the Earth and V_{circ} for the orbit of the Earth.

1) Assume that 1950 DA is a spherical rock ($\rho_i = 3\ g/cm^3$). Calculate the total mass of the asteroid.

2) Determine the maximum orbital velocity of 1950 DA.

3) Determine the minimum orbital velocity of 1950 DA.

4) Determine the orbital velocity of 1950 DA at 1 AU.

5) If 1950 DA hit the Earth, determine the impact speed. Include the gravitation effect of the Earth. Assume that the encounter is prograde and in-line with the Earth's orbit.

6) Determine the total energy delivered to the Earth's surface by the impact of 1950 DA.

7) Express the total energy in tons of TNT (1 ton TNT $= 4.18 \times 10^9 J$).

8) Based on laboratory experiments, Schmidt and Housen (1987 *Int. J. Impact Eng.* **5** 543-560) have derived an expression for the diameter of simple impact craters. Use this to determine the size of the resulting crater from 1950 DA.

$$D = 1.1 \left(\frac{m_i}{\rho_i}\right)^{0.26} g^{-0.22} v_i^{0.44} \left(\frac{\rho_i}{\rho_t}\right)^{0.073} \text{[cm]}$$

Note: everything is in cgs units (you will have to convert your answers from above). m_i = mass of impactor, ρ_i = density of impactor, g = surface gravity of Earth (GM/r^2), v_i = impact velocity, ρ_t = density of target (assume Earth $\rho_t = 5$ g/cm^3).

9) From how deep is material evacuated by the impact of 1950 DA?

10-15) Answer questions 4-9 assuming the the orbit of 1950 DA is retrograde.

Please show all your work (including units) in as complete, concise, neat, and organized a manner as possible.

Due: Thur May 9 in class (−2% for every hour late)