Pluto: The Twilight World

If you want to explore what the lighting conditions are where you live that mimic Pluto's noontime sunshine, visit NASA's *PlutoTime* website at

http://solarsystem.nasa.gov/plutotime/

Just input your location and the program will predict at what time you should go outside and see what your world looks like with Pluto's illumination!

The luminous energy of our sun is so great that even from the distance of Pluto, 7.5 billion kilometers, it is still bright enough to cast shadows!

The orbit of Pluto is not a perfect circle but an ellipse. This means that instead of having a constant distance to the sun, Pluto's distance changes from 7.3 billion kilometers to 4.4 billion kilometers. For part of its orbit, it is actually closer to the sun than Neptune (4.7 billion km)!

The brightness of our sun depends on the planet's distance according to the Inverse-Square Law which states that, as you double a planet's distance from the sun, the sun's brightness diminishes by a factor of $1/2^2 = 1/4$. If a planet is 40 times farther away from the sun than our Earth, sunlight will be $1/40^2 = 1/1600$ times dimmer.

This is a big problem for spacecraft powered by solar panels. It means that to create the same amount of electricity near Pluto where sunlight is 1600 times dimmer, you need solar panels that cover 1600 times as much area! That makes them very heavy, and this is why spacecraft use nuclear power (called Radioisotope Thermoelectric Generators or RTGs) instead of solar power.

Things to think about: The distance from Earth to the sun is 150 million km. From the closest and farthest distances to Pluto from the sun, by what factors is sunlight dimmer on the surface of Pluto during each of these times? If the solar panel on your roof measures 10 meter^2 to generate 2000 watts and costs $6000, how big would the same system be near Pluto to generate the same amount of power?