Extra Topic: How far out do long period comets go?

You've read about the Oort cloud, and about how the orbits of some objects within it are perturbed by gravity into ellipses that pass close to the sun at one end. Short period comets like Comet Halley have their orbits mostly within the solar system, but what about long period comets? A long period comet takes a long time to go once round in its orbit: maybe1,000, or 10,000 or 20,000, or even a million years. How long do you think their orbits are from end to end? Longer than the solar system? Further across than the Oort Cloud? As long as our galaxy the Milky Way?

Here's a way to figure this out using what you know from reading the Comet's Tale. Scientists sometimes make some assumptions to simplify their work. Look for the assumptions here. Solve each part, and in the end you should have the answer to "how long is a long period comet's orbit?"

Look for underlined words in the Comet's Tale glossary.

a) 1 AU is about 500 light seconds. The Oort Cloud is about 100,000 (one hundred thousand) AU from one side to the other. How long would it take a light ray to travel from one side of the Oort cloud to the other? b) A certain long period comet has a period of 20,000 (twenty thousand) years, and travels in a very flat elliptical orbit.

Simplify: suppose the orbit is completely flat, as if the comet were traveling on a straight line from one end of its orbit to the other in half the period.

b) A certain long period comet has a period of 20,000 (twenty thousand) years, and travels in a very flat elliptical orbit.

Simplify: suppose the orbit is completely flat, as if the comet were traveling on a straight line from one end of its orbit to the other in half the period.

One year is 31,536,000 seconds.
Simplify: suppose 30,000,000 (30 million) seconds is close enough to give you a good estimate.

How many seconds does it take the comet to travel the length of its orbit? Compare this to the time it takes light to cross the Oort Cloud.

c) If the comet's average speed is one six thousandth (1/6000) the speed of light, about how long is the comet's orbit, in AU? [hint: First, figure out how many AU the comet would go if it traveled at light speed. At the actual speed, it will cover only 1/6000 of this distance, so divide by 6000.]

Answers: a) 100,000 AU × 500 seconds/AU = 50,000,000 or 50 million seconds; b) 10,000 years × 30,000,000 sec/year = 300,000,000,000 or 300 billion seconds; c) At light speed it would cover 600,000,000 AU or 600 million AU in 300 billion seconds. Divide by 6000 to get 100,000 AU: just about the diameter of the Oort cloud. Many orbit shapes are possible, and depending on how close the comet comes to the sun at perihelion, the orbit might (or might not) extend far beyond the average radius of the Oort cloud. This is just a rough estimate for a comet with a certain (hypothetical) period, but it gives us an idea of the lengths of orbits for very long period comets.