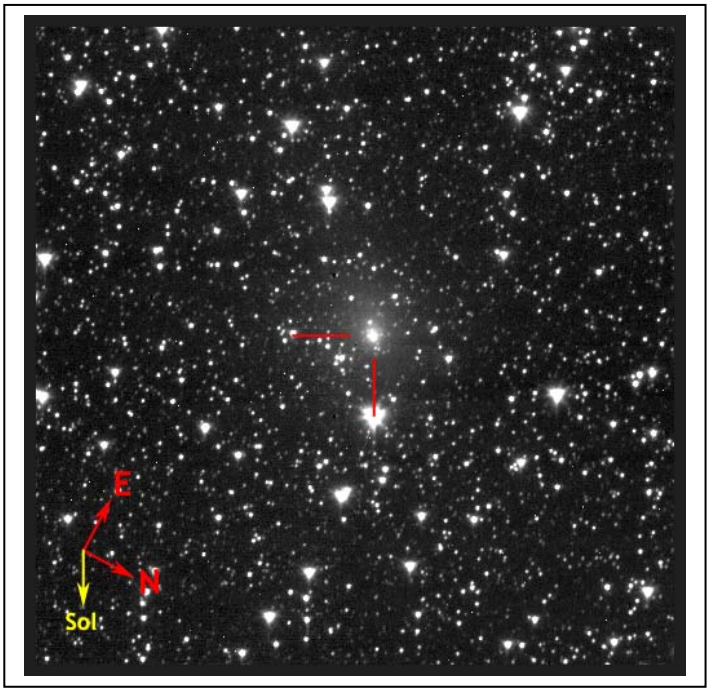

This image was taken by the Deep Impact spacecraft on September 20 as it approaches Comet Hartley 2 from a distance of 46 million kilometers.

On November 4, the spacecraft will approach to within 700 kilometers of the surface of the comet.

The image area is 0.29 degrees on a side, and the nucleus of the comet is about 1 kilometer in diameter. The comet can be seen as the fuzzy spot near the center.

Whenever you look at a distant object, you see the object's angular size not its actual physical size. There is a simple formula that relates the actual size and distance to an object, to its apparent angular size:

$$Tan\left(\frac{\theta}{2}\right) = \frac{d}{2R}$$

where d is the object's width or diameter in kilometers, and R is its distance from the obeserver in kilometers. For example, a DVD disk (d=12 cm) held at arms-length (R=24 cm) will subtend an angle of θ = 28 degrees.

Problem 1 - Deep Impact will pass to within 700 km of the nucleus. How big will the comet nucleus appear to the Deep Impact spacecraft if its diameter is 1 kilometer?

Problem 2 - The Deep Impact High-Resolution Imager (HRI) has a format of 1024 x 1024 pixels and a field of view of 0.118 degrees. A single pixel sees an angular field of 0.118 deg/1024 pix = 0.000115 degrees. At a distance of 700 km, what linear distance will a pixel resolution of 0.000115 degrees represent?

Problem 3 - How many pixels across will the comet nucleus appear in the image taken at closest approach with the HRI?

Problem 1 - Deep Impact will pass to within 700 km of the nucleus. How big will the comet nucleus appear to the Deep Impact spacecraft if its diameter is 1 kilometer?

Answer: d = 1 kilometer, and R = 700 km, so solving for θ in the formula we have

$Tan(\theta / 2) = \frac{d}{2R}$ so Tan (θ/2) = 1 kilometer / (2 x 700), and so **θ = 0.08 degrees**

Problem 2 - The Deep Impact High-Resolution Imager (HRI) has a format of 1024 x 1024 pixels and a field of view of 0.118 degrees. A single pixel sees an angular field of 0.118 deg/1024 pix = 0.000115 degrees. At a distance of 700 km, what linear distance will a pixel resolution of 0.000115 degrees represent?

Answer: Tan(0.000115) = L/700 km so
L = 700 Tan(0.000115) km **L = 1.4 meters/pixel**.

Problem 3 - How many pixels across will the comet nucleus appear in the image taken at closest approach with the HRI?

Answer: The resolution of the imager is 1.4 meters/pixel. The diameter of the nucleus is believed to be about the 1 kilometer, so the comet nucleus will subtend about 1,000 meters x (1 pixel/1.4 meters) = **714 pixels**. Below is an image taken by the Lunar Reconnaissance Orbiter at a resolution of 1 meter showing the Apollo 11 landing area on the moon. A similar-resolution image will be possible for Comet Hartley 2 using HRI!