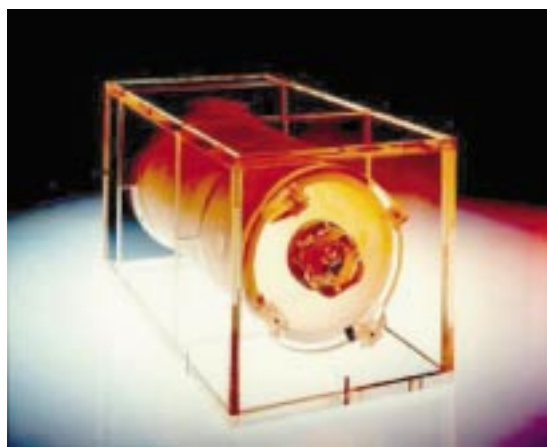


## Following The Guide Star

While the stars in the sky may appear to be fixed points of light, they are anything but still objects. They wander around the sky relative to other objects, and their light diffracts, or scatters, as it passes through our atmosphere. In order for Gravity Probe B to work at the level of precision necessary, both of this wandering motion and diffraction had to be monitored.

The motion of the star around the sky is monitored by a sophisticated system of radio telescopes operating in conjunction with each other. Telescopes from New Mexico to



Australia to Germany focus on our guide star (IM Pegasi) and map its movements as if one telescope the size of the Earth was focused on the star. The motions of the guide star are compared to a distant quasar, an exceptionally still object in the sky.

The second issue -- finding the exact center of a star whose light is widely diffracted -- is solved by using a sophisticated optical telescope only 14 inches long. Diffraction spreads the star image to a diameter of 1,400 milliarc-seconds, corresponding to a focused image 0.001 inch

across. Locating the star to 0.1 milliarc-second means finding the image's optical center to 0.1 millionth of an inch -- a formidable task.

GP-B accomplishes this task by focusing the starlight in the "lightbox" at the telescope's front end, and passing it through a beam-splitter ( a half-silvered mirror) which forms two separate images. Each image then falls on a roof-prism (a prism shaped like a peaked rooftop) which slices the image into two half-disks. The light signals of each half-disk are converted to electrical signals and then re-joined for comparison. If the half-disks do not match up exactly, the telescope adjusts its aim to focus on the center of the guide star and perfectly align the half-disk images.