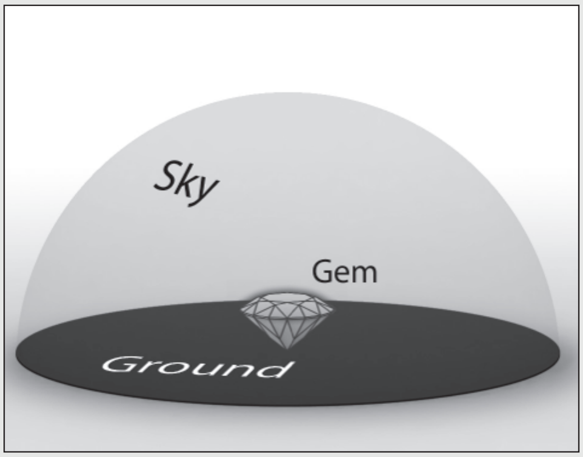

Figure 15-6 The optical environment of a gemstone includes both the ground and sky.

Here's a short explanation of how it works, adapted directly from Robert Strickland's excellent documentation at www.gemcad.com/gemray.htm. Imagine the gemstone sitting face-up below the dome of a planetarium. The floor, or "ground" is completely black, in the sense that no light can enter the rear of the stone, and any rays that either miss the gem or exit the pavilion are lost. The three lighting models correspond to three types of illumination projected onto the dome above the gem, in other words, three different "skies" (see Figure 15-7).

The Random model contains a mottled blend of bright and dark areas and corresponds to the mixed lighting environment that you are most likely to encounter when viewing a gem. As a result, the Random ray trace (Figure 15-5) is the most "realistic," allowing you to see subtle reflectance patterns as adjacent facets pick out different points on the sky. The COS or cosine sky model is bright at the zenith, darkening steadily to black at the horizon. Finally, the ISO or isotropic sky model has uniform illumination, like a very cloudy day.

Figure 15-7 The Random, Cosine, and Isotropic lighting models.

The Random ray trace is obviously helpful in comparing and optimizing gemstone designs, but what is the use of the COS and ISO models?

Great question. Two great answers.

The first answer is straightforward. The ISO ray trace lets you make an objective measure of how much light the gem sends toward the viewer from the environment. Yes, this is the famous "ISO Brightness" quoted in many gemstone cutting diagrams (see Chapter 5.1.1). Uniform illumination is essential to this calculation, since, for example, a gemstone could get unlucky with the Random lighting model and show the viewer a lot of dark patches on the sky. Tipping the gem or moving the sky around slightly would produce a significantly different light return.