Answer #351

The answer is (c); the laser beam will wiggle. This can be shown by viewing the video below. Again all footage was taken carefully using a tripod planted firmly to the ground; no shaking was caused by the camera.

Video of laser beam which shows the convection currents at first and then pans left to zoom in onto the "twinkling star." Alternate high-res version.

As the hot plate heats the air above it, the density of the air above the plate is altered from that of the air around it. As the laser beam enters these pockets of slightly different densities, the light refracts as it enters and again as it exits, as light always does when encountering a change in medium. Each refraction will cause the image of the laser beam to translated slightly, jostled side-to-side and up-and-down, according to Snell's Law.

One might then conclude that the net effect of these refractions would result in a stationary image on the wall; the side-to-side refractions "canceling themselves out" perhaps. But this is incorrect! Since the very nature of the hot air currents is *random* one cannot predict with certainty which direction the beam will be pushed to during each refraction. The end result is the image wiggles around in all directions, twinkling as it were, but in the long run--in the average--remains in the same position.

This is an explanation for why stars twinkle. The light from the stars, viewed as point sources from our humble perspective, are refracted this way and that as they travel through the Earth's atmosphere. When they reach our eyes, they appear to move slightly from side to side, shining in the night's sky due to the refractions caused in the atmosphere. If you haven't been up on your stargazing, you might have also seen the same effect from the hot air rising from a barbecue.

But as we know, celestial bodies aren't points! Suppose we could somehow travel closer to see the celestial object not as a point, but more like a sphere. We wouldn't want to get too close to a Sun, so imagine the object as the Moon. What might happen then? For the answer (or rather the question) head on over to Question 352.

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For questions and comments regarding the *Question of the Week* contact Dr. Richard E. Berg by e-mail or using phone number or regular mail address given on the Lecture-Demonstration Home Page.