

Gravitational Waves Really Are Shifty

In "LIGO and the Detection of Gravitational Waves" (PHYSICS TODAY, October 1999, page 44), Barry Barish and Rainer Weiss write: "Because gravitational waves are not scattered as they propagate between source and observer, they should provide information about what's happening in the innermost and densest regions of the astrophysical source." If the authors are referring to the general theory of relativity, they must have in mind a linearized approximation to the full nonlinear theory. Even in the shortwave approximation, Albert Einstein's gravitational waves undergo gravitational redshift and deflection of the direction of propagation, just as light does. They actually backscatter off the background curvature. In Einstein's theory, shortwave gravitational waves passing through the Solar System experience the same redshift and deflection as light does.

ASHER KLATCHKO
(klatchko@reed.edu)
Etec Systems, Inc
Hillsboro, Oregon

BARISH AND WEISS REPLY: Asher Klatchko is right; we were a bit sloppy. The gravitational waves should follow the null geodesics of the space between our detector and the source. So, as he correctly points out, there are likely to be distortions of the gravitational wavefronts as the waves pass through the spatially varying gravitational potentials on their way to the observer. Gravitational lensing should take place for gravitational waves much as it does for electromagnetic ones. In the article, however, our intention was to point out that the phenomenon of absorption and reemission—which leads to an optical depth and thereby makes it impossible to look into a strong source for many electromagnetic sources—is unlikely to occur in gravitational ones. Gravitational waves could prove to be the most penetrating waves in nature; that is in part their charm but also their curse, since it makes them so difficult to detect.

BARRY BARISH
(barish@ligo.caltech.edu)

California Institute of Technology
Pasadena, California

RAINER WEISS
(weiss@ligo.mit.edu)
Massachusetts Institute of Technology
Cambridge, Massachusetts ■

Lake Shore Magnetics



**ISO 9001
Certified**

**APS Booth
500, 502, 504**



Lake Shore manufactures magnetic measurement instrumentation and systems for the characterization of magnetic and magneto-transport materials.

Lake Shore's magnetic measurement products include benchtop and hand-held gaussmeters, a precision integrating fluxmeter, Hall generators, Hall probes, and coils.

Lake Shore system products include vibrating sample magnetometers, Hall measurement systems, hysteresisgraphs, electromagnets, and magnet power supplies.

**Innovative Instrumentation for
Magnetic Measurements**

www.lakeshore.com

LakeShore

Lake Shore Cryotronics, Inc. 575 McCorkle Blvd. Westerville, Ohio 43082
Phone: (614) 891-2244 Fax: (614) 618-1600 e-mail: marketing@lakeshore.com