in closed timelike curves, and 3) prediction of the future through application of the Copernican principle ("We are not special") to our relationship to the universe's current conditions.

A second theme, describing work in cosmology that Gott carried out with Li-Xin Li, is an interesting take on the problem of the universe's initial conditions, although their scenario is hard to evaluate without better knowledge of the early universe than we have. A third section describes an attempt to estimate the likely future duration of current conditions by presuming that we are observing them at a typical moment—neither in the first nor the last 2.5% of their lifetimes. As an example, the fact that the Internet is 33 years old leads us to predict, with 95% confidence, that it will last between another 10 months and another 1320 years. Such a level of precision is of little help to investors and planners; the method does, however, serve as a reality check against the temptation to extrapolate our current situation naively forward in time.

The test of a popular-level book is whether it will excite and educate the lay reader. The ideas discussed in this book are undoubtedly exciting and should appeal to a wide audience. The educational mission is less obviously fulfilled; Gott puts an effort into careful exposition, but he spends a great deal of time on issues unlikely to be of great public interest, such as the nature of various quantum vacuum states. I worry also that the initial explanation of the nature of space-time in special and general relativity was given short shrift; if readers do not fully follow the way time works in well-established contexts, it would be hard for them to understand the more exotic space-times.

Meanwhile, the question of what role closed timelike curves might play in the real universe remains embarrassingly unclear. Very likely it will remain so until we achieve a fuller understanding of quantum gravity—or are visited by tourists from the future.

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Tsunami: The Underrated Hazard

Edward Bryant
Cambridge U. Press, New York, 2001. $74.95, $27.95 paper (320 pp.). ISBN 0-521-77244-3, ISBN 0-521-77599-X paper

In *Tsunami*, Edward Bryant illustrates the threat of such phenomena with a set of mock docudramas based on five historical tsunami events. He then proceeds to the science underlying the threat.

The book's mechanics are good; list of symbols, formulas, tables, figures, illustrations, list of references, and index are well presented. References are cited as a subheading in each named section of two or three pages. This does make for easier reading though it may blur the sources.

Bryant is at his best in the fairly extensive sections involving geomorphology, which is clearly his specialty. The features of numerous ocean coastal areas resulting from both tsunami and storm waves are well developed and interesting. Of necessity, these analyses are based on major geological events and their effects (which he refers to as "mega tsunami") and most are prehistoric. Since even many of the more recent, documented, deadliest tsunamis (Lisbon, Krakatau, Sanriku) occurred more than a hundred years ago, tsunamis may be underrated only by those in areas that do not experience them. Tsunamis are an important public safety problem, but Bryant

does not make this clear in the text.

The book contains full tabular and graphical coverage of tsunami causes, source areas, damage, and deaths. But, there is little comparison of the hazards and risks relative to hurricanes, which affect many of the same areas. Bryant lists almost a half million tsunami deaths in the Pacific in the last 2000 years. T. S. Murty, in his definitive *Seismic Sea Waves* (Canadian Fisheries and Marine Serivce, Ottawa, 1977), finds the same number killed by storm surges (usually from cyclones) from 1970 to 1979.

Bryant's book is broad in scope, chronologically and technically. Its readability lies between Murty's *Seismic Sea Waves* and Walter Dudley's more popular *Tsunami*! (U. of Hawaii Press, Honolulu, 1988). Unfortunately, important sections lack the validity of either of those works.

The major problem of this book—a real handicap in a reference or textbook—is the number of inaccuracies. Some will be noted by any careful reader as self-contradictory from one page to another; others will grate on someone knowledgeable in the field. On page 17, an earthquake with a surface magnitude greater than 8.2 is said to "affect the entire Pacific Ocean once every 25 years." Earthquakes and tsunamis of course do not occur with regularity, and their time distribution does not fit a recognizable pattern. The 1975 earthquake and local tsunami on the island of Hawaii did not kill 19 people, as Bryant states but just two—bad enough if you know their friends, but why inflate it?

Less important but no less bothersome are some conventions such as using "tsunami" as plural. True, Japanese does not use plurals. But "tsunami" has become an international word, and the "s" is added to pluralize it, even by the Japanese, as can be seen in Japanese papers in the referenced *Science of Tsunami Hazards*. Repeated references to the 1946 Aleutian tsunami as "Alaskan" can be misleading; other authors separate these zones. Such errors crop up repeatedly.

The section on the Pacific Tsunami Warning Center (PTWC) mentions the center's flaws in the first paragraph. But the flaws in his review of the system are more noticeable than problems in the system itself. He confuses the International Tsunami Information Center (ITIC) with PTWC. The ITIC is an office; it does not issue warnings or perform some of the other services he lists. I know the present director of the warning center as well as the two prior directors. I also serve on a committee that reviews the warning operation. It is doing very well.

Some of the problems with this book seem to arise from the author's extensive use of Internet information instead of original sources. Scanning his reference list reveals some unfortunate omissions: Doak Cox, who has published extensively in this field for 50 years; Gaylord Miller, with 20 years of publications as director of the Joint Tsunami Research Effort. Although Murty is listed, he is seldom cited.

On the last page we learn that this volume is a "textbook" whose purpose "is to make readers aware that tsunami are ubiquitous along our shorelines." It probably does so.

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