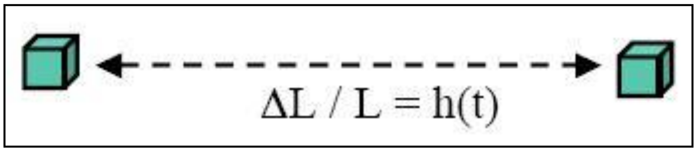

B. Schutz, Mathematical and Physical Perspectives on Gravitational Radiation, 2 August 2002

50 years of the Cauchy problem in General Relativity. Electronic proceedings of the Cargèse Summer School on mathematical general relativity and global properties of solutions of Einstein's equations. July 29 - August 10, 2002, Cargèse, Corsica, France

http://fanfreluche.math.univ-tours.fr
http://fanfreluche.math.univ-tours.fr/lecturer/Schutz.htm
http://fanfreluche.math.univ-tours.fr///slide/semaine1/jour4/schutz/GravRad.pdf

Snapshot at 00:04:20 from video.wmv (156 MB)

Excerpts from Schutz' expose GravRad.pdf:

p. 1: "No universal definition of gravitational radiation: cannot invariantly define local GW content of an arbitrary solution.

"Worse than similar situation in EM, because of *equivalence principle* and *nonlinearity*.

"Equivalence principle implies no *local* definition possible in any situation: must attempt "regional" definition in regions at least as large as a wave-length. Any definition must be either an *approximation* or a *limit*. Definitions will generally have to cope with gauge problems.

"Nonlinearity compounds the difficulty of formulating approximations.

"Generally, expect to be able to define radiation if the wavelength is shorter than other relevant lengths and if there is a stationary "background" metric. Helps if there is a preferred frame and/or gauge."

p. 9: "The reason that an invariant energy is possible at infinity is that there is a *preferred observer*, who in fact defines infinity, and who is flat (asymptotically). Moreover, this observer is infinitely large, so that grad is short wavelength and can be localized. This is the one place where we can define a universally agreed **energy flux** (emphasis mine – D.C.) carried by gravitational waves.

From a physical point of view, null infinity is *very* far away. A measure of how far one has to get from a source to be "near" infinity is to consider the divergence of the true curved-space light-cones from their flat-space approximations, which wind up at spatial infinity. Martin Walker first pointed out the enormous distance required to separate these cones by just one wavelength or period of the gravitational wave, a reasonable length scale for a radiation problem. The separation is something like $2M \ln(r/M)$. Setting this equal to λ for the Hulse-Taylor pulsar, we solve for r and find that it is a bit more than 10^{10^9} km! This is unimaginably bigger than the observable Universe, whose radius is a mere 10^{23} km.

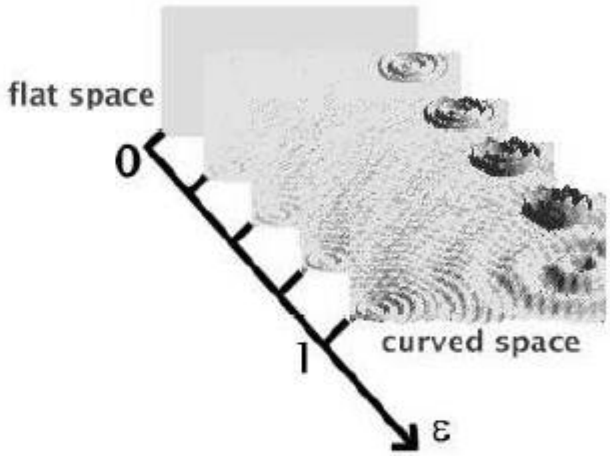

Fig. 2, p. 4 in GravRad.pdf

NOTE

"People sometimes make errors," said Edward Weiler, NASA's Associate Administrator for Space Science, on September 30, 1999, after the crash of Mars Polar Lander spacecraft. One of the teams used English units (e.g., inches, feet and pounds), while the other used metric units.

Perhaps something similar happened also with the European Space Agency. The only difference, however, is that all people from LIGO "scientific" collaboration knew very well the insoluble problems of GW "astronomy" and tried to conceal their dirty little secrets for **decades**.

For example, regarding "the one place where we can define a universally agreed **energy flux** (emphasis mine – D.C.) carried by gravitational waves" (see the excerpt from B. Schutz on p. 9 above), notice that the author "forgot" to mention that he and the rest of experts from LIGO "scientific" collaboration must (**i**) install **GW mirrors** at **exactly** (not "asymptotically") null infinity (see above) and also **exactly** at spacelike infinity, and (**ii**) **avoid** all nonlinear interactions [Ref. 1], which "may result in dispersion of the gravitational waves, their amplification, etc." [Ref. 2].

Forget it.

D. Chakalov
December 18, 2015
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[Ref. 1] Charles W. Misner et al., *Gravitation*, W H Freeman & Co, 1973, p. 968:

> All nonlinear interactions of the wave with itself are neglected in this first-order propagation equation. Absent is the mechanism for waves to scatter off each other and off the background curvature that they themselves produce. Also absent are any hints of a change in shape of pulse due to self-interaction as a pulse of waves propagates. There are no signs of the gravitational collapse that one knows must occur when a mass-energy m of gravitational waves gets compressed into a region of size $\lesssim m$. To see all these effects, one must turn to corrections of second order in $\mathscr{A}$ and higher [e.g., equations (35.59c) and (35.60)].

[Ref. 2] L. P. Grishchuk and A. G. Polnarev, Gravitational Waves and Their Interaction with Matter and Fields, in *General Relativity and Gravitation*, ed. by Alan Held, Vol. 2, Ch. 10, Plenum, New York, 1980, p. 427:

> Due to the nonlinearity of gravitation a weak gravitational wave can **interact** (emphasis mine – D.C.) with a smooth background gravitational field. This interaction may result in dispersion of the gravitational waves, their amplification, etc.