STANDING WAVES IN GENERAL RELATIVITY

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In the mid-thirties, Albert Einstein and Nathan Rosen undertook an attempt to find exact wave solutions of equations of Einstein's theory of gravity [1]. They found physically satisfying cylindrical waves.

Almost two decades ago Hans Stephani formulated a question [2]: *Are there standing gravitational wave solutions of vacuum Einstein's equations?* Stephani suggested to look for exact solutions such that [2]: (i) the constitutive parts of the metric functions should depend on the timelike coordinate only through a periodic factor, and they should also depend on spacelike coordinates; (ii) the time average of some of the metric functions should vanish; in particular, the analogue of the Poynting vector (if there is any) should be divergencefree and the time average of the spatial components should be zero.

These criteria may raise ambiguities. We propose a covariant definition of standing gravitational wave which can solve these issues.

[1] A. Einstein and N. Rosen: *On gravitational waves*. Journal of the Franklin Institute, 223:43-54, 1937.
[2] H. Stephani: *Some remarks on standing gravitational waves*. General Relativity and Gravitation, 35:467, 2003.