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Erratum: Decay of solutions of the Teukolsky equation for higher spin in the Schwarzschild geometry

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It has recently been brought to our attention that, as noticed in a footnote in [1], the form of the energy density for gravitational waves given in Eqns (1.4) and (A.1) is incorrect (because the Bel-Robinson tensor of the Schwarzschild geometry is not divergence-free with respect to the perturbed metric). This error can be corrected in a straightforward way as follows: Given a solution Φ of the Teukolsky equation for $s = 2$, all the components of the Weyl tensor can be computed using the Teukolsky-Starobinsky identities (see [2]). The corresponding metric perturbations can be obtained by integration (for explicit formulas see [5]). Expanding the resulting metric perturbations in spherical harmonics and choosing a specific gauge (as worked out in detail in [6, 7]), one obtains solutions of the well-known Regge-Wheeler and Zerilli equations. For each such mode solution, the corresponding energy of the gravitational wave is given as the spatial integral over a definite energy density (this energy density is given in a convenient form in [4, Eqn (1.10)]). Taking the sum of all modes, one obtains a corresponding formula for the energy of the gravitational wave described by Φ. Clearly, the resulting expressions for the energy density are quite involved, but, exactly as explained in the paragraph after Eqn (1.4), the arguments in our paper do not involve the specific form of the energy density.

We finally remark that the recent methods in [3] do not require any conservation laws. Specializing these methods to the Schwarzschild geometry, it is no longer necessary to refer to a conserved energy for gravitational waves.

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