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Fundamental solutions for the wave operator on static Lorentzian manifolds with timelike boundary

We consider the wave operator on static, Lorentzian manifolds with timelike boundary and we discuss the existence of advanced and retarded fundamental solutions in terms of boundary conditions. By means of spectral calculus we answer this question by studying the self-adjoint extensions of an associated elliptic operator on a Riemannian manifold with boundary (M, g). Assuming that (M, g) is of bounded geometry, this problem can be tackled within the framework of boundary triples. These consists of the assignment of two surjective, trace operators from the domain of the adjoint of the elliptic operator into an auxiliary Hilbert space h. Self adjoint extensions of the underlying elliptic operator are known in one-to-one correspondence with self-adjoint operators Θ on h. For a natural choice of boundary triple, each Θ can be interpreted as the assignment of a boundary condition for the original wave operator. We prove that for each such Θ, it corresponds a unique advanced and retarded fundamental solution. In addition we prove that these share the same structural property of the counterparts associated to the wave operator on a globally hyperbolic spacetime.