Subtleties of Different Approaches to Electromagnetic Analogue Space-Times

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While entering a prosperous stage of experimental accessibility, the field of analogue space-times still has under-appreciated features. One such feature shall be demonstrated in this talk: The traditional narrative is to render a second order, hyperbolic partial differential equation of not general relativistic origin (under mild, further assumptions) in a metric formalism, see, for example, [Chr02]. This enables the use of general relativistic notions in a non-general-relativistic context, just as it provides options to mimic metrics (or metric features) known from general relativity in this other physical context. Ironically, one of the earliest examples of an analogue space-time due to Gordon [Gor23] — linking electrodynamics of media with general relativity — is of a different nature: Here, the analogy is formed through the algebraic property that a metric links tangent and co-tangent bundles. If one wants to approach this example in the usual way via differential equations, one has to deal with cumbersome cartographic distortions [FT16]. We will both demonstrate this issue in the context of Hawking radiation, as well as introduce a new, simple analogue model for electrodynamics in media following the traditional 'analytic' approach, that is, through partical differential equations. The work presented in this talk is based on [SV18].

References

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