Hawking radiation and classical tunneling EUGENE TRACY, DMITRIY ZHIGUNOV, William & Mary — "Hawking radiation" is most familiar as a quantum field phenomenon in curved space-times that contain an event horizon. Unruh pointed out that acoustic waves in *classical* fluids with *nonuniform* background flows can exhibit analogous behavior. [1] The "event horizon" in that case consists of the set of spatial points where the flow speed and sound speed are equal. A WKB analysis [2] of the acoustic wave equation reveals that tunneling occurs at the "event horizon," but it is not of the standard type. We have recast the Unruh model into a self-adjoint form using a formulation of linearized MHD due to Brizard [3]. A self-adjoint formulation of the linearized wave equation allows the use of variational methods. These provide a systematic means to derive conservation laws and, after discretization, symplectic integration schemes.

[1] G Volovik, M Novello, and M Visser, *Artificial Black Holes* (World, 2002).
[2] ER Tracy, AN Kaufman, AJ Brizard, and AS Richardson, *Ray Tracing and Beyond: Phase Space Methods in Plasma Wave Theory* (Cambridge, 2014).
[3] AJ Brizard, "Hermitian structure for linearized ideal MHD equations with equilibrium flows," PLA **168** (1992) 357.

Eugene Tracy
William & Mary

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