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Stress-energy Tensor for a Quantized Scalar Field When a Black Hole in Four Dimensions Forms From the Collapse of a Null Shell

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A method will be presented which allows for the numerical computation of the stress-energy tensor for a quantized massless minimally coupled scalar field in the region outside the event horizon of a 4D Schwarzschild black hole that forms from the collapse of a null shell. This method involves taking the difference between the stress-energy tensor for the in state in the collapsing null shell spacetime and that for the Unruh state in Schwarzschild spacetime. The construction of the modes for the in vacuum state and the Unruh state will be discussed. Applying the method, the renormalized stress-energy tensor in the 2D case has been computed numerically and shown to be in agreement with the known analytic solution. In 4D, the presence of an effective potential in the mode equation causes scattering effects that make the the construction of the in modes more complicated. The numerical computation of the in modes in this case will be presented.

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