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Charged quantum fields inside black holes

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The strong cosmic censorship conjecture states that black hole spacetimes cannot be continued beyond their inner horizon due to the divergence of local observables, such as the stress-energy tensor of a classical or quantum scalar field, at that horizon. In the case of a spherically symmetric, charged black hole, numerical and analytical studies indicate, that this conjecture is violated classically, even for charged scalar fields, but that the conjecture can be restored by quantum effects in the real scalar case. Here, we present a study on the behaviour of quantum charged scalar fields in a charged, non-rotating black hole. Apart from an extension of the results for real quantum fields, we focus on the charge current induced by this field. We derive an expression for the renormalized current in the Unruh vacuum. In addition, we demonstrate numerically, that the quantum scalar field can charge, instead of discharge, the black hole near the inner horizon.

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