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Firewalls in General Relativity

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We present spherically symmetric solutions to Einstein's equations, which are equivalent to canonical Schwarzschild and Reissner-Nordstrom black holes on the exterior, but with singular (Planck-density) shells at their respective event and inner horizons. The locally measured mass of the shell and the singularity are much larger than the asymptotic Arnowitt-Deser-Misner mass. The area of the shell is equal to that of the corresponding canonical black hole, but the physical distance from the shell to the singularity is a Planck length, suggesting a natural explanation for the scaling of the black hole entropy with area. The existence of such singular shells enables solutions to the black hole information problem of Schwarzschild black holes and the Cauchy horizon problem of Reissner-Nordstrom black holes. While we cannot rigorously address the formation of these solutions, we suggest plausibility arguments for how "normal" black hole solutions may evolve into such states. We also discuss the stability of these structures.

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