Horizon singularities and energy momentum tensor classification

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Physical black holes are trapped spacetime domains that are bounded by apparent horizon. Geometry in its vicinity can be obtained from two assumptions: curvature scalars at the horizons are finite and they have formed in finite time of a distant observer. One of the consequences is that to obtain real-valued solutions to the Einstein equations, the null energy condition must be violated. Even if curvature scalars on the apparent horizon are finite, this timelike surface is mildly singular. A static observer near the apparent horizon will observe diverging negative energy density. While an infalling observer detects a finite energy density and finite tidal forces, an observer attempting to escape the black hole faces a mild firewall (infinite energy density at the apparent horizon, that, however, results only in a finite integrated value) and divergent tidal forces. The Energy Momentum Tensor content can give us a hint about the nature of matter surrounding the black hole. Its type (and thus the question of how exotic black hole atmosphere is) is subject to ongoing investigations. Consistency of the description requires at least, two-fluid model to describe the matter content.

[1] Pravin K. Dahal, Sebastian Murk and Daniel R. Terno, *AVS Quantum Sci.* **4**, 015606 (2022).