The Hawking energy on the large and small scale

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The Hawking energy is a quasi local energy in General Relativity. The idea is to obtain a measure for the energy contained within a given volume by measuring the bending of light rays across its boundary. We simply regard it as a functional on spherical surfaces.

On the one hand we analyze the behavior of critical surfaces with small area and identify points in the ambient manifold around which they concentrate. Additionally, we present an expansion of the Hawking energy on small spheres. On the other hand we investigate the Hawking energy on asymptotically Schwarzschild manifolds. In particular, we construct a foliation of the outer region of the asymptotically flat end by large critical surfaces. Not only does this allow us to calculate the total energy of the ambient manifold, but it also yields a notion of center of mass.

This work is part of my dissertation and is strongly inspired by the corresponding analysis of the Willmore functional in [1,2,3],

References

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[3] T. Lamm and J. Metzger and F. Schluze, Foliations of asymptotically flat manifolds by surfaces of Willmore type, *Mathematische Annalen* **350** (2011), pp. 1–78.