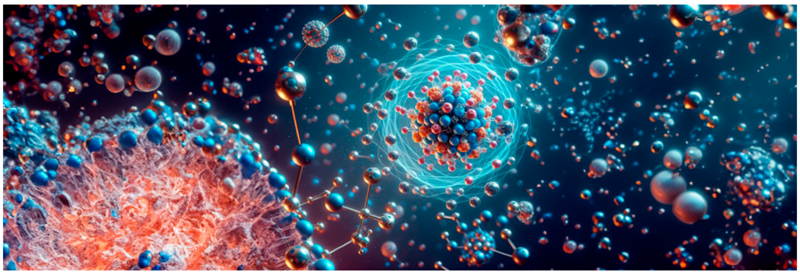

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# Einstein's equation of state

This undergraduate thesis work consists in a deepth study of the Einstein's field equation in general relativity over a thermodynamic perspective. We study the local Minkwoski space-time $(\mathbb{R}\ , \eta_{\mu\nu})$ evoking the usual causal horizon $t^2 = |\vec{x}|^2$ as a thermal wall and space-like events as a thermodynamic system. In that sense, heat $Q$ is naturally the flux of energy across the horizon, temperature $T$ is associated with the thermal distribution of the Unruh effect, and entropy $S$ emerges naturally as the area of the horizon. Then, following the arguments of Jacobson in *Thermodynamics of Spacetime: The Einstein's Equation fo State* (1995) it can be shown that the relation $\delta Q = TdS$ implies $T_{\mu\nu} \propto R_{\mu\nu} + f g_{\mu\nu}$, from where the Einstein's field equation is straighforward. In this thesis we explore quantum field theory in curved space-times, Raychaudhuri's equation, Shannon entropy and laws of black hole mechanics given by Hawking, Carter and Bardeen in order to achieve the deduction above.

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