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Relativistic Bondi-Hoyle Accretion onto a Rotating Black-Hole: Density Gradients

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In this work, we present, for the first time, a numerical study of the Bondi-Hoyle accretion with density gradients in the fully relativistic regime. In this context, we consider accretion onto a Kerr Black Hole (BH) of a supersonic ideal gas, which has density gradients perpendicular to the relative motion. We show that, unlike in the Newtonian case, all the studied cases, especially those with density gradient, approach a stationary flow pattern. To illustrate that the system reaches steady state we calculate the mass and angular momentum accretion rates on a spherical surface located almost at the event horizon. In the particular case of $M = 1$ and BH spin $a = 0.5$, we observe a disk-like configuration surrounding the BH. Finally, we present the gas morphology and some of its properties.

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