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On a new Einstein field equation with possible application to black hole cosmology

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Here we consider the hydrodynamic form of the momentum equation associated with the Gross-Pitaevskii equation (GPE) in general Riemannian metric [1] and show that, under particular steady state conditions, a new Einstein field equation can be determined in presence of negative scalar curvature. Since GPE vortex defects in Bose-Einstein condensates are useful, analogue models in cosmology, a relativistic form of GPE is also considered on generic metric, in order to show connection with models of analogue gravity, thus providing physical background for mathematical modeling, and rigorous grounds for future investigations of black hole dynamics, Hawking radiation and curvature effects on physics [3].

This is joint work with Renzo L. Ricca (UniMiB).

[1] Roitberg, A. & Ricca, R.L. (2021) *J. Phys. A: Math. Theor.* **54**, 315201.
[2] Roitberg, A. (2021) *J. Phys.: Conf. Ser.* **1730**, 012017.
[3] Barceló, C., Liberati, S. & Visser, M. (2001) *Class. Quantum Grav.* **18**, 1137.

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