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Hawking radiation in an exactly solvable BEC model

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In the past years the experimental detection of the Hawking radiation in Bose-Einstein condensates (BECs) has taken a remarkable leap forward (J. Steinhauer, *Nature Physics* **12**, 2016 and J.R.M. De Nova et al., *Nature* **569**, 2019). Exploiting the particular features of hard core bosons in 1D, i.e. the Tonks-Girardeau gas (S. Giovanazzi, *Phys. Rev. Lett.* **94**, 2005), we are able to obtain the exact solution of a BEC flowing against an obstacle and we examine it in the framework of sonic black holes; in this limit we recover Hawking result without making use of the gravitational analogy and we find that a precise correspondence between the emission of phonons in the upstream region and the Hawking-like mechanism requires additional conditions to be met (A. Parola, M. Tettamanti and S. L. Cacciatori *EPL* **119**, 2017). Moreover, we investigate the correlations between the Hawking quanta and the in-falling partner and we describe the model also from a semiclassical perspective (M. Tettamanti, S. L. Cacciatori and A. Parola, *Phys. Rev. D* **99**, 2019).

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