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Erratum

Erratum to: Thermodynamic implications of the gravitationally induced particle creation scenario

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We would like to rectify an error regarding the validity of the first law of thermodynamics (FLT) on the apparent horizon of a spatially flat Friedmann–Lemaitre–Robertson–Walker (FLRW) universe for the gravitationally induced particle creation scenario with constant specific entropy and an arbitrary particle creation rate Γ (see Sect. 3.1 of original article). Please note that the subsequent calculations in the original article are not affected in any way by this unfortunate error.

Now, in Eq. (14), the differential dE_A of the amount of energy crossing the apparent horizon will be

$$-\mathrm{d}E_A = \frac{1}{2}R_A^3(\rho + p + \Pi)H\mathrm{d}t = \frac{3\gamma}{2}\left(1 - \frac{\Gamma}{3H}\right)\mathrm{d}t.$$

and NOT

$$-\mathrm{d}E_A = \frac{1}{2}R_A^3(\rho + p)H\mathrm{d}t = \frac{3\gamma}{2}\mathrm{d}t,$$

as we had previously calculated. The FLT, which was not true in general in our original work, now clearly holds and this puts our model on a stronger footing since the FLT, being an energy conservation law, should always hold good in a perfect thermodynamic system.

Thus, in this erratum, we clarify that the FLT is always true on the apparent horizon of a spatially flat FLRW universe for the gravitationally induced particle creation scenario with constant specific entropy and an arbitrary particle creation rate.

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