Photons and Specific Entropy

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Roger Penrose (1981) defines specific entropy as the ratio of photons per baryon. For example, the universe currently has an average of 10^8 photons per baryon while a black hole has at least 10^20 photons per baryon. According to this, when galaxies eventually collapse into black holes, then the universe would average at least 10^20 photons per baryon.

Is this correct or incorrect?

And if this is correct, what generates the roughly 10^20 photons per baryon (assuming that that number of baryons does not change)?

And does this imply that some type of particle or energy is converted into photons, which evidently results in what we call an increase in specific entropy?

And if all possible, please keep these answers understandible to a non−physicist:)

Penrose, R. [1981]: "Time−Asymmetry and Quantum Gravity", in C.J. Isham and R. Penrose and D.W. Sciama (eds) Quantum Gravity 2: A Second Oxford Symposium, Oxford: Clarendon Press, pp. 245−72.

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