Do ultra high energy cosmic rays form a part of dark matter?

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Abstract

It is considered whether or not recent ultra high energy cosmic ray observations hint at the possibility that the unaccounted for higher energy rays have become dark matter. Key words: entropy, cosmic ray, dark matter.

With respect to the Schwarzschild black hole entropy [1–13]

$$S_{bh} = \frac{A_{bh}}{4\ell_p^2} = 4\pi \frac{E_{bh}^2}{E_p^2}, \tag{1}$$

a characteristic energy level can be associated with radial distance if the Planck energy value is considered to be replaceable

$$\pi \frac{r^2}{\ell_p^2} = 4\pi \frac{E_{bh}^2}{E(r)^2} \implies E(r) = \frac{E_{bh} 2\ell_p}{r}. \tag{2}$$

Where $r > R_s$, the g_{tt} component of the Schwarzschild metric is equivalent to

$$g_{tt} = -\left(1 - \frac{E(r)}{E_p}\right). \tag{3}$$

For instance, the Earth's mean radius is $r \approx 6371$ kilometres, and its mass is $M \approx 5.97 \times 10^{24}$ kilograms. The resulting characteristic energy level at the surface of this idealized Earth is $E(r) \approx 2.7$ Joules (e.g., 1.7×10^{19} eV).

Given this specific magnitude for $E(r)$, it seems worthwhile to consider whether or not the observed abrupt falloff in the cosmic ray energy spectrum at around 10^{19} eV is mostly dependent on the values of r and M at the site of observation [14, 15]. If this were indeed the case, then it would seem plausible that all massive bodies are electromagnetically non-interacting where

$$\frac{E_k^2}{E_0 + E_k} \geq E(r). \tag{4}$$

Perhaps such behaviour would also be related to the missing mass problem of galactic dynamics [16]?

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