Hawking Radiation in Data General Relativity theory

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ABSTRACT

In IJTP-D-18-00281 or preprint "General relativity and the representation of solutions"(Sangwha Yi write) in researchgate ,we found new general relativity theory (we call it Data General Relativity Theory;DGRT). We treats the data of Hawking radiation by Data general relativity theory.

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1. Introduction

In IJTP-D-18-281 or preprint "General relativity and the representation of solutions"(Sangwha Yi write) in researchgate ,we found new general relativity theory(we can call it Data General relativity theory). We obtain data of Hawking radiation and Gravitational wave by Data general relativity theory.

In our article, $c=1$

If we introduce Data general relativity theory,

First, the gravity potential $g_{\mu\upsilon}$ is

$$ds^2 = g_{\mu\upsilon}dx^\mu dx^\upsilon \tag{1}$$

In gravity potential $g_{\mu\upsilon}$, we introduce tensor $f_{\mu\upsilon}$ and scalar K.

$$f_{\mu\upsilon} = Kg_{\mu\upsilon} \ , \quad \frac{\partial K}{\partial x^\lambda} = 0$$

$$ds'^2 = f_{\mu\upsilon}dx^\mu dx^\upsilon = \bar{g}_{\mu\upsilon}d\bar{x}^\mu d\bar{x}^\upsilon = \bar{g}_{\mu\upsilon}\frac{\partial \bar{x}^\mu}{\partial \bar{x}'^\alpha}\frac{\partial \bar{x}^\upsilon}{\partial \bar{x}'^\beta}d\bar{x}'^\alpha d\bar{x}'^\beta$$

$$= \bar{g}'_{\alpha\beta}d\bar{x}'^\alpha d\bar{x}'^\beta = f'_{\alpha\beta}dx'^\alpha dx'^\beta$$

$$\bar{g}'_{\alpha\beta} = \bar{g}_{\mu\upsilon}\frac{\partial \bar{x}^\mu}{\partial \bar{x}'^\alpha}\frac{\partial \bar{x}^\upsilon}{\partial \bar{x}'^\beta} \ , \quad f'_{\alpha\beta} = f_{\mu\upsilon}\frac{\partial x^\mu}{\partial x'^\alpha}\frac{\partial x^\upsilon}{\partial x'^\beta} \tag{2}$$

$$f_{\mu\upsilon} = Kg_{\mu\upsilon} \ , \quad \frac{\partial K}{\partial x^\lambda} = 0$$

$$ds^2 = g_{\mu\upsilon}dx^\mu dx^\upsilon, \ ds'^2 = f_{\mu\upsilon}dx^\mu dx^\upsilon = \bar{g}_{\mu\upsilon}d\bar{x}^\mu d\bar{x}^\upsilon \tag{3}$$

The other representation of Kerr-Newman solution is

$$ds'^2 = f_{\mu\upsilon}dx^\mu dx^\upsilon = Kg_{\mu\upsilon}dx^\mu dx^\upsilon = K\cdot ds^2$$

$$= -K(1-\frac{2GMr-kGQ^2}{\Sigma})dt^2 + 2K(2MGr-kGQ^2)\frac{a\sin^2\theta}{c^4\Sigma}dtd\phi$$

$$-\frac{K\Sigma}{r^2-2GMr+a^2+kGQ^2}dr^2 - K\Sigma d\theta^2$$

$$-K\sin^2\theta[r^2+a^2+(2GMr-kGQ^2)\frac{a^2\sin^2\theta}{\Sigma}]d\phi^2$$

$$= -(1-\frac{2G\sqrt{K}M\sqrt{K}r-kGKQ^2}{K\Sigma})d\bar{t}^2 + 2(2\sqrt{K}MG\sqrt{K}r-kGKQ^2)\frac{\sqrt{K}a\sin^2\theta}{K\Sigma}d\sqrt{K}td\phi$$

$$-\frac{K\Sigma}{Kr^2-2G\sqrt{K}M\sqrt{K}r+Ka^2+kGKQ^2}d(\sqrt{K}r)^2-K\Sigma d\theta^2$$
$$-\sin^2\theta[Kr^2+Ka^2+(2G\sqrt{K}M\sqrt{K}r-kGKQ^2)\frac{Ka^2\sin^2\theta}{K\Sigma}]d\phi^2$$
$$=-(1-\frac{2G\overline{M}\bar{r}-kG\overline{Q}^2}{\overline{\Sigma}})d\bar{t}^2+2(2\overline{M}G\bar{r}-kG\overline{Q}^2)\frac{\bar{a}\sin^2\bar{\theta}}{\overline{\Sigma}}d\bar{t}d\bar{\phi}$$
$$-\frac{\overline{\Sigma}}{\bar{r}^2-2G\overline{M}\bar{r}+\bar{a}^2+kG\overline{Q}^2}d\bar{r}^2-\overline{\Sigma}d\bar{\theta}^2$$
$$-\sin^2\bar{\theta}[\bar{r}^2+\bar{a}^2+(2G\overline{M}\bar{r}-kG\overline{Q}^2)\frac{\bar{a}^2\sin^2\bar{\theta}}{\overline{\Sigma}}]d\bar{\phi}^2$$
$$=\bar{g}_{\mu\upsilon}d\bar{x}^{\mu}d\bar{x}^{\upsilon}$$
$$\overline{\Sigma}=K\Sigma=Kr^2+Ka^2\cos^2\theta=\bar{r}^2+\bar{a}^2\cos^2\bar{\theta}$$
$$\sqrt{K}t=\bar{t},\ \sqrt{K}r=\bar{r}\ ,\theta=\bar{\theta},\phi=\bar{\phi},\sqrt{K}M=\overline{M},KQ^2=\overline{Q}^2,\sqrt{K}a=\bar{a}$$
$$\bar{J}=\overline{M}\bar{a}=KMa=KJ \tag{4}$$

In this time, we obtain the data of the time t, the distance r, the mass M, the charge Q and the angular momentum J

2. Obtaining process information of Hawking radiation

Steven Hawking fined Black –hole’s Heat Mechanics.

By Hawking Radiation in Wikipedia, We obtain the new data from formulas of Black-hole’s Heat Mechanic. We start the obtaining process informations of Hawking Radiation.

The near horizon temperature of Schwarzschild black-hole is

$$T=\frac{1}{4\pi\sqrt{2M(r-2M)}} \tag{5}$$

The near horizon temperature of black-hole is in Data General relativity theory

$$\overline{T}=\frac{1}{4\pi\sqrt{2\overline{M}(\bar{r}-2\overline{M})}}=\frac{1}{4\pi\sqrt{2\sqrt{K}M(\sqrt{K}r-2\sqrt{K}M)}}=\frac{1}{4\pi\sqrt{K}\sqrt{2M(r-2M)}}$$
$$=\frac{T}{\sqrt{K}} \tag{6}$$

The radiation temperature T_H of Schwarzschild black hole

$$T_H=\frac{\hbar}{8\pi GMk_B} \tag{7}$$

The radiation temperature $\overline{T}_H$ is in Data General relativity theory.

$$\overline{T}_H = \frac{\hbar}{8\pi G\overline{M}k_B} = \frac{\hbar}{8\pi G\sqrt{K}Mk_B} = \frac{T_H}{\sqrt{K}} \tag{8}$$

The black hole's entropy

$$dS = 8\pi MdM = d(4\pi M^2) = \frac{dQ}{T} \tag{9}$$

The black-hole's entropy $d\overline{S}$ is in Data General Relativity theory.

$$d\overline{S} = 8\pi\overline{M}d\overline{M} = d(4\pi\overline{M}^2) = d(4\pi KM^2) = K\,dS = \frac{d\overline{Q}}{\overline{T}} = \frac{d(\sqrt{K}Q)}{\frac{T}{\sqrt{K}}},$$

$$d\overline{S} = KdS\;,\quad \overline{Q} = \sqrt{K}Q \tag{10}$$

Stefan-Boltzmann-Schwarzschild-Hawking blank-hole radiation's power P_{ev} is

$$P_{ev} = A_S\varepsilon\sigma T_H{}^4,\; A_s = 4\pi r^2,\; \varepsilon, \sigma \text{ is constant} \tag{11}$$

Stefan-Boltzmann-Schwarzschild-Hawking blank-hole radiation's power $\overline{P}_{ev}$ is in Data General relativity theory.

$$\overline{A}_s = 4\pi\overline{r}^2 = K4\pi r^2 = KA_s,$$

$$\overline{P}_{ev} = \overline{A}_S\varepsilon\sigma\overline{T}_H{}^4 = KA_s\varepsilon\sigma\frac{T^4}{K^2} = \frac{P_{ev}}{K} \tag{12}$$

The rate of evaporation energy loss of the black-hole is

$$P_{ev} = -\frac{dE_{ev}}{dt} \tag{13}$$

The rate of evaporation energy loss of the black-hole is in Data General Relativity theory.

$$\overline{P}_{ev} = -\frac{d\overline{E}_{ev}}{d\overline{t}} = -\frac{d(E_{ev}/\sqrt{K})}{\sqrt{K}dt} = \frac{P_{ev}}{K},$$

$$\overline{M}_{ev} = \overline{E}_{ev} = \frac{E_{ev}}{\sqrt{K}} = \frac{M_{ev}}{\sqrt{K}} \tag{14}$$

The evaporation time t_{ev} of a black hole is

$$t_{ev} = \frac{5120\,\pi G^2M^3}{\hbar} \tag{15}$$

The evaporation time $\bar{t}_{ev}$ of a black hole is in Data General Relativity theory.

$$\bar{t}_{ev} = \frac{5120\ \pi G^2 \overline{M}^3}{\hbar} = \frac{5120\ \pi G^2 K\sqrt{K} M^3}{\hbar} = K\sqrt{K} t_{ev} \qquad (16)$$

3. Conclusion

We more obtain the information of black-hole Heat Mechanics in Data General Relativity theory.

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