Dominant Energy Condition and today's Distributional Geometry

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Sad news for today's Distributional Geometry. The DEC is violated throughout the paper [T. Kawai and E. Sakaney, Prog. Theor. Phys. **98**, 69 (1997)], also directly on their main result at $r = 0$. The less grim situation is for paper [J. Foukzon, arXiv:0806.3026v1, (2008)]. The DEC violated throughout $m < r < \infty$, also directly on his main result at horizon $r = 2m$. But deep inside ($r < m$) black hole the DEC, as well as WEC and NEC are satisfied.

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I. FROM WIKIPEDIA

The dominant *energy condition* (DEC) stipulates that, in addition to the weak energy condition (WEC) holding true, for every future-pointing causal vector field (either timelike or null) $\mathbf{Y}$, the vector field

$$U^\nu = -T^\nu{}_\mu Y^\mu$$

must be a future-pointing causal vector. It means if causal vector has

$$Y^\nu Y_\nu \leq 0, \qquad Y^t > 0\,,$$

then the same for $\mathbf{U}$

$$N := U^\nu U_\nu \leq 0, \qquad U^t > 0\,.$$

That is, mass-energy can never be observed to be flowing faster than light.

II. MY CONTRIBUTION

But because inside Schwarzschild black hole the Y^t (of falling body from infinity) turns to negative, the *future pointing demand* must be replace by the Same Sign Condition (I called it SSC)

$$Y^t U^t > 0$$

Throughout the papers under critical refereement the SSC is satisfied (to be shore, I checked the *massless scalar field* and Reissner-Nordström spacetimes). My paper is the continuation of my own earlier publication [1]. So, I advise you to read the "roots".

A. Paper [2]

Taking non-radial ($Y^\phi \neq 0$) isotropic vectors, I showed that DEC is not satisfied. Considered general case $Y^\nu = (Y^t, Y^r, 0, Y^\phi)$ with undefined Y^t, Y^r, Y^ϕ and from the normation $Y^\nu Y_\nu = -1$ or $Y^\nu Y_\nu = 0$ has extracted the Y^t. So DEC condition $N \leq 0$ simply turns to $(Y^\phi)^2 \leq 0$ with unspecified Y^r. But because $N \leq 0$ must hold for any $Y^\phi \in (-\infty, \infty)$, the DEC is violated throughout the spacetime. Especially fatal on $r = 0$, there $N \to +\infty$.

Taking non-radial timelike vectors, the DEC simplifies to

$$(5\, r^2\, (Y^\phi)^2 - 4)\, \epsilon^4 \leq 0$$

with ϵ as infinitesimally small parameter of regularization, adopted by Distributional Geometry. Taking all range of $Y^\phi \in (-\infty, \infty)$, the DEC is violated throughout of $0 \leq r < \infty$. Let's consider the most important for Kawai point $r = 0$. Because is easy to show $Y^\phi \sim 1/r$, there can always be achievable, that the $r\, Y^\phi$ doesn't turn to zero as $r \to 0$. So the DEC is violated directly in the center $r = 0$.

P.S. Using the Maple calculations, I have kept in mind, that under the horizon the sign of causal Y^t must be allowably set to negative, because metric time-component changes the sign.

B. Paper [3]

Taking the isotropic and timelike vectors is not difficult to show, that DEC is violated if $r > m$, with infinite violation on horizon $r = 2m$. Limits from left and right saturate at infinite $N \to +\infty$ there.

It is not surprising, that there is superluminal velocities (DEC violation) on horizon: there is spheroid matter of zero mass, but with tremendous surface tension, see my result [1]. Such fairytale wouldn't be true.

[1] Dmitri Martila, *Comment on: "Distributional Energy-Momentum Densities...*: The Lebedev Physical Institute of the Russian Academy of Sciences (LPI RAS) http://forum.lebedev.ru/viewtopic.php?f=14(please insert symbol "and")t=3755 (2011), Estonian Research Portal http://www.etis.ee (2011)

[2] T. Kawai and E. Sakaney, Distributional Energy-Momentum Densities of Schwarzschild Space-Time, Prog. Theor. Phys. 98 (1997) 69-86; gr-qc/9707029

[3] Jaykov Foukzon, Distributional Schwarzschild Geometry from nonsmooth regularization via Horizon, arXiv:0806.3026v1 [physics.gen-ph], Report number: EW-234-45, (2008)