Stuck Metrology Meter into black Hole: joy and excitement

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(Dated: December 17, 2015)

Abstract

Using the conservation of the Metrology Standards (it is their definition), one gets new insights into the singular nature of the black hole Universe. How much has been said in the media, that Earth-man never sees the body B fall into a black hole. Reason: time dilation. But researcher A with rocket has full control of the situation, he can come close to Black Hole, almost to contact and observe everything. Therefore, the distance between A and B may be zero. It does not depend on when in the past the body B was shut into a black hole. Therefore, the black hole horizon has one big collision of bodies. Conclusion: The falling body is flattened on the horizon like by a concrete wall. Reason: on the horizon is singularity. Therefore, near the horizon even the most powerful engine can not operate and will fall into a black hole, reaching relativistic velocities of the fall. However, the space outside the ship becomes shorten through the Lorentz contraction of lengths. And therefore it is more likely to catch B than when A was in safety. A vector and a tensor consist not only of the components, but of the basis vectors. Therefore, multiplying basis vectors on the tensor itself, I get a scalar. Singular scalar, to conclude that even when the singularity were removed from the components, it is moved to the base of the curvature tensor. Therefore "removable" "coordinate singularity" of the curvature tensor is actually real and is not removable by coordinate transformations!

I. THE MOTION OF METROLOGY STANDARD (THE METER)

Let us consider the metrology standard, it is unchanging. The body A places the standard ahead to measure the distance between himself and another body B. Both are moving radially into the Schwarzschild black hole. Let us find velocity of standard's surface points J at any spacetime position P. Because number of atoms inside the standard conserves $N = const$ (see also the publication in the famous Scientific forums of many professors: Dmitri Martila, "Is the Dark Matter solved?" www.researchgate.net), then holds

$$v_0 \, ds_0 = v \, ds \,,$$

where ds_0 is proper time inside the standard at the body A, ds is proper time inside the standard at given spacetime position P. Velocity of the P observed from standard's J (and, thus, velocity of the J observed from P due to relativity) is $v = \sqrt{g_{rr}}\, dr/(\sqrt{-g_{tt}}\, dt) = (dr/dt)/(1 - 2M/r)$, velocity v_0 has the same formula, only taken at A. It is convenient to find proper time via the metric tensor, you get $ds^2 = \beta\, dt^2 - v^2\, \beta\, dt^2$, where $\beta = 1 - 2M/r$. Then

$$ds = dt \sqrt{(1 - 2M/r)(1 - v^2)}$$

The same formula one uses at A, only with v_0 and r_0 denotations. The v has two solutions. We choose the one which in the limit $r \to r_0$ coincides with v_0.

The more precise calculation would not reach over magnitude of ds^2, because the intensity of amount of particles is $\sim dv \sim a\, ds$. Thus, the number of particles is $\sim ds^2$, which turns to zero in comparison with ds^1 as ds is small.

The amazing fact is following. For given v_0 and r_0 the standard will no reach the horizon (because $W := v\sqrt{1 - v^2}$ has absolute maximum: $W_m := 1/2$ at $v = 1/\sqrt{2}$)! Therefore, there be the major change in the in-falling bodies: we believe the naked singularity of horizon acts. It can act way before the reaching the horizon, as the equation in this section show. Indeed, the critical velocity while moving towards black hole is $V_0 = 1/\sqrt{2}$. The free falling body, which starts to fall with zero velocity, starts major deformation at reaching $v_0 = V_0$. It happens near the black hole at $r_0 = 4\, M$.

But let now consider two particles, which are separated by not large distance.

II. FALLING OF TWO BODIES

The vector of geodesic radial motion in Schwarzschild spacetime we find following simple way: $u_\nu\, u^\nu = -1$ and $u_t = -E = const$. Then $u^t = E/\beta$, $(u^r)^2 = E^2 - \beta$. If at $r = R$ the $u^r = 0$, then $E^2 = 1 - 2M/R$. Let us denote $dt/dr = u^t/u^r = f(r, R)$. Latter function f and its dr-integral turns to infinity at horizon. Let from $r = R$ at $t = 0$ falls with zero initial velocity body B. After that at $t = \delta$ falls with zero velocity the body B. The observers, which measure the distance between the bodies, compose the line of measuring has $dt/dr = F$ along it. This line starts from point (r, t) and intersects with body B at $Q(q, t_q)$. Then holds $\Delta t_1 = \Delta t_2$, where on the left is the coordinate time to reach the point Q for body B; and on the right is for body A to reach from point R the position (t, r), from which the line of observers reaches the Q.

$$\int_R^q f dr = \delta + \int_R^r f dr + \int_r^q F dr\,.$$

So

$$\int_r^q (f - F) dr = \delta\,.$$

The first vector in co-moving thetrad (along the line of measuring) is velocity of observer $e^{(t)}_\nu = -u_\nu$, because must be $u^{(t)} = 1$. The second vector one finds from $u^{(r)} = e^{(r)}_\nu\, u^\nu = 0$. While measuring distances the $d\hat{t} = e^{(t)}_\nu\, dx^\nu = 0$, what gives the function $F = dt/dr$. Then insert this relation into $d\hat{r} = e^{(r)}_\nu\, dx^\nu = \psi\, dr$. Thus, you get the distance between the bodies:

$$\Delta\hat{r} = \int_r^q \psi\, dr\,.$$

Because it is believed, what the distance to horizon is finite, then $\Delta\hat{r} = 0$ in the limit $r \to q$.

So, it is enough to show, what $\int (f - F) dr = \infty$ while $r \to 2M$. Our theory can not disprove the effect found in the previous section. Indeed, while approaching the horizon, the range of measuring distance turns to zero. Thus, if the body B leaves this range, one can not say, what it never meets the A at the horizon. Thus, our theory can not fail, but can gain additional support via the calculations.

Note, what at the maximum range of measuring distance the velocity is $v = 1/\sqrt{2} < 1$. Thus, one expects, what the F in the integral, which corresponds to measuring observer has no compensating effect on near luminal travel f of the in-falling particles. Thus, the distance between the bodies do shrink.

III. FAILER OF FALLING DUST

The dust energy tensor in co-moving coordinates, mean, what the time runs homogeneously along the $\hat{r}$ axis. Thus, the dust particle do have the same time while approaching the horizon. Then from geodesic deviation equation is known, what such particles do cross the event horizon without increasing the density. Thus, I recommend not to rely on the dust case, while one would fall into black hole: the one is not the dust!

IV. FLASHING THE BLACK HOLE WITH WATER

I flush the black hole with incompressible perfect fluid [1]. The incompressible water never disappears. But it does, thus, Horizon Singularity compresses. Contradiction with generally accepted idea, that one can fly through the horizon alive.

Consider thick layer of perfect liquid falling down on black hole horizon. I am holding the background Schwarzschild metric fixed and the principal absence of the contraction of water, i.e. it has constant density $\rho = const$ but variable pressure $p(r)$. From material tensor

$$T_\mu^\nu = (\rho + p(r))\, u^\nu\, u_\mu + p(r)\, \delta_\mu^\nu$$

covariant divergence, which must be zero $T^\nu_{\mu\,;\nu} = 0$, follows zero divergence of 4-velocity $u^\nu_{;\nu} = 0$ (while derivation use the fact $u^\mu\, T^\nu_{\mu\,;\nu} = 0$). There is solution, where static observer at fixed $r > 2M$ measures asymptotically decreasing radial velocity $u^r \to 0$ as $t \to \infty$ of local flow: water never goes, unless Horizon Singularity compresses the water, because $p(r = 2M) \to \infty$.

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[1] Media report "APM 08279+5255 - The Largest Water Mass In The Universe (So Far) on Lis DC, Neufeld DA, Phillips TG, Gerin M, Neri R. Discovery of Water Vapor in the High-redshift Quasar APM 08279+5255 at z = 3.91. Astroph J Lett. 2011;738:L6.