© Michael H. Shulman, 2013
(shulman@dol.ru, www.timeorigun21.narod.ru)

About Black Hole's relief

(05.09.2013)

One often refers to the famous Wheeler's theorem "Black holes has no hair". However, this theorem is hold for an *isolated stationary* black hole (BH) only, while this one can be described using few global parameters (mass, angular momentum, charge).

In fact, we can observe such the BH only that interacts with its environment and consequently are neither isolate or stationary. So, one can state that each non-stationary BH has to have an uniform gravitational "relief" which must be in principle available to external observer.

1. Non-stationary black holes

One often refers to the famous Wheeler's theorem "Black holes has no hair". However, this theorem is hold for an *isolated stationary* black hole (BH) only, while this one can be described using few global parameters (mass, angular momentum, charge). In the book **[Novikov and Frolov, 1989]** the authors wrote:

> Wheeler summarized the results of a large number of paper devoted to the final states of the black holes and formulated a conjecture that in its evolution to the stationary state, an isolated black hole sheds through radiation all those characteristics that radiation can remove. …
>
> An isolated black hole cannot be a source of any massive field since all the radiation modes are possible for such the fields … and accordingly to the Wheeler conjecture all from them have to be radiated during the transition into the stationary state.

Since 1970s the "membrane paradigm" was accepted in the BH theory. Accordingly to it, an *external* observer can strictly consider the BH horizon as 2Dphysical membrane consisting in a *viscous fluid* having certain mechanical, electrodynamic, and thermodynamic features [see, for example, **[Novikov and Frolov, 1989]**). These membrane features are determined by its surface gravitational and electric charges. In fact, a *mechanical* membrane shape (BH's *event horizon*) comes to a dynamic *equilibrium* due to interaction between surface pressure, gravitation and centrifugal forces. As the authors of the mentioned paper wrote, if BH is created due to the gravitational collapse of a asymmetrical non-rotating body, then the non-spherical hole appears initially. The hole membrane is deformed, and the equilibrium between its gravitation and surface pressure is absent. Because of that the membrane oscillates and emits the gravitational waves that take away with its deformation energy. This effect together with the membrane viscosity leads to the horizon stabilization and becomes the perfect spherical one at the equilibrium.

The important conclusion that we can deduce from the above is that it is *non-correctly in principle* to consider any model in which an *isolated* BH absorbs a particle or a body. Particularly, just such confusion generates famous so-called "information paradox". In fact, any such the absorption disturbs the BH stationarity; it reacts by the *transitional* radiation emission that is *not connected* with the stationary thermal Hawking emission and BH evaporation **[Shulman, 2013]**.

Hence, the possibility itself to observe the matter flows (including interstellar gas) infalling onto BH also contradicts to the BH isolation assumption[1]. It means that the membrane shape is not symmetrical and uniform one (i.e., at equilibrium). So, in similar case one can state that the BH horizon is specified by a *relief*.

2. The BH relief non-uniformity and evolution

It is naturally to suppose that the membrane's relief could turn out to be very inhomogeneous (like lunar landscape) while the external matter is absorbed. However, this relief may be movable: these surface density non-uniformities having some kinetic energy displace along the membrane like usual particles in the external world which collide and exchange by energy.

These non-uniformities existence can lead to some interesting situation when the super-dense areas appear and even "secondary" collapse happens on this membrane; then a "baby black hole" are born there. If the BH membrane in our Universe is similar to a sphere surface, then the "usual" non-uniformities have to be similar to the hills and valleys, and the "secondary' BHs are similar to the "holes" on such the membrane.

As the source BH absorbs the matter from the Universe and evolves, its total mass and size increase as well as the mass and size of each local object on the membrane. So, an "observer" could "see" the increasing timelike funnels; they growth due to the total primary BH expansion as well as due to absorption of the membrane local compactions. The bottom of each funnel is determined by the birth time moment of the corresponding baby BH.

3. Can a distant observer in our Universe see the BH growth?

Let us return to our Universe and the primary BHs in it. Taking into account that signal propagation from the BH horizon up to a distant observer is infinitely slowed, it seems at first sight that a distant observer should see the BH just *in the first time point only*.

However, the growing BHs absorb a *large amount of matter* that streams to the event horizon. When the accumulated mass around the horizon becomes dense enough, it collapses too. So the visible size of the BH increases still.

Because of that the primary BH evolution with time in our Universe also can be represented by the timelike funnel, where its bottom is determined by the birth time moment of the corresponding primary BH.

References

[Novikov and Frolov, 1989] Novikov I.D., Frolov V.P. Physics of Black Holes (Dordrecht: Kluwer Acad. 1989)

[Novikov and Frolov, 2001] Novikov I.D., Frolov V.P. Black holes in the Universe. *Phys. Usp.* **44** 291–305 (2001)

[Shulman, 2013] Shulman M. About Black Hole and Information Paradox. http://www.timeorigin21.narod.ru//eng_time/BH_information_paradox_eng.pdf

[1] Note, it is one more remarkable evidence of the similarity between BHs and elementary particles.