

Black Hole for Dilettante

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Even now, some articles about Black Hole are often found in mass media. Unfortunately, however, most of those authors of the articles do not understand the basic physics of Black Hole at all. This must be mainly because they are not theoretical physicists, and further those people that provide news sources of the articles must be, indeed, far from experts not only on quantum field theory but also on general relativity or even physics itself.

In this short note, I should make a brief but scientifically correct explanation concerning the physics of Black Hole. At present, there are so many fake information on the physics of Black Hole that some reliable physics lectures must be absolutely needed to improve the present situation. For example, some group of scientists insisted that they discovered Black Hole by making photograph of nucleus of galaxy. This is practically a joke in physics and is quite similar to the story that a man insisted to have seen a god in the forest.

Why can these incredible stories floating around in mass media? This must be because these writers of scientists do not understand the modern physics at all. Nevertheless, if these stories are repeatedly reported in the mass media, then non-physicists might well tend to think and accept that the existence of Black Hole might have been confirmed. This is unfortunate since they do not know what Black Hole should be in terms of correct physics terminology.

1 What is Black Hole ?

Recently, quite a few people have asked me to explain what should be the physics of Black Hole. Therefore, I decided to make a brief but reliable explanation as to what should be the physical meaning of Black Hole in terms of modern physics terminology.

At present, Black Hole is considered to be a kind of star, but its original definition comes from the singularity of the special solution of the Einstein equation. In this sense it has nothing to do with stars. However, those people who consider themselves to be experts on Black Hole may have a picture similar to neutron stars even with higher density. But they believe that light could not escape from the boundary of Black Hole.

● Black Hole in Space-Time :

Now, it is believed that Black Hole is a hole in space-time which is “black”, even though they do not understand what it means by “black” in terms of physics. In addition, “experts” on Black Hole do not understand the dynamics of Black Hole at all since they are just physicists who cannot carry out any physical evaluation of neutron stars. In fact, they just talk about Black Hole with their imagination, which has nothing to do with science. Therefore, concerning the story of Black Hole, most of people dilettante are just bound in the chaotic states for a long time.

1.1 Nucleus of M87 Galaxy

The recent observation of a would-be Black Hole is related to the nucleus of M87 galaxy. This galaxy is in the distance of 60 million light years from here and it has presumably a diameter of 120 thousand light years. Further it may have a nucleus of galaxy which has a 650 million solar mass. Apart from the accuracy of these numbers, it should be quite natural that the nucleus of galaxy should have some kind of neutron stars, and this is not inconsistent with modern physics. In this case, one can easily estimate the radius of this neutron star, and it is around 10 thousand km which is slightly larger than the earth radius.

1.2 Black Hole and Neutron Star

From the kinematics of Black Hole, light cannot escape from the surface of this Black Hole, and this is the basic assumption of Black Hole, though without any physical foundation. This is the only point that is connected to the difference between neutron star and Black Hole. Thus, one can easily see that there is no way to observe this difference between neutron star and Black Hole.

1.3 Formation of Super Neutron Star

The formation of super neutron stars should be connected to the large supernova explosion. This type of formation mechanism must be very important to understand, but it has never been studied until now. This may well be connected to the fact that the new gravity model is discovered only about ten years ago [4, 5], and therefore, it is clear that the dynamics of nucleus of galaxy should now be investigated. Indeed, it must be a very interesting subject in nuclear astrophysics.

1.4 Responsibility of Person in Charge in Science Section ?

It is a serious problem that mass media published many exaggerated and fake articles which reported that Black Hole was discovered. However, the responsibility for writing incorrect stories of Black Hole may not necessarily be held by people in charge in science section of mass media. But it may well be that the real responsibility of writing wrong articles should rather be taken by the physicists that distributed publicly these incorrect information on Black Hole. Unfortunately, these physicists understand neither modern physics nor general relativity, and probably the fact that they are “physics amusia” must be much more serious than the propagation of wrong information about Black Hole.

1.5 Black Hole and Neutron Star

In order to clarify the physics of Black Hole one must understand quantum field theory, astrophysics, nuclear physics and general relativity in depth, and further one should be able to calculate some physical quantities in this field of research.

- Gravitational Collapse ? :

For example, nuclear physicists should know quite well that the nucleon-nucleon interactions should be strongly repulsive at the short distance, and thus they know that any stars with much higher density than neutron stars cannot exist at all. On the other hand, any large stars with similar density as neutron stars may well exist in nature since there is no basic problem for the formation of gigantic neutron stars. In addition, there is no physical process of gravitational collapse since the gravitational force cannot be very large at the origin of neutron star center. In fact, the gravitational force with finite distribution of mass has the strength which is only 1.5 times stronger at the origin than at the surface.

2 Physics of Black Hole

Historically, Black Hole is defined as the singularity of the solution in the Einstein equation, and thus it has nothing to do with the formation of stars. Therefore, experts claim that Black Hole is a black “hole” in space-time or they assume that, near the surface of Black Hole, space is distorted so that light cannot escape from Black Hole or something of this kind. These explanations have nothing to do with physics, and therefore only the terminology of Black Hole have been floating around until now. Unfortunately, Black Hole became very popular as if it were a special kind of star.

2.1 Neutron Star

Experts may explain that Black Hole is a star which has a very high density, and they imagine that it should be similar to neutron stars, but should have even higher density than neutron stars. However, they do not discuss how Black Hole can be formed in the universe since there is no physics equation related to the general relativity. This is clear since the general relativity is a theory for the coordinate system. Therefore, it has nothing to do with dynamics, and indeed no dynamical model is related to the general relativity.

2.2 Nucleus of Galaxy

Black Hole has no relation with the internal structure of star, and experts define or only claim that Black Hole should have a very large density. However, stars with very high density are, of course, known as neutron stars which are confirmed in terms of Pulsars. In this respect, the nucleus of galaxy should be a very high density star similar to neutron star, and this is consistent with the modern physics. Therefore, it should not be surprising if the nucleus of galaxy becomes an enormous neutron star in size and mass. Indeed, it should attract billions of stars in galaxy, and therefore, it should not be strange at all if there should be a gigantic neutron star at the center of galaxy.

2.3 Surface of Black Hole

The most important assumption concerning Black Hole is related to space distortion at the surface of Black Hole, and it is assumed that light cannot escape from Black Hole. However, space distortion in three dimensions cannot be physically understandable at all. Space distortion is replaced by the light propagation in space, but this cannot be treated in terms of classical mechanics. Further, the general relativity is not a dynamical theory, and therefore, it cannot make any predictions how light should propagate in space. “Experts” on Black Hole only state verbally but not physically as to how space should be distorted, though only from their imagination. The propagation of photon can be treated only if the electromagnetic field is quantized. In addition, space in the general relativity is just the coordinate system, and human being cannot realize real space.

2.4 Space Distortion is a Prank of “Physics Amusia”

Thus, nobody can understand space distortion at all, and those people who draw some picture of space distortion are simply making their imagination of scientific fiction. The idea of space distortion must be a result of a prank from “physics amusia”, and it has nothing to do with physics.

3 Einstein and General Relativity

Here, there is no important reason to make any tutorial description of the general relativity since the model is worthless in physics. The general relativity is an equation for coordinate system, and Einstein thought that the coordinate system might well be influenced if there should exist a distribution of stars. This is obviously a model which is constructed by physics dilettante. Further, this general relativity is not consistent with the special relativity even though the relativity principle is the most important physics law. Probably, Einstein might have realized this fact of violation of the special relativity, and therefore, he may have claimed that the relativity should be called “special relativity” and his new theory should be named “general relativity”.

3.1 Relativity and Its Importance

Most readers may well tend to think that the work of theory of relativity must have been achieved mainly by Einstein. However, it is, by now, known to experts that the credit of constructing the theory of relativity may not necessarily go to Einstein, and his contribution to the relativity should be carefully re-examined.

- Rest Mass :

Indeed, the connection of the rest mass with the Lorentz invariant quantity is an important achievement made by Einstein. However, the real importance of theory of relativity should not be for this rest mass issue, but for the theoretical framework itself that all the theoretical models must satisfy the Lorentz invariance. This is, of course, quite well-known to modern physicists.

In fact, this formulation of relativity is made up by Lorentz and Minkowski and other scientists before Einstein, and therefore, Einstein's contribution to the theory of relativity is not necessarily very great.

- Overvalued :

At present, the work of Einstein concerning theory of relativity is considered to be overvalued. In fact, his paper has no reference, and thus it is written as if everything were done by himself. This is not a fair way of writing papers, but at the time of his day, this way of writing might be one of the reasons of overvaluation.

- General Relativity is Inconsistent with Relativity :

On the other hand, since the general relativity does not satisfy the transformation property of relativity, it is quite difficult to accept that Einstein understands the essence of theory of relativity. In this sense, readers may well understand that it is simply impossible to appreciate the general relativity from modern physics point of view.

3.2 Fundamental Equation in Physics

If one wishes to construct a fundamental equation in physics, then one has to make all kinds of careful examinations of physical phenomena from various aspects. However, the Einstein equation is just constructed by making the second order differentials of the metric tensor in the left-hand side and by making the energy- momentum tensor with the distribution function of stars in the right-hand side.

- Physical Ground of Einstein Equation :

Surprisingly and frighteningly, however, there exists no physical phenomenon corresponding to its basic ground of the Einstein equation. Furthermore, one cannot understand what the equation for the coordinate system means in physics. Probably, the author of this equation by himself should not have any concrete pictures for the equation, apart from the vague imagination of space distortion. At the end of 19 century, there seems to be a paper which discusses space distortion, and possibly Einstein may have referred to this paper.

3.3 Physics Sense of Einstein

Up to now, the general relativity is critically reviewed, but no special comment on Einstein himself is made yet. Here, however, I should make a brief comment on Einstein himself even though this is nothing but a feeling. It is not clear whether Einstein might be a “physics amusia” or not, since, at the time of construction of general relativity, quantum mechanics was not discovered yet. Therefore, it is not surprising that he did not have any quantum mechanical and probabilistic way of thinking at the time of 1917.

- Solvay Conferences and Controversy of Quantum Mechanics :

However, the controversy of quantum mechanics between Bohr and Einstein at the Solvay Conferences on Physics in 1930 indicates that Einstein could not understand the essence of quantum mechanics which is a probabilistic behavior. This may suggest that Einstein continued to keep the deterministic view of the world, and he wanted to defend the general relativity that is the center of this ideology. By now, it is confirmed that the fundamental physics is described in terms of quantum and probabilistic pictures. On the other hand, some group of physicists still believe in the general relativity, even though it disagrees with quantum behavior. What should be their aim?

4 Physics and Shokunin (Professionals)

If one wishes to achieve something interesting in physics, then one should become “physics Shokunin”. In order to become a theoretical physics Shokunin, for example, one should solve all kinds of exercise problems and examine fundamental physics formulation, in particular, Dirac equation with electromagnetic interactions.

4.1 Importance of Shokunin

The Shokunin spirit must be important for other area of researches as well. Japanese should have a respect for Shokunin spirit since Edo period. This spirit may well be similar to the Meisterschaft in Germany. In fact, it is believed that this spirit must have been a key issue for the cultural and economic developments of Japan and Germany.

4.2 Drastic Decrease of Theoretical Physics Shokunin

In the field of theoretical physics, however, Shokunin researchers have decreased drastically. This may be related to the fact that many researchers at present tend to become knowledge-biased, and therefore, they do not work hard to improve their skills in physics. However, even if they transpose a knowledge of one field of research into the other field, this does not mean that they make any real progress in physics. In order to make a solid progress even a little bit, one has to work very hard to improve one’s skills of theoretical and computational as much as possible.

● All Physics Institute :

At present, a few researchers work at “All Physics Institute” to make a real progress in physics, though they are materially impoverished but physically quite rich indeed. This group of Shokunin researchers are reconstructing modern physics, and a new theoretical scheme will be eventually constructed in near future.

References

- [1] J.D. Bjorken and S.D. Drell, “Relativistic Quantum Mechanics”, (McGraw-Hill Book Company,1964)
- [2] J.J. Sakurai, ”Advanced Quantum Mechanics”, (Addison-Wesley,1967)
- [3] K. Nishijima, “Fields and Particles”, (W.A. Benjamin, INC, 1969)
- [4] T. Fujita, “Symmetry and Its Breaking in Quantum Field Theory” (Nova Science Publishers, 2011, 2nd edition)
- [5] T. Fujita and N. Kanda, “Fundamental Problems in Quantum Field Theory” (Bentham Publishers, 2013)