A Black Hole Model Consideration and a New Model for Gravity

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In this brief note, suggestions are made for an improved black hole model. Prof. Hawking has just rescinded some of his thoughts on what a black hole is or isn't. The suggested model characteristics are the result of back-to-basics thoughts about the interactions of a black hole and its surroundings. Not being a seasoned astrophysicist but rather a professional electrical engineer, there may be some errors or omissions, and for that I offer apologies in advance.

Not So Classic Astronauts

Begin by extending the classic example of astronauts with flashlights traveling through space toward and away from each other at nearly the speed of light. In the new examples the astronauts are mimicking figure skaters with a neon green glowing belt around their waist. With a stationary observer located on the same plane and the astronaut perpendicular to the astronaut's axis of rotation, as the rotation rate increases, the neon green color shifts to blue on one end and red on the other with a whole spectrum of colors in-between. The end of the band rotating toward the observer is "blue" shifted while the other end is "red shifted. Now the astronaut pulls her arms in closer and further increases her rate of rotation. The colors along the band further shift toward the ultraviolet and infrared spectrums. And as the rotation rate further increases, the color shift becomes even more extreme with X-rays on one edge and radio frequencies on the other.

By the way, for an observer positioned along the axis of rotation, the band will not be color shifted at all and will remain green in color independent of the rotation rate. In general when the observer and rotating astronaut are not in the same plane, the color shifting effect will be dependent upon the observation angle formed between the observer and astronaut relative to her axis of rotation. The apparent rotation velocity is a function of the actual velocity and the sin of the observation angle.

Now let's return to the original rotation speed and apply a receding motion between the rotating astronaut and the stationary observer. First, without any rotation the green band will now appear as red. With rotation, the band will be infrared at one end and return to green on the other end. As the astronaut pulls her arms increases her rate of rotation again, the emitted photon colors are shifted due to both the rotation and the receding motion. At high receding rates (approaching the speed of light) and high rotation rates (also approaching the speed of light), the color shifting must approach certain limits.

The limits are simply imposed by the speed of light. Once the receding velocity plus the apparent rotation velocity reaches or exceeds c, the emission simply becomes invisible. In other words, the light source falls behind a visible light cone which we already know exists for simple receding objects; the event horizon. A way of interpreting the effect is that emitted photons just cannot reach the distant observer as the observer is receding.

Finally, what happens when the rotating astronaut has an approaching motion combined with a rotation. For combined approaching and rotational velocity below c, the color shifting functions as expected. The green band will appear blue and the ends will be yellow and violet. At higher approaching rates (approaching the speed of light) and high rotation rates (also approaching the speed of light), the color shifted photon probably just disappears. If observed, the blue shift would be so extreme as to create negative frequencies. This would be equivalent to time advancing in the negative direction which is simply just not possible. Hence any emitted extremely blue shifted photon can never be received by the observer.

(There is no doubt that this last condition represents substantial controversy. The exact behavior under this condition is however is not required for the remaining presentation. If true, there are a number of interesting side-effects and predictions. One of the most immediate is a dual-ring particle collier where particles are accelerated in counter opposing directions. The only collisions occurring would be bounded by relativistic behavior, i.e. particles which approach and collide below the speed of light.)

Rotating Black Holes

Rotating black holes are next to be considered. It has been observed that many black holes rotate and that some black holes may be rotating at nearly the speed of light. For a distant observer, with a significant red-shift, portions of the rotating black hole will actually be moving at a relative speed greater than c. The portion of the black hole which becomes invisible in the gravitational domain is a conical section of a sphere. As the black hole rotates, the equivalent mass in a conical region can be considered as non-existent relative to a distant observer. In other words, it is beyond the gravitational event horizon.

It should be noted that the effect of rotational motion is not limited to black holes. Rather, this would apply between an observer and any moving rotating body such as an ordinary star, neutron star, accretion disk as well as the black hole itself. Galaxies at or beyond the observable Universe boundary have enough linear velocity to disappear relative to a distant observer in a visible and gravitational sense.

Gravitational Blue Shift

Gravitational force disappears between a distant observer and a rotating body when the combined linear speed and rotation meets or exceeds the speed of light. The portion of the rotating body, which relative velocity to a moving observer is exceeding c, is no longer having an effect on the gravitational force between the observer and the rotating body. We cannot anticipate that the gravitational force drops from g to zero instantly across this boundary. Rather, using a photon-inspired model for gravitons, the gravitons will be “red shifted” to “infinity” at the boundary. On the other side of the rotating body, gravitons will be “blue shifted” (but will never exceed c as a combination of linear and rotational motion). The observed gravitational force will be on average proportional to the equivalent reduced mass (removing the mass of the rotating body exceeding c) acting at the center of the body. (Note the center of mass is expected to be shifted as well.)

Gravity Field of a Black Hole

For nearby observers, all of the rotating body’s mass may have an effect. However, the points on the rotating body nearest to the nearby observer will have the greatest effect (as a result of the blue shift) and will influence the motion of the nearby observer via gravity. Hence rotating gravity effects will direct the assembly of the accretion disk itself and may explain how gravity “escapes” a black hole. It should be noted that because of the counterbalance of red vs. blue shifting in a rotating body, we may be greatly underestimating the effective mass in the rotating body.

The actual gravity field around the black hole ranges from the static gravitational force observed at the axis to a strengthened response peaking along the plane of rotation. This effect should occur for all rotating bodies, the extent of which is dependent on the speed of rotation.

Cosmological Expansion

In the early Universe, it is unlikely that many large black holes existed. As the Universe continued to evolve, more and more black holes had been created and enlarged. At some time, super massive black holes had started to consume huge quantities of ordinary matter. When the black hole is recognized as a rotating body, the gravitational effect on a galaxy's neighbors (near and distant) is diminished. Hence cosmological expansion may simply be due to the loss of effective mass rather than a fundamental shift in the force of gravity, g.

Gravitational Flatness

The visible Universe is considered flat in our standard observable three dimensions. Galaxies near the edge of our visible Universe may interact gravitationally to galaxies which are unobservable to us. In a similar fashion, gravitational effects within clusters of galaxies may be substantially greater, but yet significantly weaker to other galaxies moving away from the cluster. Hence the Universe should not be considered flat in a gravitational sense as the combined linear and rotational motion need to be considered between pairs of objects. (There is no implication as to required extra dimensions by the non-flatness, rather simply an observation that the effect of gravity needs to be determined on a pair-wise basis between objects.)

Black Hole Model Improvement and New Model for Gravity

As discussed infra, the relative motion of the black hole body (spherical if not rotating and bulging/ ellipsoid-like when rotation) to its observers needs to be taken into account. For distant receding observers, a conical section of the sphere/ellipsoid will disappear beyond the event horizon. There are many implications of such a model feature. First, it should be obvious that this is universal for all rotating bodies. Second it shows how relatively nearby mass can disappear and diminish the effective gravitational force without requiring an unexplainable weakening of the force of gravity itself.

It is also doubtful that the effect of gravity at this boundary is discontinuous but rather smooth and tapered. For this reason it is proposed that the effective gravity between two moving bodies be:

$$G_{\text{effective}} = (1 + v_{\text{relative}}/c)\ G$$

Certainly relativistic effects come into consideration as well and perhaps this gravitational model is inferior. However, this gravitational model would help explain the more distant event horizon in the plane of a rotating black hole. At rotating speeds approaching the speed of light, the gravitational effect is twice in rotational plane as opposed to the plane through the poles.

This gravitational model may also help explain the tiny correction factors still necessary for GPS calculations and may be related to the "Pioneer Anomaly".

With respect to Prof. Hawking recent comments on event horizons, this model acknowledges the relative nature of an event horizon as being special to that (distant) observer. As a nearby observer is moving faster and faster, the notion of event horizon changes and may all together disappear.