The quantum uncertainty principle, gravitational waves, and black holes

By Willi Penker

April 10, 2010

Abstract

Following the basic rules of the uncertainty principle, gravitation itself becomes uncertain and even massive black holes go into superposition without the possibility of ending up in a real singularity.

Keywords: Black hole, quantum uncertainty principle, gravitation

The uncertainty principle or superposition is valid for all unobserved objects, as shown in the double-slit experiment performed with fullerene molecules. This experiment proves that even molecules can go into superposition by getting those superpositions to interfere and display a typical wave pattern. The molecules go into superposition as long as they are unobserved.

However, a fullerene molecule has a rest mass, whereas light does not. For rest mass to go into superposition means that the gravitation it causes must also become uncertain, a kind of gravitational superposition. If this weren't the case, the object's whereabouts would always be given away by its gravitation, and no superposition would be possible.

Gravitation obviously underlies the same principle of uncertainty as the whereabouts of anything in a relative moving state. This can also be concluded from the object's uncertainty itself. If one measures an object's fixed relative location, one will not gain any information about the object's impulse. But its impulse carries energy, and therefore also causes gravitation. If one knows the object's impulse and therefore its overall state (rest mass plus energy from its impulse), one will have no idea of the object's exact location. The object's gravitation is uncertain too, since it always has an uncertain component. Either the location is uncertain or the energy from the impulse is uncertain.

This behavior of matter and gravitation prevents anything from collapsing to a singularity. Once a collapsing object reaches a density such that its escape velocity reaches the speed of light, it is completely unobserved from the rest of the universe. There no longer exists any information about the whereabouts of the particles inside, which means that the entire massive object goes into superposition and, with it, gravitation becomes uncertain. Any assumed change in the gravitation within caused by any further assumed collapse of the matter inside results in a gravitational wave from the object. As such, the object will be carrying energy with it, causing this wave to follow its own gravitational rules. The departing wave will be dragged back, never able to leave the object's event horizon. Therefore, not even gravitation itself is able to bring information about the object's state to the outside world.

To get this superposition to collapse to a fixed point, a singularity, the object's "where" needs to be observed, but this is impossible, since it is behind an event horizon. This basic effect of quantum mechanics will prevent anything from collapsing to a real singularity.