There's nothing absolute about time

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One of our Puranic tales describes the experience of King Kakudmi, who had a beautiful daughter named Revati. As she approached marriageable age several young men started approaching her father with marriage proposals. With the natural desire that his choice should be right, he finally decided to consult no less an authority than Brahma, the creator of the universe.

Arrived at Brahma's abode Kakudmi discovered that he had to wait since Brahma was busy. In fact, Brahma sent word that after his urgent work gets over he will be free to see him. So along with his daughter the King waited. True to his word, Brahma called him soon after and asked him the reason for his visit.

Having given the background, Kakudmi stated the bottomline: would the Great Brahma advise him as to whom amongst the existing aspirants should be choose as Revati's husband. On hearing the problem, Brahma laughed and said, "It is as well that you brought Revati with you. For, while you waited here for about five minutes, the time has moved faster on your Earth. Perhaps a few million years have elapsed since you left to visit me. Naturally all those young men you talked about have been dead and gone!" So Brahma gave him the name of Balaram (the older brother of Krishna) as the ideal son-in-law who will be around at the time Kakudmi would reach his palace.

This episode shows the radical idea named Revati. Each observer carries his own timeline and one needs to adjust the lines for the passage of time of different observers before comparing their measurement details. Einstein's relativity theory brought this fact to the attention of the physicists.

One observes that events in a train recede to become more and more distant the more one approaches the train. However, the train is at rest in the same absolute reference frame as the observer on the platform. He therefore concludes that the train is approaching, and the traffic on it is receding. The result is that the length of the train appears to be shorter than its actual length.

The same effect is observed in the case of stars. When a star is moving away from us, its light appears to be shifted to longer wavelengths, a phenomenon known as the Doppler effect. The effect is more pronounced for stars moving away from us than for stars moving towards us.

Indeed there may come a stage when no signal from B will ever reach A. As Kakudmi and Revati found, the time passage near B had slowed down considerably as he continued to fall inwards. And using a modern version we could say that Brahma's abode is just outside the horizon of a black hole! The limit, which is crossed by B in order that no signal from B will ever reach A, is called the event horizon of the black hole.

How do we discover black holes? If a black hole cannot be seen, how do we know that there is a black hole in a certain part of the space? The answer is: a black hole is made of concentrated matter which has large mass and hence a strong gravitational influence on the surroundings.

For example, astronomers detect gravitational waves. These are stars going around each other under the gravitational attraction of their mutual mass. If one of them becomes a black hole, we will see only its companion and from its circular motion, deduce that it has a companion star. Why? Because Newton's laws of motion tell us that if the star were a single isolated one, it would have gone on in a straight line with uniform velocity. But it is a binary; it is a companion star, which exerts gravitational pull on it.

Many star pairs like these are known to be sources of X-rays and these come because stars interact by generating flow of plasma (not blood plasma but fluids of electrically charged particles), which flows from the visible star into the black hole. This in turn causes the production of X-rays. In the 1970s, space technology could place X-ray detectors in space, which led to the discovery of many such X-ray sources.

From their studies one could show that at least a few handful black holes. More recently, astronomers could detect a more bizarre system: a pair of black holes going around each other.

How do we know that there are black holes out there? This technology is the recently deployed system of detectors of gravitational waves. A black hole pair churns up its gravitational environment and produces waves of gravity. The recent use of laser interferometers in detecting such a black hole binary made of two black holes of around 35 and 29 solar masses respectively. Note that in this case neither of the two black holes will be visible to ordinary telescopes.

Clearly, black holes, the havens of bureaucrats, exist in space and can be found given the benefits of technology.

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