Israeli Researcher Develops New Theoretical Model of Time Machine

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Technion Israel Institute of Technology researchers have developed a theoretical model of a time machine that, in the distant future, could possibly enable future generations to travel into the past. An article on this research was published last week in the scientific journal Physical Review.

“In order to travel back in time, the spacetime structure must be engineered appropriately,” explains Prof. Amos Ori of the Technion’s Faculty of Physics. “This is what Einstein’s theory of general relativity deals with. It says that spacetime can be flat. That is – it has a trivial, simple structure. But it can also be curved with various configurations. According to the theory of relativity, the essence of gravitational fields is in the curving of spacetime. The theory of relativity also defines how space is curved and how this curvature develops over time.”

The main question is – if according to the principles of curvature development in the theory of relativity - can a time machine be created? In other words – can we cause spacetime to curve in such a way as to enable travel back in time? Such a journey requires a significant curvature of spacetime, in a very special form.

Traveling back in time is actually closing time-like curves so we can go back to an event at which we were present in the past. In flat space, it is not possible to close curves and go back in time. In order for closed time-like curves to exist, there has to be a curvature of a specific form on spacetime.

The question Prof. Ori is investigating is – do the laws of gravity permit the development of spacetime with the required curvature (closed time-like curves)? In the past, scientists raised a number of objections to this possibility.

Prof. Ori is proposing a theoretical model for spacetime that could develop into a time machine. The model overcomes some of the questions, which, until now, scientists have not succeeded in solving. One of the difficult claims against a time machine was that, in order to create a time machine, it would be necessary for it to contain material with negative density. And since we do not have such material – and it is also not clear if the laws of nature enable the existence of such material in the quantities required - it is not possible to build a time machine. Now, Prof. Ori comes along and proposes a theoretical model that does not require material with negative density. The model that he proposes is, essentially, a vacuum space that contains a region field with standard positive density material.

“The machine is spacetime itself,” he explains. “Today, if we were to create a time machine – an area with a warp like this in space that would enable time lines to close on themselves – it might enable future generations to return to visit our time. We, apparently, cannot return to previous ages because our predecessors did not create this infrastructure for us.”

Prof. Ori emphasizes that we still do not have the technology to control gravitational fields at will, despite the fact that the theoretical principles of how to do this exist. “The model that we developed at the Technion is a significant step but there still remains a number of non-trivial open questions,” he stresses. “It may be that some of these questions also will not be solved in the future. This is still not clear.”

As an example, he brings up the problem of instability according to

which in spacetime with a time machine there could be disturbances with increasing strength so that spacetime would be disrupted to such an extent that it would cancel out the time machine. Prof. Ori, one of the few scientists in the world investigating this issue, hopes that continued research will present a clearer picture with respect to these questions.

Source: Technion Israel Institute of Technology