Time Travel without Paradox

What might a system of laws look like if it is to allow for time travel, and do so in a way that steers clear of paradox?

It is easy to imagine a system of laws that avoids paradox by banning time travel altogether. It is also easy to imagine a system of laws that avoids paradox in an unprincipled way. It could, for example, postulate an "anti-paradox force" to deflect Bruno's bullet before it hits Grandfather.

Or it could postulate a restriction on the world's initial conditions, disallowing worlds with problematic time travel. That's not what we're after here. What we'd like to understand is whether there could be a system of laws that allows for interesting forms of time travel but manages to avoid paradox in a *principled* way.

We will explore these issues by considering a "toy model": a system of laws that allows for interesting forms of time travel but is much simpler than the actual laws of physics. This will allow us to bring some of the key issues into focus while avoiding the complexities of contemporary physics.

As it turns out, there are solutions to Einstein's equations that allow for time travel, in the sense that there are paths through spacetime that form a closed loop and do not require traveling faster than the speed of light. (For an amazing example of how this might happen, see the bonus video at the end of this lecture.)

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Can we ban time travel?

It already happens. Every time I reverse an operation, I'm going back in time, returning somethin... 3

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