

Young physicist 'squares the numbers' on time travel

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Paradox-free time travel is theoretically possible, according to the mathematical modeling of a prodigious University of Queensland

undergraduate student.

Fourth-year Bachelor of Advanced Science (Honours) student Germain Tobar has been investigating the possibility of time travel, under the supervision of UQ physicist Dr. Fabio Costa.

"Classical dynamics says if you know the state of a system at a particular time, this can tell us the entire history of the system," Mr Tobar said.

"This has a wide range of applications, from allowing us to send rockets to other planets and modeling how fluids flow.

"For example, if I know the [current position](#) and velocity of an object falling under the force of gravity, I can calculate where it will be at any time.

"However, Einstein's theory of [general relativity](#) predicts the existence of time loops or time travel—where an event can be both in the past and future of itself—theoretically turning the study of dynamics on its head."

Mr Tobar said a [unified theory](#) that could reconcile both traditional dynamics and Einstein's Theory of Relativity was the holy grail of physics.

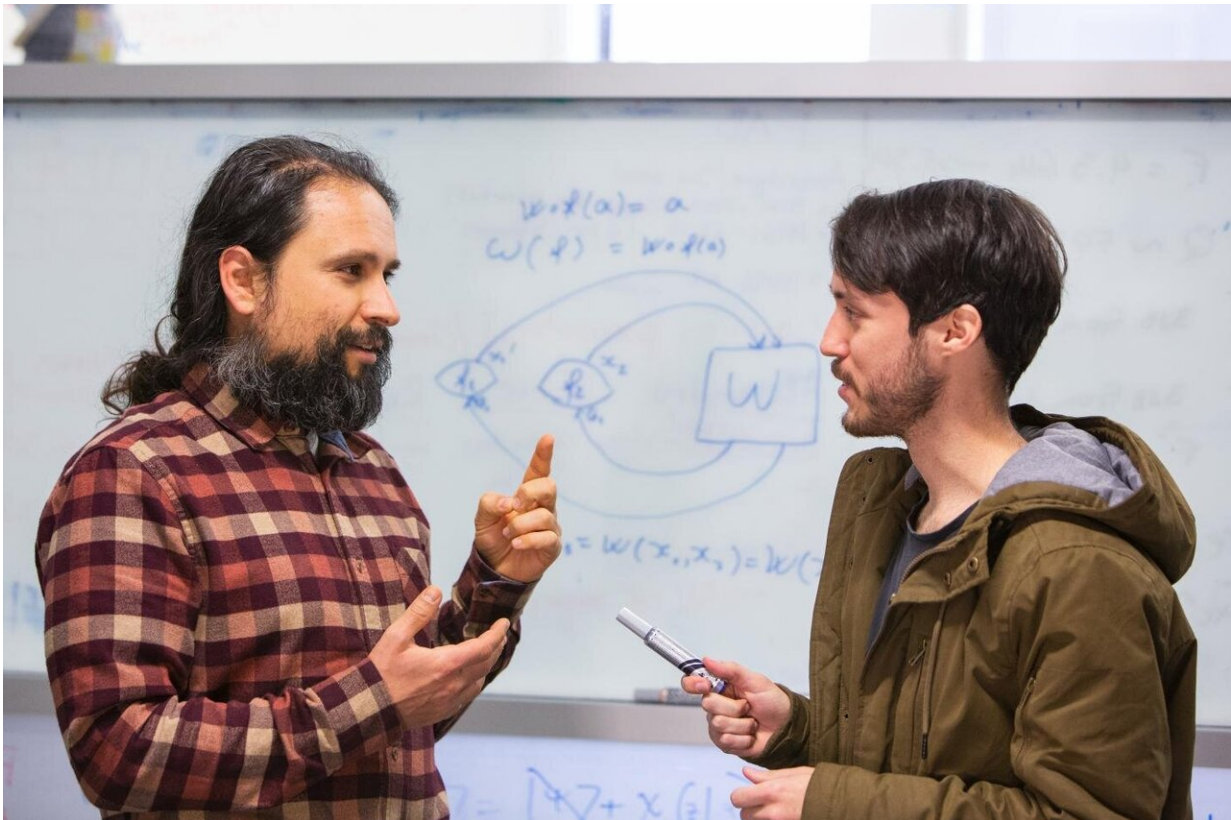
"But the current science says both theories cannot both be true," he said.

"As physicists, we want to understand the Universe's most basic, underlying laws and for years I've puzzled on how the science of dynamics can square with Einstein's predictions.

"I wondered: "is time travel mathematically possible?"

Mr Tobar and Dr. Costa say they have found a way to "square the

numbers" and Dr. Costa said the calculations could have fascinating consequences for science.



Dr Fabio Costa (left) with Bachelor of Advanced Science (Honours) student Germain Tobar. Credit: Ho Vu

"The maths checks out—and the results are the stuff of science fiction," Dr. Costa said.

"Say you traveled in time, in an attempt to stop COVID-19's patient zero from being exposed to the virus.

"However if you stopped that individual from becoming infected—that

would eliminate the motivation for you to go back and stop the pandemic in the first place.

"This is a paradox—an inconsistency that often leads people to think that time travel cannot occur in our universe.

"Some physicists say it is possible, but logically it's hard to accept because that would affect our freedom to make any arbitrary action.

"It would mean you can time travel, but you cannot do anything that would cause a paradox to occur."

However the researchers say their work shows that neither of these conditions have to be the case, and it is possible for events to adjust themselves to be logically consistent with any action that the time traveler makes.

"In the coronavirus patient zero example, you might try and stop patient zero from becoming infected, but in doing so you would catch the virus and become patient zero, or someone else would," Mr Tobar said.

"No matter what you did, the salient events would just recalibrate around you.

"This would mean that—no matter your actions—the pandemic would occur, giving your younger self the motivation to go back and stop it.

"Try as you might to create a paradox, the events will always adjust themselves, to avoid any inconsistency.

"The range of mathematical processes we discovered show that [time travel](#) with free will is logically possible in our universe without any paradox."

The research is published in *Classical and Quantum Gravity*.

More information: Germain Tobar et al, Reversible dynamics with closed time-like curves and freedom of choice, *Classical and Quantum Gravity* (2020). [DOI: 10.1088/1361-6382/aba4bc](https://doi.org/10.1088/1361-6382/aba4bc)

Provided by University of Queensland

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