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Realização:



# EXAME DE PROFICIÊNCIA DE LEITURA EM LÍNGUA ESTRANGEIRA

DATA: 11/11/2012

HORÁRIO: das 8 às 11 horas

## CADERNO DE PROVA

Idioma:

**INGLÊS**

Área de Pesquisa:

**(2) CIÊNCIAS EXATAS E DA TERRA, ENGENHARIAS**

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- Esta prova é constituída de um texto técnico-científico em língua estrangeira, seguido de 5 (cinco) questões abertas relativas ao texto apresentado.
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# Physicist: 'Looper' is light on time travel technology

New Bruce Willis movie, "Looper", opening Sept. 28, is a time-traveling gangster tale that looks fun but offers impossible physics, says one scientist.

By Dan Vergano



Time travel has been invented, at least in Hollywood, as a device for Bruce Willis to keep materializing in science-fiction thrillers.

The latest is *Looper*, opening Sept. 28 nationwide, a time-travel tale that combines gangsters with science fiction's "what-if-you-killed-your-grandfather" paradox. In the future of the film set in 2044, a hit man played by Joseph Gordon-Levitt works for mobsters from the future, who send their victims back in time for him to kill.

Opening the Toronto International Film Festival earlier this month, the film already has garnered good reviews from the film critics who have seen it, but the reviews from real time-travel experts are just starting.

"Everyone wants to go back in time and kill Hitler, or just fix our social lives," says MIT physicist Edward Farhi, after seeing an advance screening of the film. "It is a fun idea for

a movie theater, but in terms of getting time travel right, I think you'll need to stay in the classroom."

The time-travel device in the movie, a clunky, illegal gadget that takes its looks from the first atom bomb, is set to only send people on a one-way 30-year trip into the past. The film explores the dramatic possibilities of time travel when its hit man, "Joe" meets his future self, played by Willis, sent back from the future to be assassinated and close the "loop" on his life. The future self escapes, and mayhem ensues.

In physics today only one kind of time travel, moving into the future, looks possible, Farhi says. Einstein's explanation of how time shifts for something moving close to the speed of light, for example, would allow a super-fast spaceship to theoretically send someone on what feels like a one-year round-trip that returns them to Earth to find that 100 years have passed by for everyone else who remained behind.

"But time travel into the past just doesn't look possible," Farhi says.

Not that physicists haven't tried. In 1949, the mathematician Kurt Gödel presented equations that seemed to permit backward time travel, a result that confounded his colleague, Einstein. In the 1980s, Caltech physicists proposed using "wormholes" in space to go backward in time. Those ideas seemed to rest on exotic matter or descriptions of the universe that don't appear in reality.

But in 1991, Princeton's J. Richard Gott proposed an actual machine built with incredibly dense "cosmic strings" that would in theory send someone encased within it as far back in time as the machine was built. "That actually seemed like it could work, so we took a closer look," Farhi says. The problem came with building the machine, he and his colleagues Sean Carroll and Alan Guth reported in a 1992 study called "An obstacle to building a time machine." Namely, he says, it would require "at least half the mass of the universe to build the machine."

Later, physicist Gerard 't Hooft of the University of Utrecht in the Netherlands found that even if you built the device, the universe would likely collapse in on itself when you hit the start button.

"None of this is all that important in *Looper*, which raises the paradoxes of time travel for dramatic effect, but doesn't really resolve them," says Farhi, who confesses to disappointment that time travel into the past looks impossible. "We even had a time travelers' convention at MIT once. We left out milk and cookies, sent out invitations," Farhi says. "But nobody showed up, which was too bad."

The astrophysicist and science fiction writer Gregory Benford came up with another time travel idea in his 1980 novel, *Timescape*, that offers an avenue for sending messages to the past. The novel sent particles that travel faster than the speed of light backward in time. The paradox was resolved in the story by a new universe splitting off every time a message successfully traveled backward in time, leaving people in the present convinced that their device hadn't worked while their alternate selves in the new universe benefited from their warnings. The idea is based on an interpretation of how physics works on the sub-atomic scale called the "Many Worlds" hypothesis, which basically suggests that new universes branch into existence all the time.

"I'm sympathetic to the 'Many Worlds' idea, but how come we always seem to end up on the world where time travel doesn't work?" Farhi asks. Lab results last year that suggested physics particles called "neutrinos" could travel faster than light proved to be false, making the ingredients for the *Timescape* plot unknown, at least so far.

"It just seems the universe is conspiring against travel backwards in time," Farhi says. That's no reason not to enjoy *Looper*, but you can likely scratch off your list of worries the idea of anyone coming from the future to get you, he says. "Time travel is certainly a legitimate topic for physicists to explore, but it really looks impossible."

Source: <http://www.usatoday.com/tech/columnist/vergano/story/2012/09/23/looper-time-travel/57830148/1>

## **EM HIPÓTESE ALGUMA, SERÁ CONSIDERADA A RESPOSTA NESTE CADERNO.**

Depois de fazer a leitura do texto, responda as questões a seguir em português.

**QUESTÃO 01** - No texto, o que é *Looper* e sobre o que ele trata?

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**QUESTÃO 02** - Descreva a aparência e o funcionamento da máquina do tempo apresentada em *Looper*.

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**QUESTÃO 03** - Releia o 6º parágrafo do texto e resuma o seu conteúdo em no máximo 6 linhas.?

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**QUESTÃO 04** - Diga o nome dos cientistas que contrargumentaram acerca da operacionalidade da máquina do tempo proposta por Gott e qual foi o argumento utilizado por eles.

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**QUESTÃO 05** - De acordo com o texto, em que se baseia o romance Timescape, de Gregory Benford?

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