Slow-time Station:
A Science Fiction Story about Black Holes

by Andrew Fraknoi

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Special Note: This story was published in an online science-fiction magazine called Theme of Absence *in April 2022. Unfortunately, the magazine has gone out of business, and has taken down its website of past issues. So, I am preserving the story in simple* Word *format, so people can still read it.*

I went to Slow-time Station not because I thought I could forget Sabina, but because I couldn't bear the thought of living in a universe where she was with another man. Each hour of the day was intolerable. I kept picturing them in bed, his fingers running up and down her body with the same possessive air that made me feel giddy and weightless during the years we were together.

In my frenzy of jealousy, I couldn't wait for time to make her into an old, broken woman, a skeletal reminder of the beauty whose spell I had once been under. And then I wanted her to die and be underground so long that all physical traces of her and her famous lover returned to the elemental earth. What's more, I wanted memories of her to be gone from every mind that ever knew her – every mind except mine.

That's what Slow-time Station could do for me. It worked that way for anyone who had the money and the connections. I was the younger son of Phillip Brunfield (of Brunfield Industries) and generally overlooked, as younger sons with brilliant older brothers often can be. But I used my uncle's position in the United Planets government, along with some of my share of the family fortune, to get priority. Furious as I was, I didn't care what it cost.

The purposes to which people put Slow-time Station were as varied as the roster of human desires. Deposed tyrants and scandal-bitten politicians wanting to make a new start, famous screen beauties feeling the first intimations that their looks would not last forever, inventors with an idea that technology could not yet turn into a viable product, and countless others vied for a spot on board. For a fee so large most people could only dream of possessing it, the fortunate ones could use the Station to see their personal time inch along, while time in the rest of the universe flowed at its usual pace.

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Slow-time Station had been built close to the Lyra X-5 black hole, the only one near enough to the Solar System so that Berenskov-effect ships could get there in three years. That's another thing that distinguished those of us on board the Station – whatever greed or passion had

brought us there, it had enough power over our lives to make us willingly give up six years of it for the journey there and back.

As black holes went, Lyra X-5 was larger than usual, but otherwise undistinguished. Nature had not provided it with a companion star or even a significant disk of swirling debris. Its region of no return was about 600 miles in diameter. No one ventured anywhere close to that horizon without a damn good purpose or seriously suicidal thoughts. But just above it, where the station orbited, protected from the grueling tidal forces by the best Berenskov-effect shielding money could buy, the lucky few could enjoy spartan but comfortable accommodations, thanking Einstein while watching their clocks slip out of synchrony with the rest of the universe. I had learned all about it in one of the six expensive schools to which my parents tried to send me – his general theory of relativity, which showed that the pace at which time flows depends on the strength of gravity. Thus, the closer you come to a black hole, the slower time itself runs.

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In a way, it was my fault that Sabina met Sandor Heifetz. In the third year of our tumultuous relationship, we seemed secure enough as a couple that I began to take her to family events. These were gala parties, befitting our position near the top of the United Planets corporate hierarchy; I confess, I wanted her to be impressed. Grandfather always tried to invite the most interesting people in the inner solar system at the time.

Heifetz was already a well-known medical "wunderkind," making a name for himself in genetic modification. And he was every bit as charming in person as the tri-d-web stories painted him. Little did I suspect how much of an impression he had made on Sabina, who had shown early research promise herself. Only a few meetings later, she must have sensed that his "gravitational pull" was greater than mine, and began quietly to arrange how she could switch orbits.

But I would outlive them both on Slow-time Station! Furthermore, I would also outlive whatever scientific reputation they made for themselves. I would rejoin the real-time stream only when they had been lost to human memory. For each day I spent on board my level of the Station, ninety-seven years would elapse on Earth. I had paid the exorbitant fee to return to real time only after ten full days had passed, placing nearly a millennium between me and all traces of their existence.

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Some chose to sleep through the return trip from Lyra X-5 to the Solar System, but I wanted to catch up on the news. In a thousand years, drastic changes would have occurred, no matter how stable our United Planets society was when I left. And, I admit, a strong motive for remaining awake was to experience, as soon as possible, a world free of Sabina and her lover. I reveled in being alive when they were long gone and forgotten.

Computer implants had changed a lot while I was at the Station, but a software update before we left allowed me to tap into the interplanetary Web while we were *en route*. Although

Heifetz was not a common name, I expected that even unusual names would be more frequent among the trillions of people on dozens of worlds that now made up humanity. But when I asked the ship's computer to bring up all references to that name, it replied that there were too many.

Surprised, I added Sabina to Heifetz and resubmitted my search. Still the computer asked for more specificity. I then asked for a general encyclopedia entry and was offered a bewildering variety of them. Choosing the first, I began to watch the highlighted summary in my virtual space. Then tri-D images of Sabina appeared all around me, and I thought I would go mad. In these scenes, she was exactly the raven-haired enchantress I remembered, but with a vivacity and purpose beyond anything she had shown to me.

Soon I understood only too well what had happened. Inspired and assisted by Sabina, Sandor Heifetz had found the genetic key to reversing aging. His first attempts to modify the DNA of experimental volunteers had gone badly, but he was sure that he was on the right track. After four years of additional work, the next human subject for the modification had been Heifetz himself. He had died within the year, as the promising changes to his DNA eventually led to an irreparable tumor instead of immortality.

But Sabina continued his work, and eventually found a safer version of the process. It was tried first on a few volunteers from their Institute and later, in huge Council-funded trials on each inhabited world in the solar system. Those early volunteers lived over 200 years on average. Further modifications led to version 3.0, which offered the promise of life lasting an average of half a millennium.

Sabina Heifetz became the most celebrated human in the history of our species. Cities, habitats, and moons were named after her. Her work was in the bloodline of every human alive; her image was everywhere. No stay on Slow-time Station would wipe out the memory of the woman who had liberated the human race from rapid aging and unwanted death.

Soon enough, I saw the cruel joke fate had paid on me. Whether I returned to the station or joined others of my species in accepting the Heifetz process, I would be faced with the torment of seeing Sabina everywhere for the rest of my long and miserable life.

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The Science Behind the Story

One of the most remarkable predictions of Einstein's General Theory of Relativity (his great framework for space, time, and gravity) is that the *pace* at which time runs is not fixed for everyone, but rather depends on the strength of gravity in your immediate neighborhood. The stronger the gravity, Einstein proposed, the slower time itself would run. This was a really radical idea — that the progress of time was not the same for all observers; that time, if you will, was not something that was universally shared.

Since all of us on Earth exist in roughly the same gravity, this effect could not be measured with available instruments at the time Einstein predicted it, in the second decade of the 20th century. It also meant that our common sense, which developed here on the Earth, with its uniform gravity, gave us no everyday tools for understanding such a "crazy" notion.

But later in the 20th century, both astronomical observations and experiments on Earth – done with far better tools – soon confirmed that Einstein's idea was absolutely correct. For example, in 1971, physicists Joseph Hafele and Richard Keating flew a very accurate "atomic" clock on an airplane and compared the pace at which it measured time to a similar clock on the ground. Because the clock aboard the plane was further from the Earth's center of gravity, it experienced (slightly) weaker gravity. And, indeed, it ran a tiny bit faster than a twin clock on the surface of our planet. Many other such experiments have now shown that this counter-intuitive prediction Einstein made is not only generally correct, but correct to many digits of precision.

Today, we rely on orbiting satellites to provide the GPS (global positioning system) signals to help us drive our cars to the right destination (even the right street address!) But these satellites orbit the Earth where gravity is less than on the surface. Einstein would have been pleased to learn that the signals from the satellites must be (and are) corrected for the tiny difference in time between them and our cars on the ground for the whole system to work.

The most dramatic situation in which Einstein's prediction comes up is near black holes, the "corpses" of dead stars, that have collapsed in on themselves as the star was dying. With all its matter drastically squeezed together, the black hole's gravity is outrageously stronger than gravity on Earth or in empty space. Accordingly, time would run much slower if you could venture close to a black hole. This is what the protagonist in our story does — by approaching the black hole, he slows down his own pace of time considerably, when compared to the rest of humanity.

I should mention that we don't recommend trying this experiment in real life — once you get that close to a black hole, really bad things will happen to your body. Let's assume you are moving toward the black hole feet first. As you approach, gravity would become so strong, that the pull on your feet (closer to the black hole) would be immensely stronger than the pull on your head (further from the black hole.) That would mean your feet would be pulled away from your head by a big difference in force. The human body is not particularly stretchable, so you would soon feel your feet pulled out of your ankles, your ankles out of your calf, your calf out of your knee, etc.

At that point, worrying about a disappointing love affair, as the "hero" of our story is doing, would be the last thing on your mind. (I made up something in the story called "Berenskov-effect shielding" to protect our narrator from getting stretched like this.)

But putting such practical technicalities aside for the moment, the key idea in the story is quite correct. As you get close to the powerful gravity of a black hole, the differences in the

passage of time between you and the Earth can become really significant. In that sense, the neighborhood of a black hole is one of the best examples we have in science of a real time machine – a place or gadget you can actually use to change the passage of time substantially from that felt by most human beings.

Depending on how close you able to venture to the black hole, you can make your time move at a snail's pace compared to its pace back on Earth. Which is exactly what our protagonist sets out to do, in an effort to root out all the traces of the lover who betrayed him. Little does he suspect the unusual circumstances that make that dream hard to realize, with even the best help Einstein can give him.

About the Author: Andrew Fraknoi retired a few years ago as the Chair of the Astronomy Department at Foothill College, and now teaches short-non-credit courses for retired people through the Fromm Institute and OLLI Online. He is the lead author of *Astronomy,* a free, online, astronomy book from the nonprofit OpenStax project, which is now the leading introductory astronomy textbook in North America. He writes short stories based on reliable astronomy; 13 of his science fiction stories have been published so far. He has served for several decades on the Board of Directors of the Search for Extra Terrestrial Intelligence (SETI) Institute. For more about his work, see https://fraknoi.com