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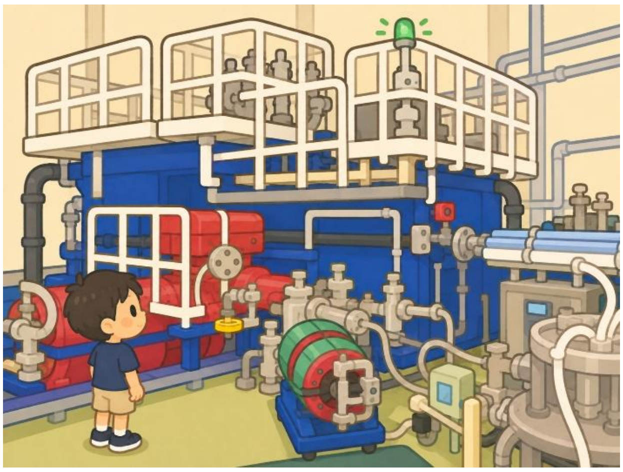
Image citation: [1]
When I was in elementary school, my grandfather, who was a researcher of a nuclear physics laboratory at Tohoku University, took me to see the cyclotron there. At the time, I had no idea why it mattered. I was mostly impressed by how huge and complicated everything was, and by how absurdly strict the safety and management procedures seemed. But in the same way little kids get obsessed with giant robots or heavy machinery, I became fascinated by accelerators and nuclear physics.
Later, after the earthquake and the Fukushima nuclear accident, my grandfather worked on applying radiation measurement techniques, such as gamma-ray and beta-ray spectroscopy, to evaluate contamination more accurately. In particular, he worked on estimating the internal radiation exposure risk from food used in school lunches, using methods based more directly on first principles instead of the simplified approximations people usually rely on. He seemed genuinely proud of that work.
At the time I was a fairly cynical teenager, so I would not say I was deeply moved or anything like that. Still, seeing him work on those problems gave me some sense of familiarity with physics and radiation. At the very least, I think I saw an example of physics being something more than just “cool.” It could actually be useful to people.
I also used to visit the National Museum of Nature and Science a lot as a child, mostly for dinosaur exhibitions. But after the special exhibitions ended, I would usually wander into the permanent exhibitions, and I especially liked the floor with the physics demonstrations. There were gyroscopes, neodymium magnets, arc discharges, little synchrotron models, and all sorts of interactive displays that felt much less like a museum and more like a playground. So in some sense I was just playing with toys. But

there were also demonstrations of things like Cavendish's torsion balance experiment and Fizeau's measurement of the speed of light. When I looked at those again later, as a middle school student, I remember being deeply impressed by how beautifully designed the experiments were. Looking back, I think I was already attracted to the idea that elegant mathematics and carefully constructed experiments could work together to produce a consistent understanding of nature across completely different scales, although of course I would not have described it that way at the time.

Another major influence came from the books lying around my house. In junior high school, I started with lighthearted, illustrated science books about general relativity and Richard Feynman's famous autobiography. They made physics feel approachable, but what truly hooked me was the rumor that theoretical physics was "beautiful but impossibly difficult."

For a socially awkward and slightly cynical middle school boy, that phrase was completely irresistible. Driven by a desire to understand this mysterious world, I began borrowing advanced textbooks by grand masters like Paul Dirac and Lev Landau from my parent's shelves. I could not understand the dense equations fully, but I was struck by their mathematical transparency. I realized that from just a few simple assumptions, these formulas could derive conclusions of terrifying power that govern the entire universe. I found this elegant logic deeply convincing, and it was what pushed me toward theoretical physics.

Right now, I work in nuclear theory. More specifically, I am interested in a theory called QCD, or quantum chromodynamics. QCD is the theory of quarks and gluons, the tiny particles and forces inside protons and neutrons.

What fascinates me is that the basic rules of QCD are very clear, but their consequences are incredibly hard to predict. When only a few particles are involved, the theory has a certain mathematical beauty. But when many quarks and gluons move together, they can create completely different kinds of behavior. They may form hot and dense matter that flows like a liquid, or they may change from one state of matter to another.

This is also connected to experiments using large accelerators. In such experiments, scientists try to recreate or probe forms of matter that are impossible to see in everyday life. Some of these questions are even connected to the very early universe, when matter may have existed in a hot and dense state very different from the world around us today.

In my own work, I am especially interested in real-time problems. That means I do not only want to know what kind of matter can exist, but also how it changes moment by moment. How do microscopic particles begin to move in unison, behaving like a fluid? How does complex collective behavior emerge from simple microscopic rules? Why do theories that appear so clear on paper become so challenging when large numbers of particles interact? While these are crucial questions in solid-state and soft-matter physics, the issue of what physical properties emerge from QCD holds a significance that marks a fundamental conceptual divide: it addresses whether the Standard Model—a framework verified by microscopic scattering experiments and grounded in first principles—can truly describe the entirety of our world. These questions are not separate from my childhood memories. The cyclotron first showed me that invisible particles could be studied with enormous machines. My grandfather’s work after Fukushima showed me that physics could matter for people’s lives. The museum experiments and the old books showed me that invisible rules could become visible through clever experiments and beautiful mathematics. In a way, I am still chasing the same feeling: I want to understand how hidden rules of nature become the visible world.

Science is a grand relay race. My grandfather passed something to me, not through a speech, but through the way he worked. Now I hope to carry that torch a little farther, by studying matter in some of its most extreme and mysterious forms. The rules of the universe are beautiful, but the mysteries left to solve are still vast. That is what I want to tell to those who are twelve years old today.

References

[1] Generated by ChatGPT.

AI Tool Acknowledgement Note: Gemini and ChatGPT was used as a generative AI tool to improve the vocabulary of the draft, refine the writing style into a more natural tone.