

## From Starlight to Quantum Computers

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In my first year of junior high school, I read a book that changed my life: *Cosmos* by Carl Sagan. It was a book about astronomy and the universe. In the book, Carl Sagan explained the stars, galaxies, and our planet Earth from a different point of view. This book showed me a new way to see the universe through science. After reading *Cosmos*, I began to see the world through the lens of science. I started asking questions about everything around me. Among all those questions, the night sky fascinated me the most. Every night, we can simply look up and easily see the stars. By observing them, we can see the past of the universe. By studying the past, we can learn how the universe may change in the future. As a 12-year-old, I thought this was amazing. Since then, I have seen the sky as a storybook of the universe.

The more I read *Cosmos*, the more I fell in love with astronomy. Then an important moment came: I bought my own telescope. I will never forget the first night I looked at the planets and stars through my own telescope. I cannot forget the first time I saw Saturn's rings with my own eyes. While watching the planets and stars, I felt that the universe was closer than I had thought. With the telescope, those stars became a new way for me to understand the universe itself. After that experience, I fell even more deeply in love with astronomy, and I became curious about everything. I tried to answer questions such as "*How was that star born?*" and "*What happens when that star dies?*" by reading books. Every night, and even during the day, I went outside with my telescope to watch the stars, the Moon, the Sun, comets and even galaxies.

While watching the stars, I had a new question. I wondered how scientists and engineers designed such large telescopes for observing faint stars. So I started to study how we can detect light and control it. While studying, I realized that light is not only something we see;

we can get a lot of information from light. We can learn how big a star is, how hot it is by analyzing the light from it. Also, we can find planets like Earth by analyzing the light.

After that, I began to think in the opposite direction: *“If light from the universe contains information, can we also put information into light?”* I was also interested in computer science, so this question led me to a new path: quantum computing. If we can control and detect light, we can use it to carry and read information. Quantum physics, which is the basic science behind quantum computers, has special rules that are very different from what we see in everyday life. Using quantum physics, we can make light that carries information in a very carefully controlled way. By using these special rules, quantum computers can solve difficult problems that normal computers need a very long time to solve. I became interested in optical quantum computers, which use light to carry and process information, and I wanted to study them.

Now, I have a new question to solve, *“How can we control light for quantum computers?”* From this question, my research started. Currently, I am studying how to create, measure, and control special forms of light for optical quantum computers. This light is very different from the light that we can see in our everyday life. This light is specially prepared based on quantum physics to carry information. These computers need careful measurements to read the information from this light. I am also studying how to make these operations faster. When we try to make the system faster, it becomes hard to control light accurately.

My goal is to create, control, and measure these special forms of light quickly and precisely. In my research, I measure special forms of light quickly and precisely, and use the results immediately to control the next light signal. With this, I am working on research to make optical quantum computers fast and precise. In the future, I hope this research will help make optical quantum computers more practical and easier to use. These computers can solve difficult problems easily in new ways. For example, they could help us perform difficult

calculations, develop new medicines, or understand nature more deeply. With this technology, we will be able to build a more convenient world and help people live better lives.

My path to studying quantum computers with light was not straight. However, every experience, including watching the night sky, was meaningful to me. My curiosity about the universe turned into curiosity about light, and that curiosity brought me to the University of Tokyo. Each experience gave me a new reason to study science and to become a researcher in optical quantum computers.

As you can see, my path has changed over time. However, my love and interest in science have not changed. A small child who loved astronomy and wondered how the universe was created has grown into a researcher studying optical quantum computers to help people. While reading *Cosmos*, I learned that science exists everywhere, and it can answer your questions to understand the universe. To me, light is both a key to understanding the universe and a tool for helping people live better lives. If something interests you, dive right in and try your best. With curiosity as your key, the door to science is always open.



(This image was created by ChatGPT5.5)

The image was generated by ChatGPT5.5. I also used ChatGPT5.5 and DeepL Write to revise the language, grammar, and wording of the essay. The content and personal experiences are my own. And I would also like to thank professor Kate Harris and my peer reviewer, Shogo Toma, for their helpful feedback.