Don’t you want to see the edge of the world?

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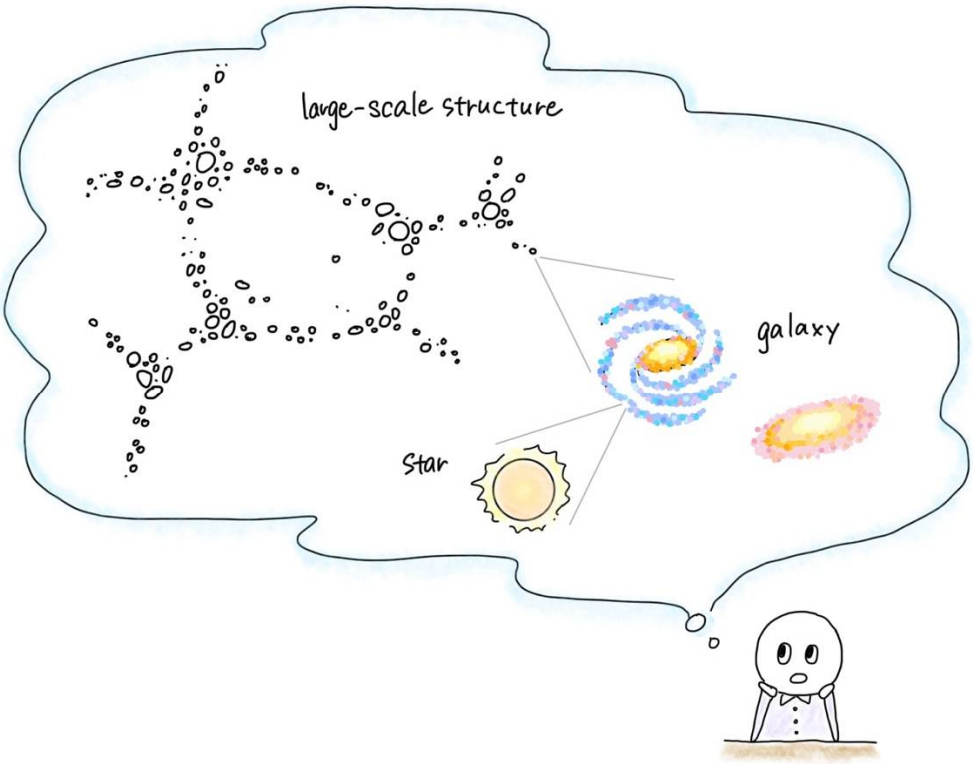

Dear 12-year-old myself,

Hope you are doing well.

I am you from ten years in the future. Now I am a graduate student in theoretical astronomy at the University of Tokyo.

First, let me explain a bit about my current study. In a nutshell, I am trying to trace back the history of the Universe, or in other words, explore the Universe farther.

Long, long ago, to be specific, 14 billion years ago, the whole Universe was born out of “nothing.” Back then, the Universe was even smaller than a grain of sand, in which everything was squeezed. As time went on, however, that tiny baby Universe grew bigger and bigger. Now it is more than 100,000,000,000,000,000,000,000 km to the edge of the Universe!

In the meantime, matter in the Universe has gradually gathered together because of its gravity to form things like galaxies and stars, and finally even the Earth. A place with a bit more matter at the beginning can concentrate more and more mass, since more matter means stronger gravity. As a result, matter is distributed in clusters, not in a uniform manner: hundreds of billions of stars, like our Sun, make up a galaxy. And hundreds of billions of galaxies make up a web-like pattern stretching out across the whole Universe. The pattern of galaxy distribution is called the large-scale structure of the Universe, the largest structure known in the world.

One way to get information about such structures is to observe light from the sky: roughly speaking, brighter regions are likely to have more matter. Yet, the reality is not that straightforward. For instance, farther objects look fainter; there are objects that emit little light even if they are very massive. So, I study how to infer actual matter distribution and sometimes the nature of celestial phenomena from observed light. The relation can be obtained, for example, by comparing objects in computer-simulated universes with mock observational data calculated from them. I believe that my study will help to make better use of observational data, which will lead to better understanding of what is or was happening far in the Universe.

By the way, I decided to study cosmology because of you. I remember you have been

interested in what this whole world consists of, how it has formed and how it will change in the future. In fact, these are fundamental questions that humanity has tried hard to give some kind of answers for ages since recorded history, sometimes by religion and other times by philosophy. In modern times, however, cosmology is probably the best way to pursue such questions: the Universe is the largest entity we know, including literally everything. Astronomy is basically about understanding what has happened in the Universe. That is, studying cosmology eventually means understanding everything in the Universe from the past to the future, hopefully.

Among many objects and phenomena that astronomy covers, my favorite is the large-scale structure of the Universe, for it is outstanding for its incredibly large size as mentioned above. What is more, you can “see”, at least partly, that titanic structure. Just imagine that tiny little yourself may be able to know about something at the other edge of the Universe. Doesn’t it sound fascinating? Plus, it provides us with good hints about the components and the history of the Universe. Especially now we have many ongoing and planned large surveys to investigate it. I am pretty excited that we can find some new facts about our world.

Now, do you feel like joining me exploring the edge of the Universe? Maybe I can give you some advice. First, cherish your moment as much as possible. I understand the entrance exams, department selection or any other kinds of tests are quite worrying for you, but I know you can make it in the end. It can be wasteful to worry too much about the future, failing to seize the irreplaceable moment you have. No need to rush through life. I suppose spending time on whatever you like to do at each point should reduce regret. After all, the time you are free to do what you want without worries is indeed

precious.

Second, you should notice that you can find numerous opportunities of learning outside of the school. One good example is books. Reading books of various topics will give color to your life. If you find some introductory books interesting, you do not need to wait to try more technical ones. It will broaden your knowledge very much and might be helpful in the future, like in college. It is never too early. Also, there should be many events where secondary school students like yourself can join exciting science activities. You should search on the Internet and please try to join a lot.

Lastly, the most important thing is to keep a sense of wonder. Question even what is thought obviously right. Stay curious about things around you. That will not only keep you excited, but also be an essential trait for scientists. It is not very easy to learn when you grow up, so just do not lose interest in the unknown.

Well, I sincerely hope for your happy journey.

See you in ten years.

Your best friend,

Your 22-year-old self

Note

Image at the top: hand-drawn by me.

Spell check: ChatGPT.

Advice: Mark Vagins and Pucheng Lu. Thank you.