My turning point in the high school

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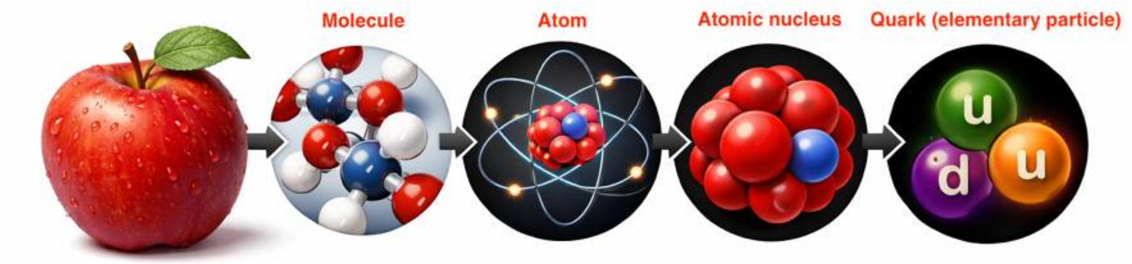
Imagine that you are standing on the ground and you have a ball in your hand. What would happen if you let it go? Of course, it would fall to the ground, but can you tell how long it takes to reach the ground or at what angle it hits? You might be able to simulate these quantities to some extent, based on your experience. However, in order to answer those questions accurately, you need physics and mathematics.

It was when I was a first-year high school student that I began to study physics. There are two teachers who taught me physics, the one who taught the basics of physics and the one who taught me some interesting things about physics which are beyond the scope most high schools offer. The first teacher taught me that the trajectory of any object can be predicted by solving Newton's equation of motion, which connects objects' positions and forces on them. It was impressive to me because the mathematical concrete solutions reinforced my intuition of this world. I became able to tell the ball's position and speed at any time and the angle at which it hits the ground, for given initial conditions.

The second teacher not only showed that physics clarifies my prediction, but he also told me that some solutions derived from physics equations betray my naive intuition. Here, I take up Coriolis' force for one example of his lecture. Again, imagine that you have a ball, but this time you are standing on the disk rotating counterclockwise around the center pole. If you throw it towards the center of the disk, how does the ball's path look like from you? Does it go straight to the center? Some of you wise readers might know the answer. However, the situation is a little more complicated than the falling ball, so I must not have been able to answer this question correctly when I was in junior high school. The answer is that the ball curves to the right as if it feels another force and it never reaches the pole. This force is called Coriolis' force, and it is responsible for the formation of hurricanes on the earth. He told me that physics can give solutions to situations even if they are difficult to imagine. I became even more enthusiastic about physics after I realized the ability for general application of physics.

In my second year of high school, I learned from the teachers that many phenomena beyond my understanding, like an object penetrating walls, occur on the quantum scale. It feels like the world of science fiction, doesn't it? Learning quantum mechanics made me realize that the true charm of physics—its capability to accurately describe even non-intuitive phenomena—is most striking in the microscopic world. This profound realization inspired me to study physics that explains the phenomena of such minuscule particles in greater depth. Since then, I have become obsessed with micro-scale physics.

That is why I have been especially interested in particle physics, whose target is the smallest components of nature, elementary particles, among many subjects offered by physics. In junior high school, I already knew objects in this world are composed of molecules, molecules consist of atoms, atoms consist of minus-charged electrons and atomic nucleus which consist of nucleons, plus-charged protons and neutral neutrons. However, the teachers taught me that there are even smaller components for nucleons, quarks. Even more, they told me that all forces in the world can be classified into only four interactions of strong, weak, electromagnetic and gravity. I became simply crazy for understanding them all.



So, I decided to enroll in the Department of Physics at the University of Tokyo and graduated from that. Now I am a first-year master's student and am joining the activity for expanding the boundary of human understanding of physics. Thanks to many researchers of both experimental and theoretical particle physics, humans accomplished establishing the standard model (SM), which describes elementary particles in this world such as electrons and neutrinos, which are ultra-light particles, and their interactions such as electromagnetic force. You may know that negatively charged objects repel each other and attract a positively charged object. This can be observed in familiar phenomena like static shocks in the dry season, where negatively charged electrons move between your hand and a metal surface. SM describes those phenomena at the most fundamental level. SM succeeded in explaining many experimental results and predicting the presence of new particles, so this represents one of the triumphs of science. Despite this success, humans are yet to make the perfect theory for describing the universe, namely "the theory of everything". I major in experimental physics, and same as other researchers in this field do, my research purpose is to test the standard model and to find phenomena beyond the model (BSM). To be more specific, I search for supersymmetry (SUSY) particles via the rare decay mode of muons. SUSY is one of the expected expansions of SM and is included in many BSM theories. In SUSY theory, any particle in the standard model has its supersymmetry partner, selectrons for electron and sneutrinos for neutrinos for example. Although this theory can explain some problems of physics remaining unsolved so that it is supported among most researchers in theoretical particle physics, none of them has been discovered experimentally. I search for them using a particle beam at an institute in Switzerland. I am hoping to confirm that this world can be described by an even more beautiful model.

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