A Dialogue between a Scientist and Philosophers

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On June 18 this year, I was given an opportunity by the Kavli IPMU to meet with philosophers at an event hosted by UTCP (The University of Tokyo Center for Philosophy).* I am here reporting what were discussed and what I thought there. The event was held to celebrate the publication of the Japanese translation of "After Finitude: An Essay on the Necessity of Contingency" by Quentin Meillassoux. The panelists included Prof. Masaya Chiba (Ritsumeikan University), Prof. Kantaro Ohashi (Kobe University), Prof. Futoshi Hoshino (Kanazawa College of Art), and Prof. Takahiro Nakajima (UTCP). I myself joined the second part of the event, "Headlands of Physics and Philosophy," where I presented the latest cosmological theories, including multiverse cosmology, and participated in a discussion with these philosophers.

My first impression of the discussion was that science and philosophy have a great deal in common in terms of the themes they deal with. In fact, many of the questions discussed (e.g. what is "time"?) are almost precisely those studied in modern theoretical physics. Of course, the roots of science and philosophy are the same, so this may not be very surprising. However, the similarity of the questions asked in the two disciplines was sufficiently remarkable for me to take note of it.

* This event was held on the University of Tokyo's Komaba Campus on June 18, 2016.

Photo: Courtesy of UTCP

On the other hand, as for the approaches to the problems, there are noticeable differences. An example of this can already be found in Quentin Meillassoux, the main topic of the event. As far as my limited understanding can tell, the questions asked (in the language of physics) include "Why can we be sure that any law that has worked before will keep working in the future?" and "Is it possible to imagine a world in which there is no fundamental law even though there may be some rules that are stable enough to apply to limited time or circumstances?" (This summary most likely does not capture the philosophy of Meillassoux very well, but at least those are the questions discussed at the event.)

What science says to these questions is, at least in my opinion, very simple. The answer to the first question is "We can't be sure." The answer to the second question is "It may be possible to do so, but

From left to right: Takahiro Nakajima, Futoshi Hoshino, Yasunori Nomura, Kantaro Ohashi, and Masaya Chiba. (Photo: Courtesy of UTCP)

we do not." These answers clearly show that science is a methodology. Science is a methodology in which we go forward by assuming that laws obtained by observation and theoretical consideration apply beyond the systems in which the laws were originally found. Of course, it is possible that predictions of such laws disagree with phenomena actually observed in (future) experiments, in which case we try to find new laws that explain the new phenomena and reduce to the old ones when applied to the original systems. However, there is no guarantee that such attempts always work—it is only an assumption (or hope) that they will. The reason science does things in this way is simply because it has been successful. In this sense, science is always empirical.

On the other hand, this methodology called science is (or at least has been) extremely powerful. In a sense, we might say that a reason for the explosive progress in science in the 20th century came from the decision to not pursue the kind of questions Meillassoux is asking. (In the past, such questions must have been studied as "science" questions.) Of course, this does not mean that asking these questions is meaningless. It simply says that science has explicitly put them outside its own applicability.

In this sense, multiverse cosmology, which I presented at this event, might have disappointed philosophers. This theory predicts that our universe can change (decay) into another universe which is ruled by laws different from those in our own universe. This, however, does not mean that the rules disappear, as Meillassoux imagines. It simply says that the rules which we once thought fundamental may not be as fundamental as we thought, so they can change. And importantly, we believe it is still possible to predict or calculate what kind of universes appear with which laws using deeper (more fundamental) laws, at least in principle. The approach of multiverse cosmology is exactly that of science.

What does the advancement of science really mean? Ultimately, it is to find a set of rules that explain the observed phenomena with a smaller number of assumptions. In particular, an "answer" to a question which does not reduce the number of assumptions does not have much scientific value. (If we answer the question "why is A, B" with "because C is D," then it merely immediately leads to another question, "why is C, D?") Putting the historical perspective aside, this is precisely the reason that the heliocentric model is superior to the geocentric model. As far as the solar system is concerned, the Ptolemaic system could predict the motion of planets reasonably precisely, but it requires many more assumptions than Kepler's three laws. An important point here is that history has repeatedly shown that a theory composed of simpler—or with a fewer number of—assumptions has a wider range of applicability. For example, Kepler's laws—or its more advanced version, Newton's laws—have a form that does not depend on the specifics of the solar system despite the fact that they were originally found by studying it, and hence can be used beyond the solar system to study the universe. What science is doing is performing repeated applications of this logic. The cutting-edge inflationary or multiverse theory is no exception.

Another question discussed at this event was "What is reality?" Science also provides, in my opinion, a clear answer to this question, which is "We don't care." Are quarks "real"? Of course, quarks cannot be isolated as asymptotic states. On the other hand, using the concept of quarks tremendously simplifies the description of the theory. By this, we say that quarks exist. If you don't like the words "exist" or "real," you might not use these words. It does not, however, change the fact that the concept is useful, and this is enough. The same applies to many other things—in fact most of the modern concepts in physics—such as spatial dimensions in gauge/gravity duality.

As we have seen, in considering what science is, determining what we do not ask plays an important role. In this sense, science is crucially different from (and complementary to) philosophy, which contemplates everything. On the other hand, we need to be careful in determining the questions we do not pursue. It is often stated that the definition of science includes testability in experiments or falsifiability. In my opinion, the application of these criteria must be done very carefully. Did many people think that inflationary cosmology could be observationally probed when it was proposed? Note that there were no discussions on density perturbation in most of the very early papers. If scientists at that time had regarded inflationary cosmology as falling outside the realm of science and had not advanced it, then there would not be precision science in this area, represented by, for example, satellite experiments.

I think something similar applies to string theory and multiverse cosmology today. It is dangerous to conclude—as some people do—that these theories are not scientific because they do not lead to predictions that can be checked immediately by experimentation (although these theories do have implications that can in principle be tested by observation, for example, the sign of the spatial curvature of our own universe). It is also dangerous to undermine the scientific value of these theories because their predictions and implications are only indirect (not one-to-one). In fact, if applied strictly, such a criterion would undermine virtually all modern theories, such as grand unified theories. For example, even if proton decay were discovered, it would be easy to construct theories other than grand unified theories which lead to decay. We must be careful not to restrict excessively the definition of science. (To be clear, I am not objecting to the use of these criteria to choose one's own research theme. I am referring to the danger of evaluating all research based on these criteria.)

In any case, things like those discussed here have probably been considered by any scientist, but it was useful (at least to me) to recall them explicitly through discussion with philosophers, who are gurus when it comes to thinking. It may be true that the relation between science and philosophy is not as close as it was centuries ago. However, it would also be true that interactions between these two disciplines can still lead to intellectual excitement. This event made me think that such is indeed the case.