Round Table Talk:
Lisa Randall with Hitoshi Murayama and Hirosi Ooguri

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Warped Extra-Dimensions sold well in Japan

Ooguri: You have already been to Japan a couple of times and your book, *Warped Passages*,[*1] which has been translated into Japanese, has sold quite well. We saw it on prominent display in great numbers in a bookstore.

Randall: Before my book even came out, my interview with the astronaut, Koichi Wakata, was shown on television and that interview was turned into a little book.[*2] So when my book came out, it had already been widely promoted. I was very impressed by how interested Japanese people were in science.

Murayama: I think I told you before that your book saved me once. Soon after I was appointed as a director of IPMU there were "who is this guy?" kind of discussions in the blogosphere, and then somebody pointed out that by looking up your book, my name could be found in it. So, it was like, "OK, well at least this guy isn't crazy or anything."

Ooguri: That is a great credential.

Randall: It is excellent. I was very impressed. I mean, I think everyone here in Japan handled things really well and they were great.

Ooguri: Do you have an impression of how Japan is doing in basic science, specifically in the particle physics area?

Randall: I think Japan is doing extremely well, especially with a new institution like IPMU. It is actually a big deal to get so much activity going on there. Moreover, they have many good experimental programs in progress, particularly in keeping up with international competition in neutrino and B physics, and of course in string theory as well. What do you think, Hitoshi?

Murayama: First of all, you should definitely come and visit IPMU; we are really hoping you will accept our invitation. Right now, this World Premier International Research Center Program is focusing strongly on having an institute in Japan, which is really international. We have just achieved a milestone in having more than half of the members being non-Japanese.

Randall: So how are the Japanese taking that? My first impression when I arrived in Japan was that everyone is Japanese. How is it working out in such an environment?

Murayama: When IPMU was launched, there was sort of a misunderstanding that this would provide new job opportunities for many young Japanese researchers. The people who were under that impression were obviously a little disappointed because there were not that many job opportunities for Japanese applicants. But at the same time, Japanese researchers were excited about the opportunity to interact with so many researchers from outside of Japan.

*1: *Warped Passages: Unraveling the Mysteries of the Universe's Hidden Dimensions* (Allen Lane at Penguin, June 2005, ECCO Press at Harper Collins, Sept 2005). Japanese version published by Japan Broadcast Publishing Co., Ltd., Tokyo, June 2007.
*2: *Extra Dimensions Exist* (in Japanese), Lisa Randall and Koichi Wakata, Japan Broadcast Publishing Co., Ltd., Tokyo, May 2007.

It is very good to get all the cross-talk

Randall: That makes a lot of sense. Obviously, it is very good to get all the cross-talk. And even when you are in Japan, it is interesting that you tell the difference between Japanese who have been abroad, and Japanese who haven't.

Murayama: That is interesting. What is the difference?

Randall: The interaction style is somewhat different. As you know, our style of interaction is a little bit different. We tend to interrupt-- things like this,--be a little bit more free form. It is not as respectful or observant of hierarchy…

Murayama: I do not want that to happen; so one of the really big things about IPMU is that we arrange our organizations to be flat; there is no hierarchy; everyone is pretty much on an equal footing…

Randall: Really? That is a big change.

Murayama: Yes, it is a big change in Japanese culture.

Randall: Is that working?

Murayama: It is working quite well so far. One of the things which most people pointed out to me at the beginning was that now that we have mathematicians and theoretical physicists, experimental physicists and astronomers under the same roof, the traditional thinking would be to create four departments, each of them headed by some senior person and having its own hierarchy. I said no, that would create just the same thing over again, so we do not want to do this. So, there is no department, everybody is in the same group, and we discuss all the hiring jointly and there is no real distinction between a senior professor and a junior professor. So that is the way it is organized. And all of the postdocs that we have hired so far look very happy. There is a German and Italian couple and they have a blog[*3] on the web. You can see that they have been enjoying life in Japan and see it as an adventure.

Randall: So this blog is a kind of access tower…

Ooguri: Actually this blog helps us in recruiting new researchers from abroad. They can be rather anxious about moving to Japan and the blog gives a firsthand account of how this couple was able to find an apartment, open a bank account, and so on.

Randall: My impression from my visits to Japan was that the people are extremely helpful and communicate with people very kindly. They are very respectful to visitors.

Ooguri: Well, there are of course linguistic barriers and also differences in custom. When Hitoshi gave a public lecture at Kashiwa, where IPMU is located, in Chiba prefecture, he solicited volunteers to help. Many people who were fluent in English signed up to help scientists from abroad get settled in Japan.

Murayama: If you imagine, for example, yourself getting appointed for a position in Japan, what would you see as a difficulty – a sort of mental block, psychological barrier, logistical issue? We have to keep working on those things. So maybe you have good suggestions…

Randall: I guess taking a few people together is always a good idea so that it is not just one person in an isolated environment. And having a couple of conferences along the way so people have some center of activity, just to stimulate things, just to get certain things started in particular research areas. I guess having other people there and, of course, having some resources. Traveling obviously is complicated and it would be important to be able to travel on a regular basis, so they do not feel too isolated. Aside from what I have mentioned, what did you think are the important issues?

Murayama: One of the things is just the psychological aspect. Just going to a different country is already a little scary, and also the common fear is that once somebody from the USA moves to Japan, there is the fear that that person may not be able to come back to the US later on, losing exposure and stuff like that. So we are putting a lot of emphasis on the fact that we actually force each one of them to spend at least 1 month every year outside Japan, so they are not allowed to stay the entire year in Japan. So we are strongly encouraging people to spend time abroad and get themselves exposed, and also at the same time get IPMU itself exposed. We are also allowing them to be away up to 3 months. So that seems to diffuse the fear among many of the candidates.

Now switching gears a little bit. What are you excited about lately about science, particle physics, cosmology…?

Recently, I have been interested in dark matter

Randall: Recently, I have been more interested in dark matter because there is a lot that just has not been thought out. Also, as you know, there are a lot of experiments that indicate dark matter. We seem to be coming to the point where we are really expecting to see some impact. That is one direction for my interest.
The other direction I have been thinking about recently is connecting to some more formal string theory

*3: http://chipango.wordpress.com/

models. From my perspective, there is a lot of interesting work in string theory, but what is interesting is if it tells us something new that we have not thought about in terms of particle physics models. There are things that might look unnatural from a lower dimensional perspective, and you can barely understand them in terms of some of the symmetries etc., but from a higher dimensional perspective sometimes there are some ideas that come out more naturally or more elegantly. It is really something that makes sense in extra dimensions. For instance, lately I have been thinking a little bit about F-theory models, which give you motivation for believing the generation number of quarks and leptons and a particular form for their mass matrices.

Ooguri: What seems to be natural depends on perspectives…

Randall: It is something that I would not necessarily have thought of from a lower dimensional perspective. It really introduces a whole new set of theoretical tools and ideas.

Ooguri: I see. IPMU could contribute in any of the areas that you are interested in. Hitoshi should tell you what is going on at IPMU.

Murayama: When we proposed this institute, I listed five questions, mostly, of course, for people who are outside of the field: what is the universe made of, how did it start, what is its fate, why do we exist in this universe and what are its fundamental laws? And I know that each of you are well aware of the significance of these questions. One of the things I emphasized to people outside the field is the following: if we ask the question about how the universe started, actually we are talking about singularity and physicists do not know how to deal with singularity. But mathematicians can define what they mean by infinity and compare different sizes of infinity and stuff like that. So this is really the area where mathematicians can come in, possibly resolving or defining the singularity in a meaningful way, and that way we can foresee some meaningful interactions between physicists and mathematicians.

Randall: Do you see meaningful interactions possibly even at a more immediate level? I mean if there are really genuinely new ideas that come in terms of model building as well. This does not always happen.

Murayama: Actually something happened at IPMU already. One of our young phenomenology guys recently collaborated with a mathematician, an algebraic geometer, precisely because of that reason.

Randall: Great. This is sort of understanding black holes or cosmology on a more abstract global level, in geometry or algebra. But at some level, I think, the interaction works both ways and is very important because it is very nice to categorize all possible geometries. But there are some physical questions without answers. So, I think it is good for people to be thinking along these physical lines as well. When you are doing things that way, I think that you most likely to progress. So, I think having standard tools for coming in and asking different questions really makes progress in ways that we have not done before.

Murayama: Now, let me talk about the projects we are involved in. On the astronomy front, we are building a new camera for the Subaru telescope, which is an 8-meter class telescope. It is pretty much the same size as Keck but the structure is much more rigid. As a result, you can mount a much bigger camera on the structure, which gives you much wider field of view. In one shot you can take an image which completely encompasses the full moon, and that will make this telescope an ideal survey telescope. So, the plan is to have the entire northern hemisphere surveyed to build a 3-D map of dark matter using the weak lensing effect and that in turn would give you information about the equation of the state of dark energy. At Kamioka, we have the plan of going on the Super-Kamiokande and one professor we hired is trying to convert Super-Kamiokande into a different style of experiment that can look for neutrinos in supernova explosions at cosmological distances - billions of light years away. It is called GADZOOKS! The real R&D is just about to start because of IPMU. And also there is another guy trying to convert the KamLAND experiment into a neutrinoless double beta-decay experiment by dissolving gaseous xenon in the liquid scintillator. And finally there is a new experiment called XMASS that is starting now for direct dark matter detection using 800 kilograms of liquid xenon.

Randall: Is XMASS definitely going to test inelastic dark matter?

Murayama: They claim that they have two orders of magnitude compared the current limit.

Randall: Great. As for dark matter, I'm also interested in DAMA data.

Ooguri: Do you seriously take the announcement of dark matter detection by the DAMA experiment?

Randall: I'm only a theorist, so I do not pretend to know if that is real. But, in this case I think there are reasonable explanations for it and also you can make interesting predictions for future experiments. So I think in terms of our role as scientists, this

is what we should be doing. The detector sensitivities have really gone to the level that you might really hope to find something. So I think while we are waiting for the Large Hadron Collider (LHC) to return[*4] this is a very good thing to be thinking of.

What do you expect of LHC?

Murayama: Let us pursue this. I am sure you have been asked this question all the time: What do you expect from the LHC?

Randall: I do not know what to expect. I think we will find a Higgs boson. Rather than saying what we expect, I think one of our responsibilities is to say what we should be on the lookout for and try to make sure that we are not missing things because we were not clever enough to figure out ways to look for them. In terms of what we will find, I am not betting on that.

Murayama: Not even on warped extra dimensions?

Randall: I would not give anything more than 5% probability at this point. It is not that I think it is impossible. There was definitely a time when it seemed that no matter what they found they were going to call it supersymmetry for at least year or two, until they figured out what it is. I think it is good to go in and say we really do not know what is there. We are just going to look at it with a clear view and see what is there, and then we will try to put it together. Of course, I would like it to be warped geometries, but I would like it to be anything. So you would not say it is definitely supersymmetry at this point?

Murayama: I would not say that. I would love to see supersymmetry and I have been pushing that idea for a long time indeed. But it is also true that there is no guarantee that it is there within the reach of the LHC.

Randall: And it is looking a little worse because we have not seen any sign of it.

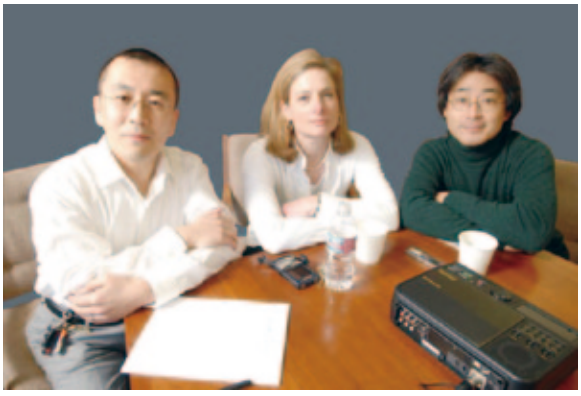
Murayama: Right. Especially in B physics experiments, which have been so dead-on correct with the Kobayashi-Maskawa theory.

Randall: I will tell you one thing that I do really like about extra-dimensional theories in general. I really do think that these are the first theories that give some compelling explanation of flavor. We have this huge clue, because neutrino mixing angles are big and quark mixing angles are small and it has to be telling us something. We have this interesting structure that the Kobayashi-Maskawa matrix is almost the identity. We have all this very powerful information, and I would say that all these extra-dimensional theories seem to give some compelling explanation of this.

Murayama: It is time for the last question. Do you have any messages especially for young people entering the field of studying stars?

Randall: One thing that I have really appreciated in Japan on my visits is how much people get excited about science, and how seriously they take it that we really can know more about the universe and about what things are made of. Science is a process of finding. I would like to emphasize that many people can contribute to its progress. Now that you are bringing a new institution to Japan, we really do to some extent look at Japan. It is a really remarkable thing that they did create this institute. It shows that Japanese people have respect, attention, and excitement about physics. Progress in science does not happen overnight. I think there are these deep questions about the universe that will be answered by having a large group of people working together over a period of time. It is a very important thing and it is just great that Japan has appreciated that.

*4: LHC at CERN is a proton-proton collider with a center of mass energy of 14 TeV. After the first collision in September 2008, LHC developed a liquid helium leak and it is now undergoing repairs. LHC is expected to resume collisions in November this year. See a related article in *IPMU News* No. 5, pp. 4-7.



Left: Hirosi Ooguri; center: Lisa Randall; right: Hitoshi Murayama.
Lisa Randall is a theoretical physicist working on particle theory and cosmology. She is famous for her particle physics models based on "warped extra dimensions." She received her Ph.D. degree from Harvard University in 1987, and has been a professor at Harvard since 2001. Before returning to Harvard, she held a professorship at Princeton University and MIT. She received numerous honors, for example, membership of the National Academy of Sciences in 2008 and the Julius Lilienfeld Prize from the American Physical Society in 2007. This round table discussion was held at the California Institute of Technology in February 2009 when she was staying there as a Gordon Moore Distinguished Scholar.