

International Heliophysical Year interview transcript

I'm Joe Davila. I'm in the solar physics branch here at Goddard. My official title is Senior Scientist, Heliophysics Division, and so my main job is solar research.

Nat Gopalswami, also from Solar Physics Laboratory of Goddard Space Flight Center. My main interest is in solar and solar-terrestrial physics. I work on CMEs and their impact on Earth – basically space weather stuff.

I'm Barbara Thompson. I work in the same branch as Joe and Gopal, and I work on basically the same research.

JD: Well, I think the first thing we want to cover is what the IHY, or International Heliophysical Year, is or was. And basically it was conceived as a follow-on to the International Geophysical Year in 1956 and '57. Fifty years later was 2007, and so we wanted to do a similar project where you could study some of the larger problems in heliophysics, that is, problems that go across the traditional boundaries of the science we do. Like, I'm a solar scientist, but the sun affects the interplanetary medium and the Earth and other planets. And the idea was to study this larger system and use this kind of project to facilitate that and encourage that.

BT: And it was the first major program that used “heliophysics” in the title in the United States.

JD: That's right.

BT: People before, they just had “heliophysics” being the sun, and this was the first major program that used it as an interconnected extension of geophysics, being the realm of the sun and all of the sun's influences.

NG: So, the International Heliophysical Year was supposed to be in 2007, and the “year”, of course, extended up to 2009. So we had a lot of interesting programs, mainly involving scientists from all over the world. We had more than 76 countries participating in the activities. So we had all kinds of activities that were conducted under this program. I can mention three of them. One is doing coordinated science, trying to collaborate and put a lot of databases together for a particular ??? problem. And another is schools. We conducted schools for master's degree students, PhD students, and young scientists who were not exposed to this kind of broad, interdisciplinary science. And also, in many countries there were interesting outreach activities. People created exhibits, made people visit observatories, and they really interacted with the public and told them about the beauty and elements of heliophysics.

BT: Gopal was our international coordinator. We were hoping to have a couple dozen countries, I think, participating. And Gopal managed to get every continent and how many countries?

NG: 76

BT: Yeah, 76 countries. It was with committees. More countries participated, but 76 had an official program, and then there were scientists in other countries that were participating on top of that. So he was wildly, wildly successful beyond what we thought we'd be able to accomplish.

JD: And the beauty of this program was, although we organized and coordinated activities, the specific activities in each country were supported locally. So this gave space scientists in the individual countries reason/motivation to go to their governments and say space science is important and should be supported as part of the science activity. So in a lot of countries that was a very motivating factor for getting space science in universities and colleges and, as Gopal says, to the public. So I think we're really, really proud of that.

BT: Yeah, especially in developing nations. When a developing nation participates in a program with wealthy countries, they tend to get lost in the mix. But by having the developing nations be leaders in their areas and determining what is appropriate for their areas – the research, the outreach, and things like that -- it meant that they get the attention that they needed from their governments and also from their people, and it meant that they'd be much more likely to have a long-lasting impact. And it was something that I think really stood out about IHY is how much the developing nations really did have a strong scientific and public presence. And it was because the people who thought they knew what they were doing needed to let go and trust the locals to know their people better and their governments better.

JD: It was far beyond anything we ever expected or conceived of. It turned out much better than we thought.

NG: One of the important aspects of IHY has been the collaboration with the United Nations.

BT: Yes, yes.

NG: So the United Nations has a program called the Basic Space **Sciences** Program, and it very nicely fit with what we wanted to do. And they helped us organize one meeting per year since 2005, even two years ahead of the actual start of the IHY. And the United Nations would provide travel support for, say, about 10-15 scientists from developing countries. Then we would try to match them with scientists from developed countries who can deploy some instruments, ground-based instruments, to observe space and their ionosphere, atmosphere, and even the sun. And that program became very successful.

BT: Oh yes.

NG: When we started, there were not many instruments or programs in Africa. But then by the end of the IHY program, there were about 1000 instruments deployed all over the world for IHY. I think that is one of the biggest achievements of IHY.

BT: Absolutely. I think that's why IHY, we called it International Heliophysical Year, but it became clear it couldn't be one year. Because if you want to study the heliophysical system, the time it takes for the solar wind to get from the sun to the end of the heliopause is months and months. And so already, if you're trying to collect data, you're spending a good part of your

year. But we had to have a year which was really getting these instruments ready and online and deployed and getting everything going. And so 2007 was nominally the deployment year, and the 2007-2008 cycle was the deployment, and 2008-2009 was using the instruments and the scientific part of it. But this was a humongous impact of IHY, I think, was that the ability to deploy instruments in these developing regions meant that, first and foremost, there were measurements where they weren't before. And particularly in the case of the Earth's ionosphere and atmospheric processes, these were really vital. But also it was linking the scientists in these developing countries to vital, really important science. Because unless a scientist in a developing nation is doing science that is important to the entire world, their impact doesn't last, their presence doesn't last in the intellectual community. And their viability is much enhanced if they are providing these vital measurements. To me, the greatest success of IHY was the ability to involve the United Nations and incorporating the science, the fundamental science, in it. And Hans Haubold, he's the fourth person. Joe is the Executive Director, I was the Director of Operations, and Nat is the Director, the International Coordinator. Hans Haubold was the fourth person in Vienna at the United Nations. He runs the Basic Space Sciences Program. And he threw himself whole-heartedly behind IHY, making it a United Nations program and...

JD: His support was...he was crucial for the success. No question about it. Don Wentzel referred us to Hans, and Hans visited here. We had some discussions, and he said...

NG: That was in 2004.

JD: 2004, 2003, something like that. And after we discussed what we had wanted to do with the instruments and stuff, Hans said he was going to dedicate his meetings for the next five years to this project, and that really got the thing rolling.

NG: It's not only the workshop support, it's also the mission they had in distributing our material, in translating the brochures in six different UN languages, and mailing all of those to various countries. 191 countries they were mailing this material to. So I think they helped us to popularize and also excite the member nations of the United Nations.

BT: And they published many books, many pamphlets and things. Their publications were very...we got...

JD: It was great.

NG: I think we had about 3 or 4 books that were published based on various aspects of IHY. One is about the entire activity edited by **lead author** Barbara. And we had a book on universal heliophysical processes as an outgrowth of a summer school. And then we had an IAU symposium, International Astronomical Union symposium, dedicated to IHY that was held in Greece. And there were some very nice proceedings brought out after the...

BT: You and Dave edited that, right?

NG: That's correct. So these are really...

BT: Dave Webb of Boston College

NG: Right. He was also a member of the school committee.

BT: He did a tremendous amount of work for IHY.

NG: The books are really a very good record of what went on during the IHY.

JD: So I'd like to mention one other thing about the history of IHY, if I could, which is that essentially this started with the International Polar Year in the 1870s. There was an International Polar Year organized, basically by European scientists to study the polar regions. And then there was another one in the '30s, and then that led to the IGY and the IHY. But the kind of connection that I thought was nice with the IHY was we were able to do our kick-off meeting for the International Heliophysical Year in Vienna. We had a workshop at the Austrian Academy of Sciences. And the Austrian Academy of Sciences, and in fact the room that we visited, was the room where the first International Polar Year was proposed by an Austrian naval officer, Karl Weyprecht in around 1870. So it was nice to make this connection back to Austria. It turns out the Office of Outer Space Affairs for the United Nations is also in Austria; it's in Vienna. And so this was a nice connection all the way back to the past that, for me, was a good thing.

BT: So we had this huge, beautiful opening ceremony in the Great Hall at the UN, and that was just really beautiful, and then went straight to the Austrian Academy of Sciences to start to continue that legacy of the IPY.

JD: It makes you feel connected to these people so long ago. They were going in wooden ships up into the polar regions and spending years there in ice-bound cabins measuring the Earth's magnetic field. This was science in the old days, and we have it a little bit easier.

NG: But one thing was clear: that people wanted to cooperate. And initially they did just the poles of the Earth. Then during the IGY period they concentrated mainly on the fluid envelope, like in the atmosphere. And then we expanded it to the entire heliosphere. So it's a multiplication in the scale of physical phenomenon we were exploring. So IHY basically dealt with the entire solar system, both its neutral material as well as the plasma. So that's the beauty of IHY.

BT: This was a year of years, because the IGY was, by far, the most successful scientific collaboration that had happened. And so, on the anniversary there is another IPY, there is an IHY, there was the Electronic Geophysical Year, which focused on...

NG: ...data systems...

BT: ...yeah, bringing it all into the digital age, and then there was the International Year of Planet Earth, which focused heavily on the people and our living environment. And all four worked...early on, it was Charlie Barton of the EGY who got us all together. In 2004, I think it was, right. Yeah, yeah. And another historic site, the Cella Montana in Rome. And we all were able to, that way, set up a nice collaboration.

JD: Right. We all agreed to work together and support each other in these different years. Each one had a slightly different focus, and it really worked out well.

NG: Yeah, it shows that the field has grown so much over the past fifty years that we cannot put everybody together. And I think this division of IPY, IHY, EGY really helped in focusing broader issues, at the same time issues that can be tackled by smaller groups. So I think, in a sense, it was good, and they knew about each other's work, and occasionally we met together. So I think it was overall great.

BT: It was nice supporting each other. We got support from all the groups, and we supported them. We had our history program, where we recognized and honored and collected material from the original IGY for the participants, and they got a special pin and certificate and everything. And we did that for all four of the Years, and so any of them that had someone they could...

JD: This was the great idea that Barbara had, which was called the IGY Gold Program, where people who had participated in the IGY fifty years before could submit their story or an artifact and receive a pin and a certificate. And we ended up getting 290-something of these. I signed them for IHY, and some of the letters I would get back would be really moving. They really appreciated that someone knew they were in the IGY and that their work was appreciated. So that was also a really good thing.

BT: Yeah, they were excited. Joe noticed that it was, gold was, the 50th anniversary, so they called it IGY Gold.

JD: I think a lot of people really were happy to see that somebody recognized them after so many years.

BT: And we got some neat connections from that, just by people finding out about it. We got Allen Shapley at our IHY United States meeting in 2006, I think, in Boulder. This was the preparatory one. He was the co-chair of the United States IGY committee.

JD: He was Sydney Chapman's assistant.

BT: Alan Shapley was a very famous character, and he was our keynote speaker at the dinner, and we all had such a wonderful time.

NG: But the IGY was conceived somewhere in Beltsville in Maryland.

BT: We went to the house once. James van Allen was here, and it was his house. And I think we had, in Italy in one of the history sessions we ran, which was really interesting, the debate was, James van Allen's wife, Abigail. There was a claim that Abby was actually the one that suggested the IGY. They had this little cocktail party because van Allen was supposed to meet Sydney Chapman -- these famous, famous people, and there were some other famous people there -- and they were talking about these great campaigns and these wonderful things. And they said well, the Polar Year, that was a big thing. One of the historian's claims that she was the one

that noticed, well, the 50th anniversary is coming up in a couple years. So she always hems and haws around it. She doesn't want to take any credit from them. But there's a couple people who say it was her idea. (laughter)

NG: Also, in a science way the sun did something funny around 2007. It started acting in a wimpy fashion in the interplanetary medium. (laughter) The solar wind was slower and the activity on the sun was also slower. So we ended up having a science group called the Whole Heliospheric Interval. They wanted to decide, what is the state of the heliosphere from this period? And then it triggered a series of investigations on the solar extrema, how the sun behaves sometimes like Maunder minimum, or where there are no sunspots at all, and things like that. So maybe the sun is going through a similar global minimum, maybe in the next 20, 30 years. So that started a very interesting investigation. And I think at the very beginning of this month, there was an IAU meeting in Argentina just focusing on this low activity of the sun. So that was actually started during the IHY meeting as one of the science investigation groups. We call them CIPs, Coordinated Investigation Programs, and this is one of those. So I think that is still going on, and probably it will continue for some more years.

BT: Yeah, we had 200 people signed up for it, just instruments and data from all over the place.

JD: There were about 67 research projects going on, most of them pretty active, and a few hundred people involved just in those projects.

BT: So that was nice. It was successful in that. The research was going to happen, but to provide an ability to have a focus on it and bring all the people together on it, it happened so much quicker. Eventually we're going to learn this stuff, and eventually it's going to come out. But it's so much more efficient if you bring everyone together who is working on it and have them focus on it. It comes out much, much more efficiently. We just so happened to be coming up on an unusual solar minimum. That was a little bonus, in that we had something even more unique about the 50th anniversary of IGY to focus on.

JD: So I guess it might be interesting to talk about where the idea came from for IHY. I guess in 1957, I was in the 2nd grade, and we used to get the Weekly Reader. And the Weekly Reader had all these rocket pictures every week and stories about the IGY and people in Antarctica, and I guess that made an impression. And around 1999, it occurred to me that this anniversary was coming up and that, gosh, we should do something. So I actually tried to convince some other people to lead us in an international year of some type -- some more famous, more prominent people to lead us in this, and basically they declined. And so rapidly it became apparent that, if it was going to happen, we would have to do it, and it would be whatever we could do. And I enlisted Barbara and Nat, and we started having sessions at various science meetings. We had at least five AGU meetings where we had sessions or discussions. Nat organized a bunch of sessions at meetings.

BT: There were special sessions at just dozens and dozens and dozens of meetings.

NG: Initially we only had about 2 or 3, 4, 5 people. Slowly it grew.

JD: So the first session...I organized a session at the COSPAR in Houston, which I think was 2002. And I had a really great program. I had Bob Helliwell from Stanford, who had been involved in IGY, and Akasofu, who's a very famous auroral physicist, I think he was Sydney Chapman's student. And I had....

NG: Emax(?) was there. I don't know whether he gave a talk or not, but he attended the IHY session we had.

BT: Kathie Olsen was Chief Scientist at the time.

JD: What struck me about this session was how few people were there. So we ended up scheduled against an LWS session in which they were talking about how to fund LWS projects. And I think we had the speakers plus about five people in this session.

BT: You never want to go up against money. You never want to go up against money.

JD: I know. At the end of this session, I was so discouraged. This was never going to happen.

NG: But speaking of money, I think NASA did support a round of proposals for IHY instrumentation.

JD: Yeah, we should definitely thank them.

BT: LWS in fact. Living with a Star, that was a new program.

NG: Big support. NASA scientists generally are not encouraged to do ground-based work, but I think this is something they realized, that we can study space from both space and ground. So I think they supported one round. And that really helped to bring a lot of people together, and they proposed instrumentation. And that, coupled with the UN support, the observatory deployment program really became very prominent. I think I would say, at the moment it's one of the biggest instrument networks, I would say, in the world right now.

JD: Certainly the biggest cooperating instruments. I don't know if we're all in a network, but everyone is cooperating together.

BT: I think we learned a lesson there, which was that the United States is so full of programs and initiatives and campaigns and yada yada yada...they were just flooded with it. And it became clear that IHY, if it was all about the United States and other similar, very highly scientifically supported nations, it would just be "yet another program". But if IHY found its heart in places where there wasn't a lot of things going, in other words, where was IHY going to have a large impact? It had to be outside the United States. And sure enough, if you look at newsletters from fifty years ago, you see IGY and everything. If you look at newsletters now, it's "acronym city". I mean, there are so many programs. We've been very successful in lots of these things. And IHY, we started after that really focusing outside the United States and understanding what truly we could accomplish by looking at areas where we could make a large difference. And certainly when I think of all the legacies of IHY, they're not in the United States. They are in other areas.

We have a lot of science support. We have a lot of observatories and things. The places where IHY really, really had impacts that lasted, in particular, were in developing nations, nations that people don't usually think of as major scientific nations.

JD: So what we did was we found that we could help people do new science by putting very inexpensive instruments in new places. The ionosphere over Africa was very poorly observed, for instance. So just by putting instruments that cost a few thousand dollars in Africa, you obtain new science there and study of the equatorial region, and in particular, the equatorial region of Africa. That's the motivation for this, was to find people who wanted to supply these instruments, that wanted to do this science in a broader geographical area, and with help from the UN and other people, try to set up, help them facilitate collaborations with research institutes in other countries. So, for instance, we had Zambia, Nigeria, Morocco, Ethiopia. We had instruments in Libya....

BT: Most African nations.

JD: Most of the countries we had instruments in. And for that it's been very successful. And I think one of the most successful is Ethiopia, which has gone from very little space science to hosting space science schools in the summer, developing space science curriculum in their university, and I understand now they are planning to install an ionosphere radar system. And so these are things that grow out of what are really instruments that cost a couple thousand dollars. When we're here, we underestimate the impact of a few thousand dollars in one of these countries that doesn't necessarily have the scientific opportunities that we have here.

BT: Yeah, and that's the thing. We're solar people, American solar people, and we found that Africa ionosphere was the place where we could...

JD: (laughter) Yeah, we get a little bit of solar, but not much.

BT: And that's because if you followed the field of magnetospheric and ionospheric research -- their global models, their interconnectedness -- they were getting so advanced at it. And over and over again, you were hearing the problem they were always encountering is that the magnetosphere connects down to this tremendously thin, highly-conducting region that is the ionosphere. And so many ionospheric processes depended heavily on how the ionosphere was behaving and responding to the magnetosphere and vice versa. So you had these local processes that were happening in the ionosphere that were causing feedback that could be felt throughout the entire magnetosphere, and the measurements were not remotely complete. THEMIS is a good example of a magnetospheric mission with a large ground-based complement to try to really complete that picture. There was a huge drive at that point to try to really complete that picture and understand that. And IHY was right there. And once we heard this and learned about this -- and there was an example, right when we were starting, of some recent measurements over Hawaii with some very fine structure and some really interesting coupling processes that could be felt throughout the entire magnetosphere -- and a light went on. And this was during the first United Nations workshop in 2005 in Abu Dhabi that we found our heart and soul in this mission deployment program. And it became clear that we could have a huge scientific impact by being able to not only have these instruments deployed and to complete the picture by understanding

the local processes and how they couple to the global, but also it just so happened that it was the developing countries that needed it. So there is this entire untapped wealth of scientific knowledge and effort that we were able to take advantage of, as well. The two of those, the developed world's magnetospheric/ionospheric research moving towards understanding that coupling, and also the developed world scientists there and having quite a bit of expertise but at that point no really strong connection in space science to the rest of the world. It really made a perfect marriage for IHY. We got tremendous response from everywhere, and it was very exciting. And it is exciting to see in a lot of developed [developing?] nations, the scientists in developed [developing?] nations will publish in local journals. You're seeing their names now in more international journals, and in papers that are read internationally. And that really makes a big difference for a scientist, for their work to be known. And it helps them get support. And most importantly, it means that our scientific knowledge is advanced more efficiently.

NG: I would like to mention one important development during IHY from the central and eastern Europe area. They started a network called -- we call them jokingly the BBC space weather network -- but actually BBC means Black Sea, Baltic Sea and Caspian Sea. Countries from that region they come together and formed a regional network, and they hold meetings each year and invite IHY people to those meetings. And they also started a journal known as "Sun and Geosphere". I think it has been running successfully since 2006. And they have already published several volumes, and they would take papers from, say, IHY workshops and then ask the authors to work and then submit to the journal. So I think it's been very useful, and it's a free online journal. Indexed ISBN and it's also in the NASA ??? system. So I think it's one of the important developments that happened from that region.

BT: And it came up organically. They felt a need because they were lumped in with Europeans and Asia, but they already had some strong space science leadership in that area. And by forming their own network and focusing on a lot -- they had observatories, and they also had a lot of new instrumentation there happening with IHY -- by focusing on that, and not only that, but actually starting an international journal there, it allowed them to have even a much larger impact. It was really neat. So many of the most significant things about IHY happened organically. There was just a need, and then we had strong dedicated people who followed through and acted upon it. And we were smart enough to not interfere. Or if I tried to interfere, Joe would remind me that that's not what I do and... (laughter)

JD:and you listened?

BT: Gopal would show up and just move a couple little things just here and there to make sure that the resources were in place, and it worked very well.

JD: I think the most important thing is affecting people. And it's the connections that you don't know about. One of them that I found out was in 2006, there was an eclipse. The eclipse path started in Brazil, and it went across the Atlantic to Ivory Coast and Nigeria, and up into Libya and to Turkey and ended in...

NG: Kazakhstan or something?

JD: ...yeah, one of the “stans”. And so we organized groups along the eclipse path, and we said where we would have a scientist or someone knowledgeable. And we sent them eclipse glasses and materials and things. It wasn’t a huge thing. But then a couple years later we had a meeting in Zambia, and there were some students there. One of the young ladies comes up to me, and she says, you know the reason I’m in space science is because of the eclipse things that you organized in Ivory Coast. She was a grad student in Ivory Coast. She had switched to space science. So this is the sort of thing: you do something small, and it affects people.

BT: Well we thought it’d be small. But some of those eclipse stations were mobbed. They had lots and lots of people.

JD: Yeah, but by small, I mean relatively easy in terms of what we are doing, but it can affect people’s lives quite a bit.

BT: That eclipse was also another thing. I think it was the start of the US State Department really getting involved. I always say scientists are great diplomats. Because if we’re supposed to be not getting along with North Korea, if there’s a person in North Korea who’s the world’s expert on that topic, I want to talk to that person. I don’t want to talk to the second place person on that topic. And it’s not because we’re not loyal to our countries. It’s just that we’re very efficient. Scientists do not like to do duplicate effort. We like to make sure that the science is advanced as efficiently as possible, and so we are very good at collaborating. We’re very good at getting beyond borders and ignoring political differences and things because we have one thing that we can agree on, which is advancing the knowledge of the physical system which doesn’t recognize the borders at all. And the State Department, there was a couple people who started to really see that, especially with the Libya trip, how much a presence of the scientific community, especially a NASA eclipse group, could have, in terms of the United States relations with Libya. And so they started to really support us, because they wanted to help maybe understand the relations between the countries and use the science as an example of positive cooperations and things.

JD: The person we were working with at the State Department was Bob ??? ; he’s since retired. But I asked him, why would you want to send scientists to a place like this? We were in Libya. And this also happened to be in 2006 during the Iraq war. And he says, how else are we going to get a positive headline in a country like this with the US activity? And it was a positive headline. And the news, TV covered us, and we went to several universities. The funny thing was, we handed out a bunch of NASA stickers, you know the round blue stickers, and we handed out a bunch of them. We went down to the eclipse in Tripoli. We went down to the eclipse site, which was in the desert, and then we came back about three or four days later, and we were driving to the airport, and the van in front of us had a NASA sticker on the back. (laughter) It was one of these stickers that we had passed out. Again, it’s one of these small things like a sticker that people appreciate.

BT: It’s nice because it really is honest. They’re not spinning it. We send a scientist to a foreign country...we really are all about science. It’s irritating to have to deal with the politics. So we tend to be good diplomats only because we find anything that’s of a diplomatic nature irritating. (laughter) And we speak a common language. And so it’s also nice, because instead of having to spin something or pretend to be on a diplomatic trip, when you are working with a scientist in a

nation that perhaps the United States hadn't had as good a relationship with, you really do feel that common scientific connection. You feel that we want to know this, we don't know it yet, and by working together, both of us get that wonderful feeling of making progress towards understanding that topic. We are just such natural diplomats in that we can connect through something that is completely separate from it.

NG: Also, scientists from individual countries, if they are really resourceful and if they have good connections, they were able to make this IHY activity brought to a new level. For example, during the eclipse expedition, I was in Turkey. And the Turkish national coordinator is **???**, and he's a solar physicist, and what he did was he contacted the Ministry of Science, and then he made them make some one million glasses to view the eclipse. And whatever we took was probably enough only for a few hundred people. And he managed to make one million glasses. And that was really grand success in Turkey, and then it was all over in the headline about the eclipse and live coverage, and it was really fantastic. So basically, this synergy between small activities we start and people pick up and then make it really big.

BT: It's funny. Sometimes you would put a huge amount of effort into something like COSPAR, and pthtt! Then there would be something... whose idea was the eclipse? Was that yours, the eclipse stations? Was it Joe's? Somebody had the idea that we would have the public viewing stations and things like that, and Dave had a role in organizing that, Dave Webb.

NG: We wanted to do something like observing the sun during the time of the eclipse, starting from Brazil all the way to Mongolia. That way you can observe the sun using various small telescopes over a period of a couple hours. Then you can see some dynamics happening on the sun. Because normally from one place you just see a few minutes, so you won't see anything. So that was the idea, but I think it didn't materialize because it was just the beginning. Maybe during the next eclipse we can do that.

JD: 2017 there's an eclipse that goes right through the United States from the west coast to Memphis or somewhere in Tennessee or something like that.

BT: We have to find the American **???**

JD: So that's our new chance to redeem ourselves on the variability of the sun.

BT: But that was neat. That was Christina Rebello Soares(?) She was the head of outreach for IHY. I think that was her first activity was those eclipse stations and things. But yeah, they just were mentioned, and I think a couple people were doing them, and they knew we had these things. And Emily Drobnes designed this poster that was translated into Arabic and Spanish and French about the eclipse. So we had resources that we were sending to people, and it just grew and grew and grew. It was really neat.

NG: Personally, I was able to make a complete set of eclipse pictures for the first time in my life. I was able to use my little SLR camera and an 800 mm zoom, and I was able to do the diamond ring in the beginning, and totality, and then also the receding of the eclipse. So I made a complete set of pictures I am really proud of, thanks to IHY. (laughter)

JD: So placing instruments in these countries, there's a need for training. And one thing that Gopal did was lead in these schools. We had a number of schools. We were able to have them in various regions across the world at various times. I think total we had maybe five or six schools, where students from these new places -- from these new research groups that now had this instrument that they kind of understand how to use but maybe they don't understand the science - - they're able to send their students to these schools and learn about heliophysics. So this is part of the idea of taking these instruments and really making a permanent dent in the universities by getting space science departments, or at least science departments, that will continue beyond IHY. During these two years, we wanted to plant the seed, but we wanted to plant it in a way where there's a faculty and there's students, so that the new faculty will come in, and this will continue and grow. And then fifty years from now there will still be, we're hoping, a space science faculty in Ethiopia and Zambia and Nigeria and these places. I think that's the real scientific legacy of IHY.

BT: We were told that what would often happen is that a developed nation would come in and they would set up something. It would be a collaboration, and as soon as the developed nation, their attention, would go away, that would immediately piffle out. So the focus we had was really on making sure that, once that connection to the external source of the instrumentation and the funding went away, it had a viability locally for the scientists involved and the research there. So that was something we had to focus on heavily was that we wanted to make sure that this wasn't a junior scientist type of position of someone in a developing nation. They were going to be a leader of that research. And Dave Webb was the lead schools coordinator (of Boston College). And he's great because he's a perfectionist. And if there's something missing, he will not stop until something is complete. And so if we needed something, and some people would say, well, we can make do. Dave wouldn't tolerate that. Dave had very high standards.

NG: I think I should mention that the observatory deployment program was so successful that we really simply didn't want to abandon that. So we started something known as the International Space Weather Initiative. This is a follow-up program to IHY, slightly smaller in scope because we are dealing only with the sun-earth connection. But it continues to have the support from the United Nations, and we continue to have this workshop which brings the scientists from developed and developing countries. And all these instruments that were deployed, they continue to operate, and we are going to do new deployments. So in that sense, we do have a functioning legacy of IHY continuing into the International Space Weather Initiative.

JD: And we recently passed a milestone by having instruments in more than 100 countries participating in ISWI. This is a huge milestone. There are 193 nations in the United Nations. So we've got 93 to go, I guess. This is a real milestone to make 100 nations. That is a huge project.

NG: I think we are doing it very quietly. There is not much publicity, but I think it's a very important milestone.

BT: Scientifically is really the focus of it. It's the scientific research, so the publicity isn't really the point.

NG: I guess fifty years from now, somebody will come and say, oh, there was IHY in 2007, and they probably will do something, maybe the International Galactic Year or something like that. Expand the scale some more.

BT: Call to ask us to speak at dinners.

JD: Well, I won't be here, but you guys can speak at dinners.