Sun-Earth Day Mission Highlights:

Interview with Gordon Emslie (RHESSI)

[Troy Cline]
In 2012 the planet Venus will pass directly between the Sun and the Earth. This "Transit of Venus" won't occur again until the year Twenty-One-Seventeen.

[Sound clip]
My name is Troy Cline and welcome to Sun-Earth Day 2012: Shadows of the Sun.

[Music Transition]
Many of our NASA missions play an enormous part telling that incredible story: the story of our dynamic solar environment.

In this podcast, we'll continue our series about the RHESSI mission with Dr. Gordon Emslie. Gordon is on the physics astronomy faculty at Western Kentucky University in Bowling Green Kentucky. The thrust of the bulk of his research for the last 30 years or so has been the study of energy release and transport in solar flares, with emphasis on the diagnostics provided by hard X-ray observations, spectra, images and polarization. Most recently, this project has been fueled with the exciting new imaging spectroscopy data from the RHESSI satellite.

To get started I asked Gordon to tell us why he studies solar flares.

[Gordon Emslie]
I study solar flares not only because they are intrinsically interesting but because they reveal all kinds of basic physics and other sources. We try to understand the process by why high energy particles are accelerated for example. Sun is a wonderful ravager to do this. The sun is 8 light minutes away. The nearest competitor, the nearest star is 4 light years away, this interview will segment will take 8 minutes. But it is a huge difference looking at something that is that close that we can study in exquisite detail and take the lessons learned and fall into other scenarios in the universe. Not only is the sun very close at only 8 light minutes away and as it turns out one of the highest brightness's per unit light of any of these- you can speak of galactic nuclei, gamma ray bursts and certainly they are more energetic overall than a solar flare. But per ton, a solar flare wins you get a tremendous amount of energy from a very compact region of the Sun. Understanding that is the key to understanding the processes not obvious as well.

[Troy]

I asked Gordon to tell us more about 'the prediction of solar flares' and how understanding those processes can help us …here on Earth.

[Gordon Emslie]

There is a subtle way to answer that question, before you can predict anything you have to understand it. I'll use the analogy of the hurricane. A hurricane prediction has come a long way. Not only from satellite pictures we can see them form and move, we understand a little better the processes of hurricane prediction. For example, how a hurricane develops over warm water or cool water, it is a fundamental understanding of the processes in establishing hurricane predictions. It is the same thing we are a long way from understanding solar flares well enough to predict them, much as you predict the weather forecast celestially. It is the necessary first step. Being able to predict these of course is the immediate applications for the Sun-Earth system space weather. Solar flares, in particular large ones can cause all kinds of disruptions to your daily life. The cell phones, that are causing interference in this conversation, could cause wide spread disruptions of cell phone signals due to atmospheric, magnetic affects in the atmosphere induced by a solar flare. They produce very pretty things, like the aurora borealis, northern lights. But on occasion they can knock down entire power grids, in the late 80's in southeast Canada there was a total blackout for several days due to a solar flare. They interacted with the Earth's magnetic field creating voltages that destroyed large sections of the power grid. So there are obvious implications of these events, and although we cannot stop them we can give warnings much as you can give a tornado warning or hurricane warning.

[Troy]

So how did Dr. Emslie get interested in astronomy and physics in the first place. Was there a particular event or specific person in his life that had the most influence?

[Gordon Emslie]

My interest in astronomy started in general when I was 6, when my grandfather gave me a book called "Frontiers' of Astronomy", by Fred Hoyle. Not the particular book you would give to a 6 year old. It had a lot of information and diagrams. It annunciated very clearly how we could actually tell what the inside of a star look like. To a 6 year old that was fascinating because you never been there, you can never go there. Thinking about it you can unequivocally learn what the inside of a star looks like. When I went to the university they said what do you want to major in, I said physics, they said what else, and I said astronomy. They said no, no, no , it is very difficult astronomy you won't be

looking at stars, it is equations. This was exactly what I wanted to do so I signed up for astronomy. One of the professors that taught that course is John Brown; he is now the Astronomer Royal for Scotland. I got involved in the solar physics community and one of the first things I did in 1976 was a trip to United States. I like to mention that if the internet was around then I probably would still be in Scotland. But in those days if you wanted access the data you had to go where the data was. I was interested in the Star Lab Observatory. That data was in a filing cabinet in Cambridge Massachusetts. So that got me across the pond, I told people I was going for the summer; it's been a long summer.

[Troy]
Towards the end of our conversation, I asked Gordon if he would share some parting advice with our listeners.

[Gordon Emslie]
As a professor I have worked with many students and it takes students along time to realize that we don't always know the answer. Whatever the college experience, it is always about getting the right answer in the back of the book. This is verification that you learn the material correctly and got the right answer you get points for that. Research is not like that. You have to have enough faith in the answer that you just obtained and then cross check it with other things and change things see if the answer moves in the direction you expect it to move. So there is always this self testing. There is no real verification that you are right. There is this building up of self confidence that you have the correct answer. A lot of my research with RHESSI involves the mathematical manipulations of observations on the space craft. I find it fascinating that you do get answers that you can independently verify. And those answers are much more confidence than when you can relate it to other things. You can see them match up that's a wonderful experience. You may find that you didn't get the answer right but you got it to the store of knowledge.

[Troy]
At the end of the interview, Gordon and I continued to talk about the importance of gathering data from a variety of sources when conducting research.

[Gordon Emslie and Troy]
Right now we have many satellites getting images in x-ray, gamma rays, optical, UV. I find it still to this day fascinating. When we put up images of the sun in all these different colors, so there must really be something going on there. We are actually observing the sun. All these different instruments verify the story. That's right they collaborate each other. That's right we have our students who go out and use sunspotters and then they go look at the Space Weather Media Viewer on their computers and they are always shocked. WOW the sunspot we just saw and recorded is exactly the one that just came down from the NASA satellite. Absolutely we all live in the same university all observing in our own way. The

aggregation of mankind's knowledge; knowledge is very easy these days, information is very easy these days, you Google it and the synthesis of the knowledge makes it very easy to understand phenomena.

[Troy]
We'd like to thank Dr. Emslie for taking the time to talk to us today, and look forward to future podcasts about the RHESSI mission.

You can find all of the information about this year's theme, "Shadows of the Sun", on Sun-Earth Day website at sunearthday.nsaa.gov. We'll continue to populate that website the latest information about our upcoming programs, background resources, activities and registration information. With the help of our friends from the Solar Dynamics Observatory mission we've even include a new event based Google Map! One of our main goals is to help you join thousands of people in learning more about the Transit of Venus on June 5-6, 2012, and then again for a total solar eclipse on November 13-14, 2012. I'll share more with about those events in upcoming podcasts.

I hope you enjoyed this Sun-Earth Day Highlights podcast. Upcoming podcasts will include interviews with additional NASA scientists, astronomers, educators and media specialists from the award winning NASA Edge team!

Don't' forget to 'like' us on Face book and follow us on Twitter to join in on the discussion with our growing Sun-Earth Day community.

For all other details about the Sun-Earth Day program including information about our past SED themes be sure to visit our website at sunearthday.nasa.gov.
While there, don't forget to register in order to receive Sun-Earth Day updates!

You can learn more about NASA by simply visiting www.nasa.gov .