Sun-Earth Day Highlights:

RHESSI – David Smith

[Opening Sound Clip]

[Troy Cline]
Although our technologies have changed over time, our goal **to understand the Sun**…remains the same.

[Sound clip]

TROY: My name is Troy Cline, and on today's podcast we're talking to someone who has used a NASA spacecraft meant to study solar flares on the sun to do something entirely different. Dave Smith is a physicist at the University of California at Berkeley, and he uses a solar mission called RHESSI to study the dynamics of lightning in the clouds over Earth. I was able to talk with Smith at the 10th RHESSI workshop.

DAVE SMITH:
My name is David Smith and I work with RHESSI satellite, to study solar flares and I've also done a lot of work with kind-a of oddball observations using the satellite that are not solar flares. We have had projects to look at radioactivity in the center of our galaxy. We've had projects to look at gamma rays from lightening that were discovered by another NASA satellite that we actually get flashes from gamma rays. So I've been lucky enough to get use this same little satellite for a lot of different.

One of the things that interests me and excites me most is that the same physics keeps cropping up in different environments whether it's black holes on the other side of the galaxy with gas flowing into it, or whether it's the environment of the solar flare and that sort of explosion, whether it's the particles in the earth's radiation belts colliding with waves and crashing into the Earth's atmosphere, or whether it is the acceleration of particles in a thunderstorm. The same two things in physics keep popping up in these environments whether it is the physics of acceleration of particles or the physics of the initiative of x-rays and gamma rays. You see this stuff from all these different environments with this one space craft; it was built to study this one thing. My ambition, although you very seldom get to really do it, I would like to take insights that have been generated by the scientists working one of these problems and bring them over to the other problems. That would be a cheap and easy way to making new progress and to me that is my niche is trying to do that rather than studying with extraordinary depth and wisdom one particular aspect of the problem which is what some of the folks here at the conference are doing.

TROY: Focusing on a wide array of subjects has worked quite well for Smith, who has spent some time focusing on the gamma ray bursts seen from lightning.

DAVE SMITH:
When we first thought of looking for the gamma rays from lightning with the RHESSI satellite I honestly thought it was almost hopeless. The satellite that had first discovered this phenomenon, looking for the gamma rays from lightning, was an enormous expensive satellite, RHESSI was tiny by comparison. So I did what you often do in a circumstance like that, rather than look at it myself, I gave the project to an undergraduate student, because even if there is no success at least they will learn something about programming and analyzing data. So I found an undergraduate student, named Lilliana Lopez and gave her this hopeless task to do and I sat with her and worked with her once a week, not expecting much. Eventually we discovered a couple of these events, I was rather startled. I sent her to a workshop with people who study lightning, a field I know nothing about. It turns out she was a hero of that workshop. People were fascinated with her data they weren't expecting it either. She came back and told me I had 6 new collaborators. We went on and it became an enormous thing, it became a boost to my career and a boost to hers. And we ended up discovering over 10 times as many of these events as where discovered by other satellites had just because of the quirk of how satellites work. So it has become a whole second career for me.

The satellite is orbiting at about 600 kilometers above the Earth's surface. It takes about 90 minutes to go around the Earth as will any satellite at that altitude. Whenever it flies over a thunderstorm with gamma rays coming up it hit the satellite. Now the satellite was built to study the gamma rays coming from the sun, which is the opposite direction. But a gamma ray is like an x-ray, and you know we use an x-ray to take medical pictures so it will go through stuff. A gamma ray is higher energy than an x-ray so it goes through stuff even better. So they just come right up through the bottom of the satellite and hit our gamma ray detectors even though that's not the direction they're supposed to be looking.

TROY: Smith says it's important to study this because there is still so much we don't understand about how lightning works and what causes it to form.

DAVE SMITH:

The kind of lightning seems to be mostly the kind that goes within the cloud rather than the kind coming down to the ground. There is still a lot we don't understand about it so we still want to measure closer up than 600 kilometers up in space. Lightning has some predictors to it. Being able to predict it better might be a good thing. But I do have to say it is more the notion of looking at this phenomena and saying how does this start, why does it happen. Even if you can't predict lightning with that knowledge it is still the sort of knowledge that t we want to pursue for its own sake. The mystery here is the

trigger of lightning, how does lightning flash start. And it may be in some cases that it starts with gamma ray flash and in particular physics, high energy physics, it causes that and it gives it the little boost that turns it into lightning bolt. We don't know yet but that is the kind of thing we want to study. It is a field that has always been there since Ben Franklin. It has always been small. But it is a really good time now, that progress has been going very quickly in the last 20 or 30 years in terms of our understanding of those phenomena. There is one thing I would say, don't go outside if you are studying lightning study in some sort of a building or inside a car.

[Music Transition]

[Closing]

Troy: Since it launched in 2002 RHESSI has improved our understanding of solar flares, which in turn can help scientists better forecast which solar flares might send their high-energy particles towards Earth.

I'd like to thank David Smith for his time and I look forward to future interviews with the people involved with the RHESSI mission.

I hope you enjoyed this Sun-Earth Day Highlights podcast. We are very interested in hearing your questions and comments. If you have something to say, just join us in Facebook or send an email to sunearthday@gmail.com . If selected we'll share it on one of our upcoming podcasts!

For all other details about the Sun-Earth Day program including information about upcoming events, visit our website at sunearthday.nasa.gov.

While there you can find more information about the recent Sun-Earth Day webcast and Tweetup that took place at the Goddard Space Flight Center. To download a copy of the webcast, just do a quick search in ITunes for NASA EDGE. From there you'll see the show called NE Live@Sun Earth Day 2011.You'll also see the new promo that was created for the 2012 Transit of Venus show that will be aired live from Hawaii on June 5, 2012.

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