Sun-Earth Day Mission Highlights:

Interview with David Young

[Opening Sound Clip]

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

[Sound clip]
My name is Troy Cline and welcome to Sun-Earth Day 2011: Ancient Mysteries-Future Discoveries. This new theme opens the door to a variety of topics ranging from ancient solar sites and discoveries to current and future discoveries. Many of these new discoveries involve NASA missions that, when combined, tell an even greater story of our dynamic solar environment.

[Music Transition]

There's Earth, there's the Sun . . . and then there's a whole lot in between. Today we discuss the energy, charged particles, and vast magnetic fields surrounding the Earth – an area of space called the magnetosphere. Dave Young is a physicist at Southwest Research Institute who has spent his whole career working on missions like the upcoming Magnetic Multiscale Mission, or MMS, to study what scientists call plasma. Plasma is an electrified gas that doesn't occur naturally on Earth, but is the most common component of the magnetosphere.

[David Young]

Plasma is an unfortunate name the guy who named plasma, plasma was an electrical engineer back in the 1930s, his name, Irving Langmuir. He called it that because it naturally see this in the laboratory, you put a thin gas in a chamber and make a spot across that gas and if you do that you see this entirely through science fiction style piece. The spot, the arch actually will jump around jump like a lightning bolt will jump around. A lightning bolt is plasma in the earth's atmosphere. Jumping around, looking like it is alive, causing it to get the name plasma, from a Latin root word which means to be alive. What plasma really is a gas that is so hot that electrons are pouring off the atoms and they stay off the atoms until you have positive charge on the element or molecules and you have negative charge on the electron and they are separated from each other and so the forces between those two are very powerful. It takes a lot of energy to keep them separated from each other. When you have that you have a very hot gas. So part of what is in a florescent light bulb for example is a very hot gas where

the ions and electrons are separated from each other. When they rejoin and they do that sometimes, they give off light. Electrons fall into the ions and becomes an atom and give off light. Plasma is very hot, a charged gas, and they typically give off light. An example ionosphere of the Earth, which is difficult to see and also the layers of the sun, the photosphere, corona are all plasmas all very hot gases that give off light and heat and this is true of the stars throughout the universe they are all basically plasma heated by the hear from nuclear reaction. So that is what a plasma is.

[Troy Cline]
So why do we care about Plasmas?

[David Young]

Let me tell you about how it all started it started with the aurora the Northern Lights, scientists in the 1950s were trying to understand where they came from. The lights were related to the activity on the sun. They didn't know how it was happening but they knew it was happening. And anyone who has seen an aurora, students should see a movie or photograph of an aurora, will see that the aurora are aligned with the magnetic field lines, they have big spiralations with them. It is pretty obvious the aurora is connected to the magnetic field so in turn to understand that and explain it we finally came to the conclusion that what is making the aurora are plasmas above the Earth's surface. Another question is where does that energy come from to make the plasmas above the atmosphere? It is like a TV screen of energetic particles that are hot plasma to make the light and the atmosphere to make what we call the aurora. So we brought that up and we followed the particles in the magnetic field lines that surround the Earth low and behold some of them go back to the sun and others like oxygen ions that you see in the aurora, go back into the Earth's magnetosphere. So you got lots of questions like where does this stuff come from and how does it get it energy. So, now you back off into the earth's magnetosphere and the blob that called the solar wind by the Earth's magnetic field, where does the energy in this magnetosphere come from? Scientists over the last 50 years have discovered that it comes from a process called magnetic reconnection. This happens when the magnetic field being carried out from the sun connects with the Earth's magnetic field it sits there and protects us from these particles. When the magnetic field is headed in the right direction they destroy each other, they annilalate each other and in the process the energy that was in the magnetic field is given up to plasma. That plasma is accelerated to high energy and some of it ends up in the aurora. When this happens on the sun, (you get solar flares on the sun) this is strictly plasma on the sun, you get magnetic field lines that are all twisted and cross each other and they reconnect. This energizes the plasma on the sun and blows it off and sends it off toward the Earth, what we call a magnetic storm. The same thing happens through the universe.

[Troy Cline]
To learn more about those geomagnetic storms, David is the principle investigator for an instrument on MMS to study the plasma surrounding Earth and that magnetic reconnection. .

"What we're doing on MMS. . . in order to understand what goes on in magnetic reconnection" (I would shorten this up a bit if possible, take out the cassini stuff, since we haven't mentioned cassini anywhere else.)

[Troy Cline]
Those incredible explosions caused by magnetic reconnection can affect more than just auroras. Those magnetic storms can knock out satellites orbiting Earth – another good reason for scientists to learn as much as they can about the sun and its plasma.

[Closing]
I'd like to thank David for talking to us today and look forward to future interviews with people involved with the MMS mission.

As many of you already know, every year we update our Sun-Earth Day resources for educators, museums, community groups and amateur astronomers. We also collect a variety of additional hard copy educational resources that are placed in a beautiful and new Sun-Earth Day folder. If you haven't already, I'd like to remind you to register on the Sun-Earth Day website in order to receive your FREE folder of materials while supplies last.

I'm excited to announce the release of a new mobile version of NASA's Space Weather Viewer! This app is an adaption of the current Space Weather Media Viewer and features near-real-time imagery from a wide variety of NASA missions, as well as video interviews with prominent scientists about the causes of space phenomena and NASA-created visualizations. You can download the app by doing a search in iTunes for the 'NASA Space Weather Media Viewer'. After downloading the app, we would really appreciate seeing your reviews and comments!

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 today's podcast be sure to visit our website at sunearthday.nasa.gov.

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