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Sara: Welcome to the January 14th, 2009 episode of Blueshift, brought to you from NASA's Goddard Space Flight Center. Our last episode came out about a year ago... so you're probably wondering where we've been! Well, we took a break in 2008 to look at our podcast and we asked for your feedback on how we'd been doing! You told us what you wanted to hear... and we listened! So now we're back, bringing you new episodes twice every month about what we're doing here in the Astrophysics Division at Goddard. We've got a lot of special stories to share this year. 2009 is the International Year of Astronomy, a year for the whole world to come together and explore the mysteries of the Universe. We've come a long way since Galileo first looked up at the sky with his telescope 400 years ago! Not only do we have better telescopes, we can also look at the Universe at many different wavelengths. Every time we do this, a whole new Universe is revealed to us.

So, with that in mind, for our first episode of 2009, we wanted to introduce you to one of NASA's newest satellites - Fermi! The Fermi observatory, called GLAST before launch, is a powerful gamma-ray observatory that launched last summer. Fermi is looking at one of the most explosive events in the Universe - gamma-ray bursts. We're bringing you the story of why we study gamma-rays, and how, through the voices of five scientists who study them: Steve Ritz, Elizabeth Hays, Stephen Holland, Jerry Fishman, and Rob Preece.

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Stephen Holland: gamma-ray bursts are the most energetic explosions that we know of. They're the biggest bangs since the big bang.

Jerry Fishman: Because they're so bright we can see them at the furthest distances of the universe, and we can find out more about the early part of the universe.

Stephen Holland: I like with gamma-ray bursts the way that they're suddenly there; you've got only, you know, a few hours to a few days to study them, then they're gone, then you move on to the next one. So it's constantly something new involved.

Rob Preece: If you think about it, they release a huge amount of energy; some of them are just pointed like a searchlight in our direction. You can imagine what would happen if one of these things went off in our own galaxy. It's got enough energy to, you know, melt silicon dust into chondrules and things like that, that we might see in meteorites. Remnants of gamma-ray bursts may actually, you know, arrive on to the earth at some point.

Stephen Holland: Ten years ago we had no idea what a gamma-ray burst was. It's a large explosion that took place in distant galaxies and that was about all we knew. And over the last ten years we've really, we've learned a tremendous amount about them. We've learned that they come from stars, we've learned that they're probably the birth cries of black holes. And that's given us a lot of new information about black holes themselves. By studying gamma-ray bursts what we've been able to do is learn a lot about massive stars and what happens to them at the last moments of their lives.

Rob Preece: It turned out that when we launched the Compton gamma-ray Observatory, we discovered that gamma-ray bursts were much, much farther away. And being much farther away there are much more energetic and much more powerful.

Steve Ritz: So, by studying the universe in gamma-rays, we're actually getting to look under the hood, to see how the engines work, which is really tracing us back to the most fundamental underlying processes that are at work in the universe. Fermi opens up a completely new set of capabilities for us, and that's why we're so excited about it.

Jerry Fishman: We can see the gamma-ray sky much better with Fermi that we could with any other previous spacecraft because it's so sensitive. We can see many more objects, we can see them in much more detail that we ever could before. We can also correlate the observations in gamma-rays with other wavelength regions, like radio and optical.

Elizabeth Hays: So, a wonderful thing about Fermi and Swift is they give us a view of objects in our universe that we can't get any other way. We see the most energetic things happening, and they're both rare and in extreme, like the deaths of stars, and very powerful jets coming out of galaxies. And the best way to see them is using Swift and Fermi to go after these; it's really a view you don't get any other way.

Jerry Fishman: The Fermi mission is an international collaboration. We have scientists from many different countries — Italy, Sweden, France, Germany — participating in the Fermi mission. It means that we can build better hardware and more sophisticated spacecraft and instruments than we could with a single nation doing it alone, even with NASA's resources. We just couldn't build this big a mission without international participation.

Steve Ritz: Sometimes I just suddenly realize that we're in a room full of people from around the world, and we're all cooperating together to understand a little bit more about how the universe works, and I think, you know, what a wonderful thing it is, what a wonderful model, that we can come together and bring our different experiences and frames of reference to work together, and all we're interested in that room is working together to understand or solve a problem. And what a great thing that is.

Elizabeth Hays: Fermi recently launched and so every day you're looking at new data, looking for new objects in the sky. I do a lot of looking actually at the data as it comes in and trying to evaluate what it is we're seeing and connect that to science, to make the decisions, do we need to take other observations to understand objects that we're seeing, and, you know, additionally I continue to work with the instrument so that we can really get the best quality of results out of what we're seeing.

Stephen Holland: Well, I think the future is quite bright in these fields. We're currently learning so much so fast that the questions are building up faster than the answers at this point. So there is a lot for people to do now, there will be a lot of these unanswered questions for many years to come.

Elizabeth Hays: It's a constant effort in puzzle solving, so if you're someone who likes solving problems, you know we get a unique opportunity to look at things that no one else is looking at, and that's always something that makes the hard work worth the effort.

Steve Ritz: Because of the large leap in all key capabilities that we've been able to put up in orbit, I'm also expecting that the most interesting science topics that we'll be discussing in two or three years may not yet be on anybody's list. And that is again one of the really exciting aspects to this project.

Rob Preece: It's just so surprising to me that every time we launch a new mission with NASA or the European Space Agency or Japan, we see something new and there is something that surprises us. The potential of the universe to surprise us is basically unlimited.

[pause]

Sara: To learn more about this story, and to keep up with what we're doing, check out our website. We've got blogs, downloads, and more. We've also got a feedback form - so let us know how we're doing, and what you'd like to hear about! You can find us at http://universe.nasa.gov/blueshift

At the end of January, we'll be back with a cosmic mystery that has our scientists utterly baffled. This is Sara Mitchell, bringing the Universe closer to you with Blueshift.

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