Transcript

Planet Mercury – Why study it?

MASAKI FUJIMOTO:

Mercury is the innermost planet of the solar system. Do you know why it is? We don't know neither. Even though it's the closest planet to the sun within the solar system, we don't know why it's there.

LOUISE PROCKTER:

Mariner 10 got this glimpse. My old advisor Jim Head used to describe it as seeing your next-door neighbor walk up and down the path every day and knowing a little bit about them, what car they drive, what kind of house they lived in, but really knowing nothing else about them. By understanding Mercury, we can start to understand more about the Earth. It's a terrestrial planet just like the Earth, the Moon, Venus. It's basically one of us.

JOHANNES BENKHOFF:

We would like to understand how our solar system is formed, where we came from. And for that, it's important that you study all the pieces you have in order to get the picture together.

ADRIAN MARTINDALE:

Mercury is a real oddball. It's a very, very small planet. And yet, it has a magnetic field. So other small planets don't tend to have a magnetic field because the core of the planet has frozen, which stops the processes that can drive the creation of that magnetic field.

SUSIE IMBER:

So a really interesting thing about the four terrestrial of planets is that only two of them have a magnetic field, and two of them don't. So the Earth and Mercury both have a magnetic field. And that's because they have a liquid iron core that's in motion and so that generates a large scale magnetic field.

JONATHAN MCAULIFFE:

The Messenger spacecraft has now given us greater detail of this magnetic field. It's a dipole field like at the Earth. And for me, that was one of the most interesting things when I first came across Mercury.

JOHANNES BENKHOFF:

It has a huge density. It is the planet closest to the sun so it has high temperatures on the surface, up to 450 degrees. Temperatures on Earth you see in a pizza oven but that what we will encounter on Mercury.

GABRIELE CREMONESE:

But up to a few years ago, we believe that Mercury is a planet quite boring. Because we didn't know so much of the planet, but now we have the images, the data of the Messenger. We discovered that is really interesting. Knowing mercury, we can know something more even on the Earth. How the Earth evolved in the last 4 billion years.

ALAIN DORESSOUNDIRAM:

Mercury was explored by a flyby spacecraft Mariner in the '70s. And we look at Mercury as a maybe a boring second moon that's full of craters. And then after that, we understood that it is more than a second moon. It has a lot of tectonic features. It has a magnetic field. Now we know that it has also a volcanic history like on the Earth.

LOUISE PROCKTER:

Messenger has shown us that it's really quite different than we expected it to be. And so we're having to rethink a lot of our models for how planets form and evolve as a result of the Messenger data from Mercury. And BepiColombo will help us to understand that even more.

KARSTEN SEIFERLIN:

As a scientist, you would go to the lab and set up an experiment. And then you start turning knobs, for example, you ramp up the voltage, and you measure the current and try to find whether there is a relation between the two. Then you come up with a theory, you put down an equation, and that's big progress in science.

Unfortunately, we can't do that with planets. You can't turn knobs on planets. But you can look at other planets that are already there. And what you can also do is you can do a computer model of a certain process like, for example, the formation of the core in Mercury, and on the computer, it looks nice.

And then you have to test it. That means that the planets that exist are test cases for your theories. You have to go there and see is there something I can understand? Is it something I can explain with the current theories, or do I have to change and come up with something new.

EMMA BUNCE:

No planet is the same. You think that you go to a planet it's going to be-- Saturn will be like Jupiter. It's not. It's like Saturn. And you explore a different planet that you haven't been to before, and you think it might be like Earth or like the moon.

And then it turns out it's like itself. They're on a spectrum. Mercury is at one end of the spectrum, the smallest planet in the solar system, closest to the sun. It has no atmosphere. It has a very weak magnetic field. It has an interesting surface and geology, which we need to understand in order to understand where it sits in the grand scheme of the solar system.

SIMON LINDSAY:

Before Mariner and before Messenger, it just sort of looks like a slightly larger version of the moon. You think that's not very interesting, just sort of it's another airless cratered body. There's plenty of those in the solar system. But it turns out it's got a magnetosphere, which is very weird. It shouldn't

do. It's too small, and it's too near the sun. It doesn't really make sense. It turns out it must have this huge, huge iron core. Which means, in turn, that it probably formed in quite a weird way. And that means that by looking at it, we can work out quite a lot about where all planets formed.

JACK WRIGHT:

It's a very small planet. It is very close to the sun, and that means it can only be seen just before sunrise and just after sunset. So it's a difficult planet to observe from the ground. And that means we know far less about it than other planets in the inner solar system.

ALAIN DORESSOUNDIRAM:

It's easy to go there. But it is not easy to stop there because you are close to the sun.

MASAKI FUJIMOTO:

As Mercury is much closer to the sun than Earth, it should be under that much stronger influence of the activity of the star, the Sun. And as a space plasma physicist interested in magnetospheric dynamics, what's going on in the space around the planet Mercury is such an attractive place because things must be crazy.

SUSIE IMBER:

It's really, really strongly driven by the solar wind. It's a very dynamic system. So if we understand what's happening at Mercury, that's going to help us to understand the dynamics of the Earth system too.

EMMA BUNCE:

So one of the most important things that we want to learn about Mercury is all about the planet itself. Say for example, how it was formed, how it has evolved as a body over time, what's happened to it in its history, how the surface has changed. We want to understand the geology, the interesting features that we see on the surface. And one of the important aspects of that is understanding the details of what the surface is actually made of.

DAVID ROTHERY:

I'm a geologist, so I like places that have geology going on, processes affecting the crust and the interior, and volcanic eruptions, and faults, and surface history. And Mercury's got all that. If it's formed from the same stuff as the Earth did, and we expect so in the inner solar system, the same stuff flying around during the birth of the planets, it should have the same size core relative to its rock, but it doesn't.

So it's lost most of its rock. So its birth was extremely violent. The rock was somehow stripped away leaving most of the original core and a very thin impoverished rocky mantle around it, which has developed volcanism and formed a crust, and so on. So something very strange happened in Mercury's birth to give it this big core, or rather leave the core there but strip away most of the rock.

Quite possibly, it was what's called a hit-and-run impactor. It came in, it careened off Venus or careened off the Earth, most of its outer part was stripped away leaving the remnant core and a very thin rocky shell. And how it did that and still hung on to the volatile elements which are abundant in Mercury is a problem.

JACK WRIGHT:

Some people are suggesting that Mercury was never where it was. It was the impactor. It hit something in the inner solar system, and it remained as Mercury. And they think that is why it has a large core and a small mantle, which is the part of the planet which surrounds the core, because the mantle was stripped away during the impact, but the core remained intact, or largely intact. And then it floated into the inner solar system where it sits today.

DAVID ROTHERY:

Finding out about Mercury will help us complete the set. It's not a place that's remotely likely to host life at the present or in the past. It's too close to the sun, but we've only got four terrestrial planets, only four rocky planets. So we can't understand how the Earth or Mars works without understanding its neighbors.

MASAKI FUJIMOTO:

Ultimately, planetary science is about why we are here, the question, why we are here. Then that leads you to the question that how is the terrestrial region, the region of the solar system around Earth, is formed. We have Mercury, Venus, Earth, and Mars. And if you look at them, Mercury and Mars are smaller. And you have two big ones, Venus and Earth. So that should be telling us something about how this region in the solar system is formed. Our ultimate question. So Mercury is sitting at the edge. But sitting at the edge doesn't mean that it's less important.