Moons

Volcanic eruptions on Io

PAUL SCHENK:

The four large Galilean satellites orbit in close proximity to each other, and they orbit in what we call resonance. Their orbital periods are multiples of each other. Io revolves around Jupiter four times in the same period that Europa orbits around twice and Ganymede orbits around once. So they're even multiples of each other. That creates a gravitational tug on each of the satellites that actually forces their orbits to be non-circular and generates enormous tides on the surface of the satellites. Io, for example, the surface actually rises up and down a hundred metres each Io day. That's the physical rock itself. That generates a huge amount of heat. It's enough to actually melt large parts of the interior of Io. If that force wasn't there, Io would probably look a lot like the Earth's Moon. And it turns out that this process is dominant throughout the outer Solar System. It's what's keeping the geysers and the jets on Enceladus active, for example. And it's what keeps the ocean on Europa warm and liquid. So studying those processes tells us a lot about how planetary dynamics works in a way that we couldn't study here on Earth. And Io's about the same size as the Earth's Moon, and yet it's covered in volcanoes.

DAVID ROTHERY:

We've got at any one time a dozen volcanoes on Io erupting red hot, molten rock, real rock, and jetting it out two or three hundred kilometres high into space through the force of expanding vapour. It's the most volcanically-active body in the Solar System. And it's producing very runny flows of molten rock, perhaps similar to basalt on the Earth. And it has very spectacular eruption plumes, which jet out tiny particles of rock and crystallised sulfur and sulfur dioxide into space. And you can see these plumes, which rise up, sort of umbrella-like against the blackness of space, and they're lit up by the Sun. And you can see the deposits formed when these things fall to the ground. On Earth, if you jet stuff into the air, you're jetting it into air not into a vacuum. And air gets involved, and it starts convecting, and you get spectacular eruption clouds. It doesn't happen on Io, which has no atmosphere. Particles just come out, and they follow trajectories governed by their speed and the gravity of the satellites. You have these nice umbrella plumes. During the Jupiter passage made by New Horizons, which is on its way to Pluto, they got video sequences showing these eruption plumes developing. And they're great to look at.