

## ARE THERE WATER GEYSERS ON EUROPA?

Space scientists announced on Monday (May 14, 2018) that a reanalysis of data collected by the Galileo spacecraft in 1997 corroborates earlier suggestions that Jupiter's moon Europa might be venting plumes of water vapour. This is very exciting news! It might mean that a planned space mission to Europa – called the Europa Clipper – could be programmed to fly through the plumes in order to sample Europa's liquid ocean, which is buried below this moon's thick ice crust. The goal would be to probe the question of whether Europa's hidden ocean has the ingredients needed to support life. **As Robert Pappalardo** of NASA's Jet Propulsion Laboratory in Pasadena, California, said:

*There are better tools now, better computational techniques, better computing. We can go back and look at that old data set anew.*

Pappalardo is Europa Clipper's project scientist. But he's not the only one thrilled by the new finding. The research was led by space physicist **Xianzhe Jia** at the University of Michigan in Ann Arbor. Jia also is co-investigator for two instruments that will travel aboard Europa Clipper. His new study, outlining the possibility of Europa plumes, was published May 14 in the peer-reviewed journal Nature Astronomy.

Jia said it was **Melissa McGrath** of the SETI Institute that inspired his team to dive back into the Galileo data. McGrath is part of the Europa Clipper science team, too. Jia said that in a presentation she delivered to fellow team scientists, highlighting other Hubble observations of Europa:

*One of the locations she mentioned rang a bell. Galileo actually did a flyby of that location, and it was the closest one we ever had. We realized we had to go back. We needed to see whether there was anything in the data that could tell us whether or not there was a plume.*

When they examined the information gathered during that flyby 21 years ago, sure enough, high-resolution magnetometer data showed something strange. **Drawing on what scientists learned from exploring plumes on Saturn's moon Enceladus — that material in plumes becomes ionized and leaves a characteristic blip in the magnetic field — they knew what to look for.** And there it was on Europa — a brief, localized bend in the magnetic field that had never been explained.

Jia's team then began to analyze the old data in earnest, feeding some of the old data into a new 3D computer model developed by his team at the University of Michigan. The result that emerged, with a simulated plume, was a match to the Galileo data from 21 years ago. Robert Pappalardo said:

*There now seem to be too many lines of evidence to dismiss plumes at Europa. This result makes the plumes seem to be much more real and, for me, is a tipping point.*

An illustration shows Jupiter and Europa (in the foreground) with the Galileo spacecraft after its pass through a plume erupting from Europa's surface. A new computer simulation gives us an idea of how the magnetic field interacted with a plume. The magnetic field lines (depicted in blue) show how the plume interacts with the ambient flow of Jovian plasma. The red colours on the lines show more dense areas of plasma.

The Europa Clipper mission may launch as early as June 2022. From its orbit of Jupiter, Europa Clipper will sail close by the moon in rapid, low-altitude flybys. If plumes are indeed spewing vapor from Europa's ocean or subsurface lakes, Europa Clipper could sample the frozen liquid and dust particles. Europa is considered among the prime candidates for life in our solar system, but is not the only one. NASA's Cassini spacecraft sampled plumes from Saturn's ocean-bearing moon Enceladus that contained hydrogen from hydrothermal vents, an environment that may have given rise to life on Earth. A bit smaller than Earth's moon, Europa's ocean resides under an ice layer 15 to 25 kilometres thick, with an estimated depth of 60 to 150 km.

