

## Are there signatures of active Europa plumes in Galileo in-situ data?

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### Abstract

Hubble Space Telescope observations made during recent years suggest that recurring water vapour plumes originating from Europa's surface exist, though they do not conclusively prove their existence [1, 2, 3]. Taking samples of these plumes in-situ from a flyby mission could allow for the study of Europa's potentially habitable ocean [4].

Indisputable (in-situ) observations of these plumes have not been reported yet. However, it may be possible that the NASA Galileo mission encountered these plumes. This mission was active in the Jupiter system from 1995 to 2003 and made several Europa flybys. It has been suggested that the high plasma densities and anomalous magnetic fields measured during the E12 flyby could be connected to active plumes [5, 6]. No new opportunity to study these plumes in-situ will arise before the early 2030's when ESA's JUICE mission or NASA's Europa Clipper will arrive.

We present an overview of in-situ data obtained by the Galileo spacecraft during the Europa flybys. The data is compared in the context of the search for signs of active plumes. Focus is in particular on the data obtained with the plasma instruments PLS (low energy ions and electrons), EPD (high energy ions and electrons) and MAG (magnetic fields).

### References

- [1] Roth, L., Saur, J., Retherford, K.D., Strobel, D.F., Feldman, P.D., McGrath, M.A., Nimmo, F., 2014a. Transient water vapor at Europa's south pole. *Science* 343 (6167), 171–174. doi: 10.1126/science.1247051.
- [2] Sparks, W. B., Hand, K.P., McGrath, M.A., Bergeron, E., Cracraft, M., Deustua, S.E. 2016. Probing for evidence of plumes on Europa with HST/STIS. *The Astrophysical Journal*, Volume 829, Number 2. doi:10.3847/0004-637X/829/2/121
- [3] Sparks, W.B., Schmidt, B.E., McGrath, M.A., Hand, K.P., Spencer, J.R., Cracraft, M., Deustua, S.E. 2017. Active Cryovolcanism on Europa? *The Astrophysical Journal Letters*, Volume 839, Number 2. doi: 10.3847/2041-8213/aa67f8
- [4] Huybrighs, H.L.F., Futaana, Y., Barabash, S., Wieser, M., Wurz, P., Krupp, N., Glassmeier, K.H., Vermeersen, B. 2017. On the in-situ detectability of Europa's water vapour plumes from a flyby mission" *Icarus*, volume 289. doi: 10.1016/j.icarus.2016.10.026
- [5] Kivelson, M.G., Khurana, K.K., Volwerk, M. Europa. Ed. by Kivelson, M.G., Khurana, K.K., Volwerk, M. Pappalardo, R.T., McKinnon, W.B., Khurana, K.K., 2009. Chap. Europa's Interaction with the Jovian Magnetosphere 545–570.
- [6] Kurth, W., Gurnett, D., Persoon, A., Roux, A., Bolton, S., Alexander, C., 2001. The plasma wave environment of Europa. *Planet. Space Sci.* 49 Magnetospheres of the Outer Planets (Part I), pp. 345–363. issn: 0032-0633. doi: 10.1016/S0 032-0633(0 0)0 0156-2.