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A new model of the neutral gas torus of Europa

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The neutral particles that escape the surface and exosphere of Europa populate a neutral gas torus around Jupiter. The detection and characterization of this neutral structure can not only shed light on the escape processes at work at Europa, but can also help to determine if Europa has a global influence on the Jovian plasma and magnetosphere.

We will present a new Monte Carlo model of the Europa neutral gas torus developed in the frame of the FACOM project funded by ANR (French national agency for research). Neutral ionization rates in the Jovian magnetosphere are computed based on Voyager plasma densities and temperatures, including suprathermal electrons. The source rate of neutrals escaping Europa's gravity is constrained with the three-dimensional Exosphere Global Model EGM [Oza, Leblanc, et al., 2019]. In particular, we will present the first simulations of the H₂O water torus of Europa, with a source rate of H₂O at Europa constrained with EGM.

Finally, we will use our new model to reconsider the observability of the neutral torus in UV observations [Roth et al., 2023], energetic ion pitch angle distributions [Sarkango et al., 2023], ENA imaging [Smith et al., 2019], and pick-up ion observations [e.g. Szalay et al., 2022]. The impact of our results on future JUICE and Clipper observations of the Europa neutral gas torus will be presented.

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References:

Oza et al. 2019: [10.1016/j.pss.2019.01.006](https://doi.org/10.1016/j.pss.2019.01.006)

Roth et al. 2023: [10.3847/PSJ/acdddd](https://doi.org/10.3847/PSJ/acdddd)

Sarkango et al. 2023: [10.1029/2023GL104374](https://doi.org/10.1029/2023GL104374)

Smith et al. 2019: [10.3847/1538-4357/aaed38](https://doi.org/10.3847/1538-4357/aaed38)

Szalay et al. 2022: [10.1029/2022GL098111](https://doi.org/10.1029/2022GL098111)

Smith, H. T., Mitchell, D. G., Johnson, R. E., Mauk, B. H., & Smith, J. E. (2019). Europa neutral torus confirmation and characterization based on observations and modeling. *The Astrophysical*

Journal, 871(1), 69.