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Citation

Huybrighs, H., Blöcker, A., Roussos, E., Buchem, C. P. A. van, Futaana, Y., Goetz, C., ... Witasse, O. (2021). The effect of Europa's perturbed electromagnetic fields and induced dipole on energetic proton depletions in the Alfvén wings. *Epsc Abstracts*, EPSC2021-299. doi:10.5194/epsc2021-299

Version: Publisher's Version

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Note: To cite this publication please use the final published version (if applicable).



The effect of Europa's perturbed electromagnetic fields and induced dipole on energetic proton depletions in the Alfvén wings

Hans Huybrighs¹, Aljona Blöcker², Elias Roussos³, Christiaan Van Buchem⁴, Yoshifumi Futaana⁵, Charlotte Goetz¹, Mika Holmberg¹, and Olivier Witasse¹

¹ESA, ESTEC, Noordwijk, Netherlands (hans.huybrighs@esa.int)

²KTH, Stockholm, Sweden

³Max Planck Institute for Solar System Research, Göttingen, Germany

⁴Leiden University, Leiden, the Netherlands

⁵Swedish Institute of Space Physics, Kiruna, Sweden

We investigate energetic proton depletions during Europa flybys E17 and E25A* by the Galileo mission. Energetic ion observations along trajectories like those of E17 & E25A are suitable for isolating the characteristics of the global configuration of the interaction region of Europa (or any Galilean moon) with the Jovian magnetosphere. Both of these flybys passed through Europa's Alfvén wings further away from the moon, where ionospheric effects are small.

We simulate the measured flux with a Monte Carlo particle tracing code and investigate the effect of the following factors: inhomogeneous electromagnetic fields, Europa's induced dipole, atmospheric charge exchange and plumes.

We find that the homogeneous fields do not explain the Galileo data. We propose that the perturbed fields associated with the Alfvén wings affect the proton depletions. The inhomogeneous fields and induced dipole alter the pitch angle distribution of the depletion along the trajectory. The plumes that are investigated in this study have a minor effect on the proton depletions compared to the inhomogeneous fields and Alfvén wings. The contribution of atmospheric charge exchange to the depletion is negligible for these flybys. Finally, we compare the simulations to the measured proton flux and discuss the contribution of the effects we have considered.

* E25A is a segment of the Io flyby I25