

Formation conditions of Titan

Immerzeel, C.; Cazaux, S.M.; Oberg, N.

Citation

Immerzeel, C., Cazaux, S. M., & Oberg, N. (2021). Formation conditions of Titan. *European Planetary Science Congress*, EPSC2021-647. doi:10.5194/epsc2021-647

Version:Publisher's VersionLicense:Creative Commons CC BY 4.0 licenseDownloaded from:https://hdl.handle.net/1887/3270737

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



EPSC Abstracts Vol. 15, EPSC2021-647, 2021 https://doi.org/10.5194/epsc2021-647 Europlanet Science Congress 2021 © Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



Formation conditions of Titan

Carmen Immerzeel¹, Stéphanie Cazaux^{1,2}, and Nick Oberg¹

¹Faculty of Aerospace Engineering, Delft University of Technology, Delft, The Netherlands (c.n.immerzeel@student.tudelft.nl) ²University of Leiden, Leiden, The Netherlands

Satellites are generally believed to form in circumplanetary disks (CPDs): a gas disk containing icy and rocky particles that accumulate to form massive moons over time. The discoveries by the Cassini-Huygens mission have led to a revision of the birth environment of the Saturnian system.

We aim to constrain the formation circumstances of Titan's building blocks by considering the moon's observed characteristics. We use radiation thermo-chemical CPD models and evaluate them on their capacity to reproduce a Titan-like satellite.

To form a moon with Titan's ice-to-rock ratio, we find that the dust-to-gas ratio in the CPD must be in the order of solar nebula values, $O(10^{-2})$. The ice availability upon accretion is otherwise incompatible with Titan's moment of inertia. Our models predict a large NH₃ inventory was available upon Titan's formation, $\Box 10-20$ wt.% of the total ice. This is consistent with the hypothesis that the observed N₂ in Titan is captured as NH₃ and converted by photolysis and shock heating, and is compatible with the possible presence of a conductive layer at 45±15 km as revealed by the Huygens probe.