

Forming volatile-rich planetesimals

A. Johansen¹

¹*Lund Observatory, Lund, Sweden*

1. Introduction

Habitable planets, such as our own Earth, form in the inner region of protoplanetary discs where the temperature is too high for volatile molecules such as water to exist in solid form. Elements and molecules essential for life as we know it - including water, carbon and nitrogen - are likely delivered via collisions with planetesimals that formed under much colder conditions several astronomical units further away from the star. I will present theories for the formation of planetesimals in protoplanetary discs (see [1] for a recent review). I will focus on the formation regions, formation times [2] and initial mass function [3] of planetesimals and make connections between planetesimal formation theories and the habitability of planets. I will show that ice lines of volatile species are favourable sites for the early formation of volatile-rich planetesimals in protoplanetary discs.

2. References

- [1] Johansen A., Blum J., Tanaka H., Ormel C., Bizzarro M., & Rickman H., The multifaceted planetesimal formation process, In *Protostars and Planets VI*, University of Arizona Press, 2014
- [2] Carrera D., Gorti U., Johansen A., & Davies M. B., Planetesimal Formation by the Streaming Instability in a Photoevaporating Disk, *The Astrophysical Journal*, vol. 839, id. 16, 2017
- [3] Johansen A., Mac Low M.-M., Lacerda P., & Bizzarro M., Growth of asteroids, planetary embryos and Kuiper belt objects by chondrule accretion, *Science Advances*, vol. 1, id. e1500109, 2015

Short Summary

Elements and molecules essential for life - including water, carbon and nitrogen - are likely delivered via collisions with planetesimals that formed under cold conditions several astronomical units away from the star. I will present theories for the formation of such volatile-rich planetesimals in protoplanetary discs.