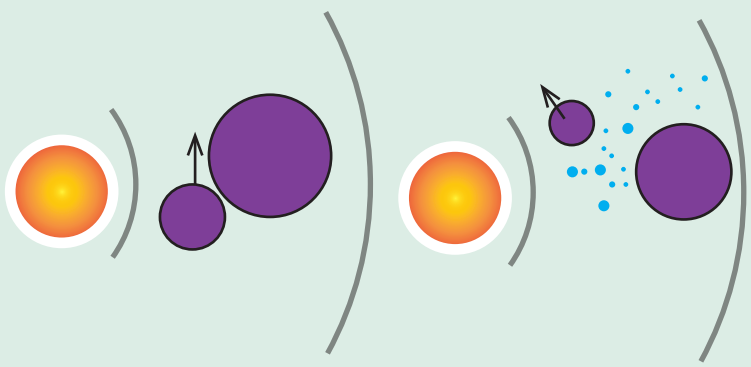
Proposed Work for DRF in the context of the overall research goal

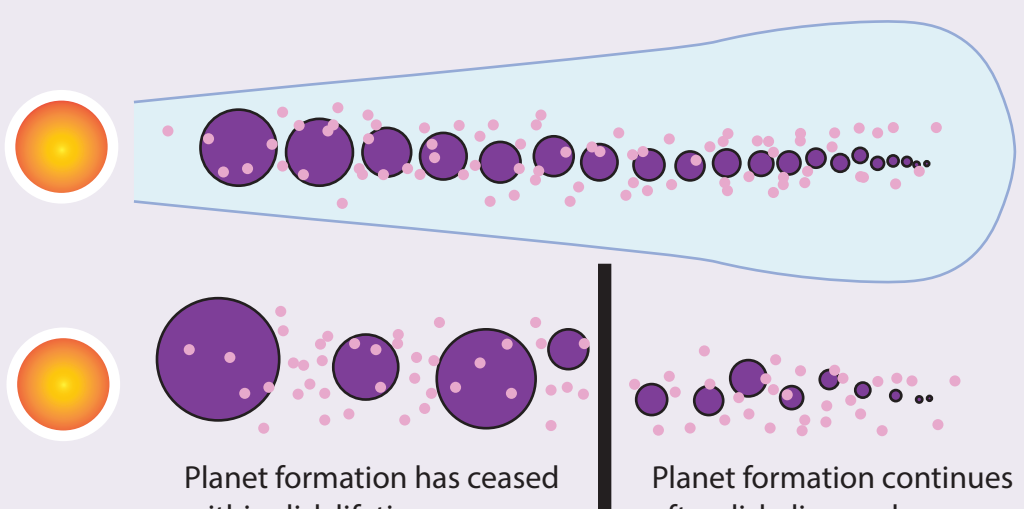
We propose to couple the N-body code SyMBA, that tracks the location and interactions of objects and uses proxy particles for debris, to the statistical debris/dust code BOULDER, that calculates the size particle distribution from coagulation and fragmentation of interacting debris/dust. We will implement Poyinting-Robertson drag and radiative pressure removal by eliminating small particles according to their lifetime. **Coupling both codes will allow for the first time to simultaneously model the growth of embryos via collisions, their interactions with planetesimals, and the production and evolution of dust that result in systems that resemble the rocky planet demographics.**



The proposed work is a seed of the research project described below to characterize dust production for realistic rocky planet formation scenarios to help interpret Spitzer, JWST and Roman dust observations

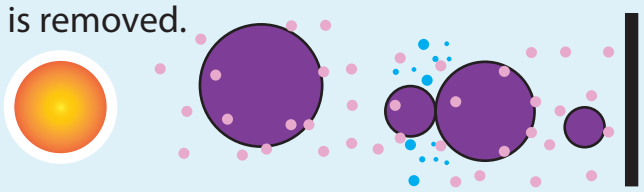
Future work: setting up initial conditions

We will start with embryos and planetesimals in disks characterized by different total masses and surface density slopes. Embryos will follow a modified isolation mass prescription initially. We will grow planets with the N-body code SyMBA in the presence of exponentially decaying gas until gas is dissipated. **The goal is to obtain the threshold radial distance (black line in figure to the right) where planets have already finished growing by the time the gas dissipates. This information is used below.**



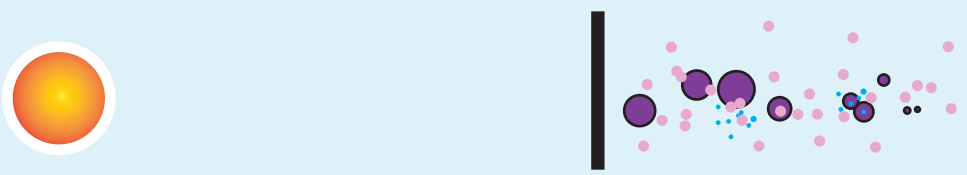
Future Work: inner disk dust production

This task is focused on the inner disk region (inside the threshold radial distance calculated above) where planet formation has ceased in the presence of the gas. Using SyMBA-BOULDER coupled code, we will follow the dust production from all collisions arising from the gravitational instabilites that are triggered after the gas is removed.



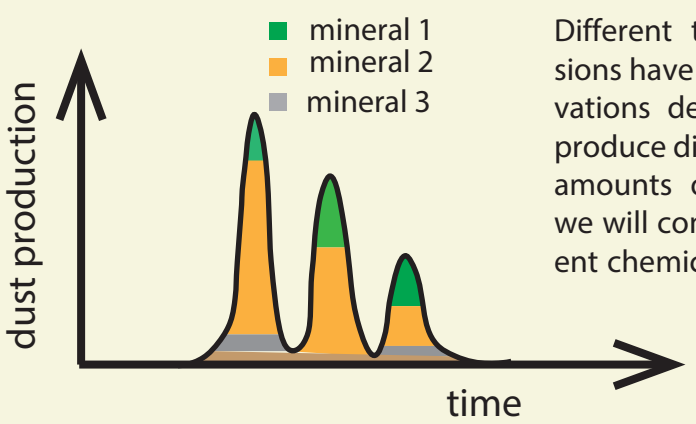
Future Work: outer disk dust production

This task focuses on the outer disk region (outside the threshold radial distance calculated above) where planets continue to form after the gas is dispersed. Using SyMBA-BOULDER, we will follow the evolution of dust produced by the sporadic collisions between embryos, and frequent collisions between embryos with planetesimals.



Overall Project Expected Outcomes

- **Lifetime of the observable dust signature**
- **Timing and frequency of dust bursts**
- **Dust's expected composition based on origin of colliding bodies and collision energetics**



Different types of collisions have different excavations depths and will produce different amounts of debris that we will connect to different chemical sources