



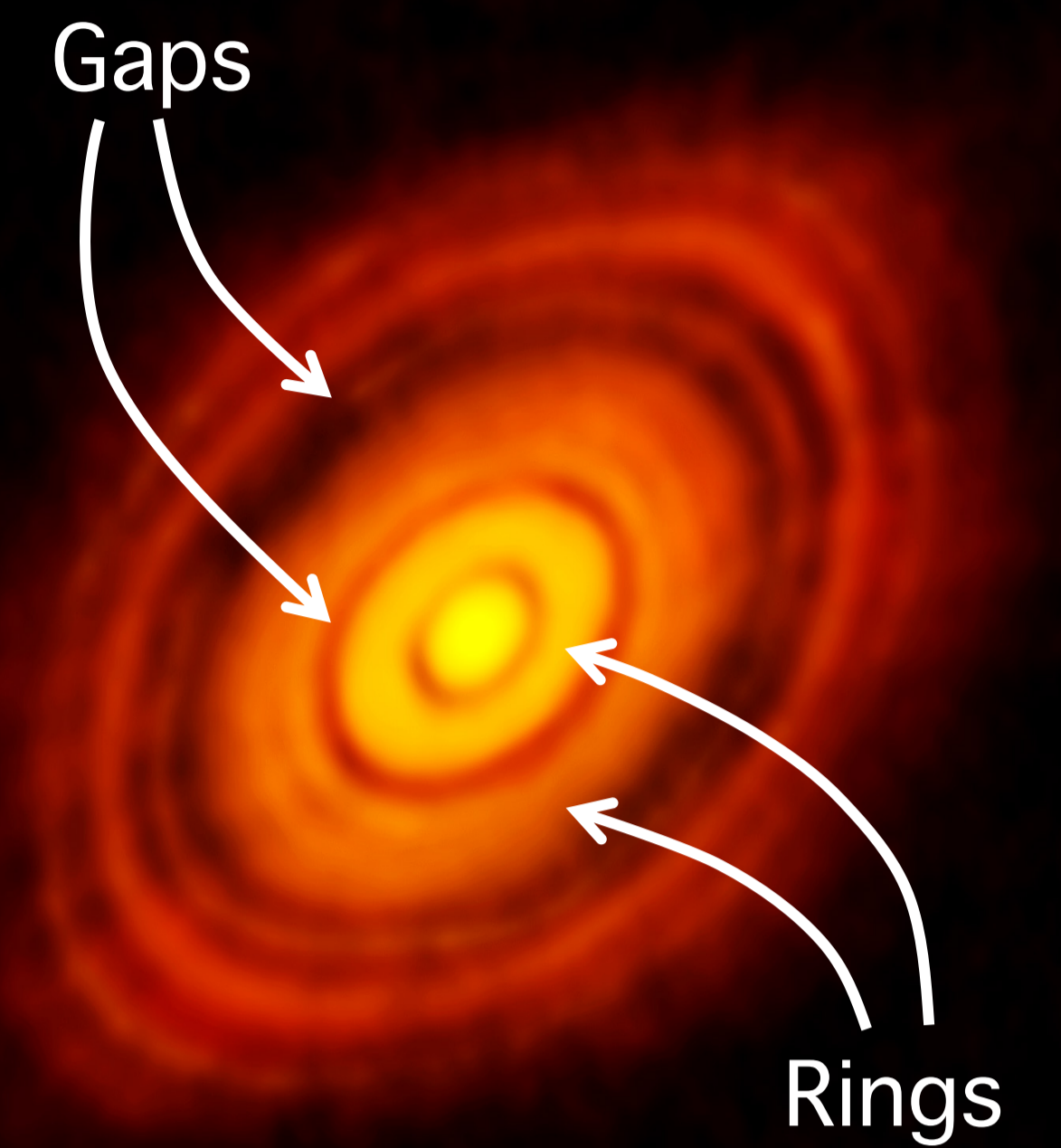
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## 1 How to Build a Planet

Protoplanetary discs consist of two components: gas and dust. To build the solid cores of planets, small dust grains must collide in such a way that they coagulate more than they fragment, growing to larger sizes.

Regions with a higher density of dust grains will see a higher collision rate with slower moving particles, making coagulation easier. High density regions can form when an embedded planet perturbs the disc, producing a ring of dust exterior to its location. There are two mechanisms by which this can happen: (a) pebble isolation [1] or (b) gap-opening [2].



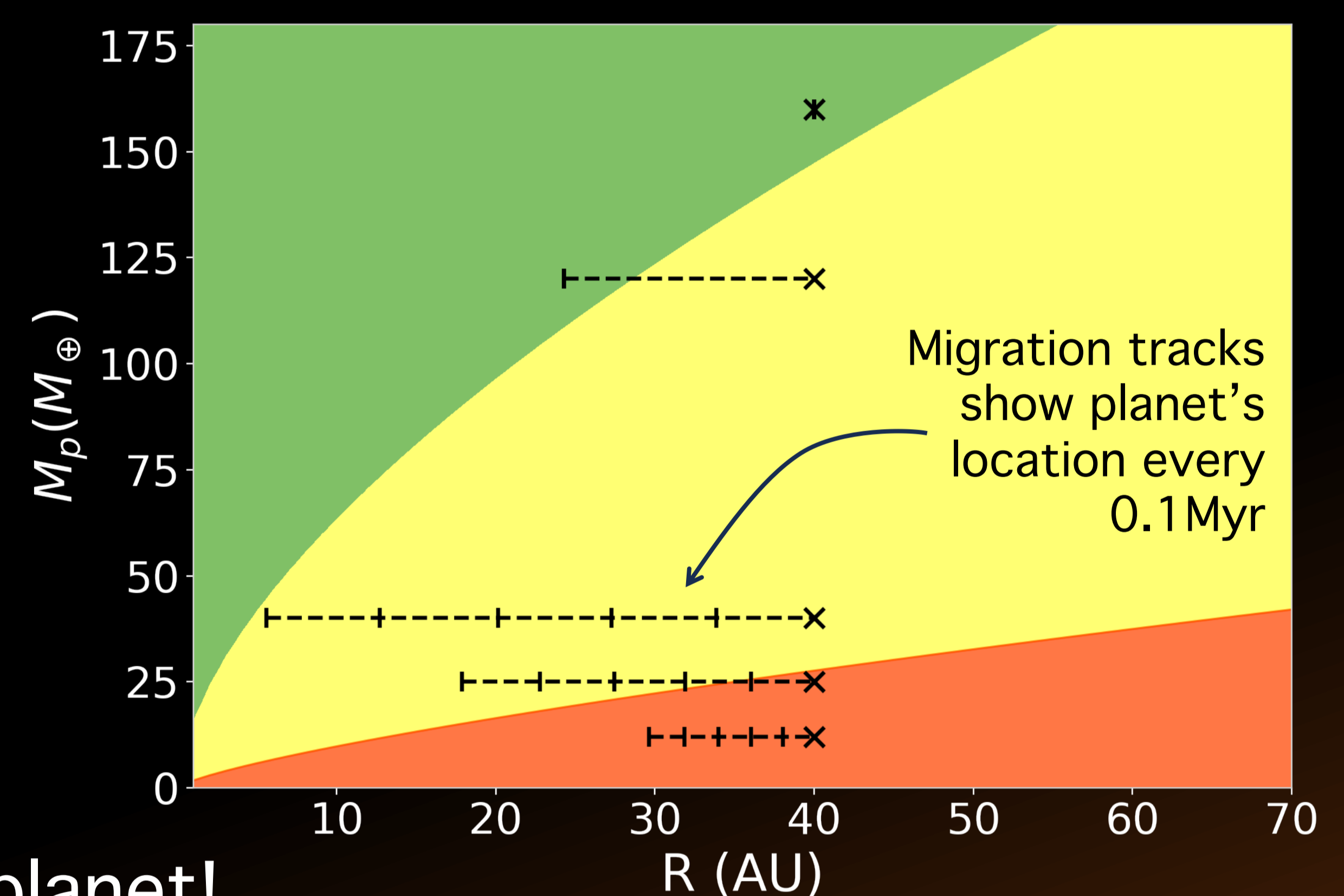
Source: ALMA

How does the presence of a planet affect dust growth, if at all?

What role, if any, does planetary migration play?

## 2 Mass Regimes

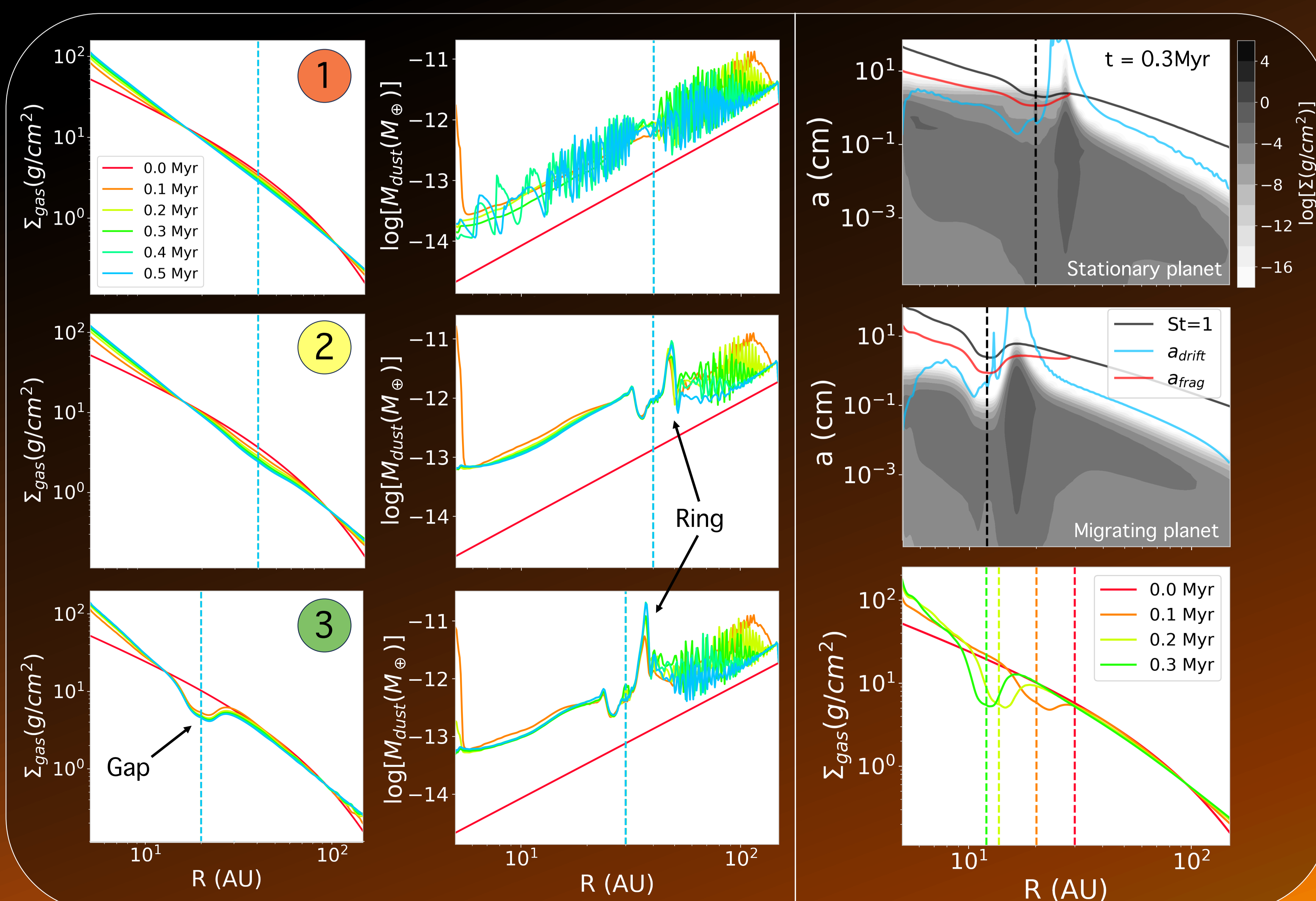
$M_p < M_{iso}$ $M_p < M_{gap}$	$M_{iso} < M_p < M_{gap}$	$M_p > M_{iso}$ $M_p > M_{gap}$
Planet not massive enough to perturb gas or dust	Planet massive enough to form dust ring but not gas gap	Planet massive enough to form gas gap and dust ring



\* Regime boundaries change over time for a migrating planet!

## 3 Hydrodynamical Models

2D global hydrodynamical simulations of protoplanetary discs run with FARGO3D [3].  
5 planet masses chosen: 1 for each regime + 2 migrating across regime boundaries.



## 4 Results

- ★ Dust growth to > cm sized objects (pebbles) possible within 300,000 years in dust rings.
- ★ 'Snowplough' effect of migrating planet induces growth interior to planet as well.
- ★ Migrating planets can produce gaps and rings more easily but growth in rings is slower.

### References

- Bitsch et al., 2018, Pebble-isolation mass: Scaling law and implications for the formation of super-Earths and gas giants, A&A
- Crida et al., 2006, On the width and shape of gaps in protoplanetary discs, Icarus
- Benítez-Llambay & Masset, 2016, FARGO3D: A New GPU-Oriented MHD Code, ApJS