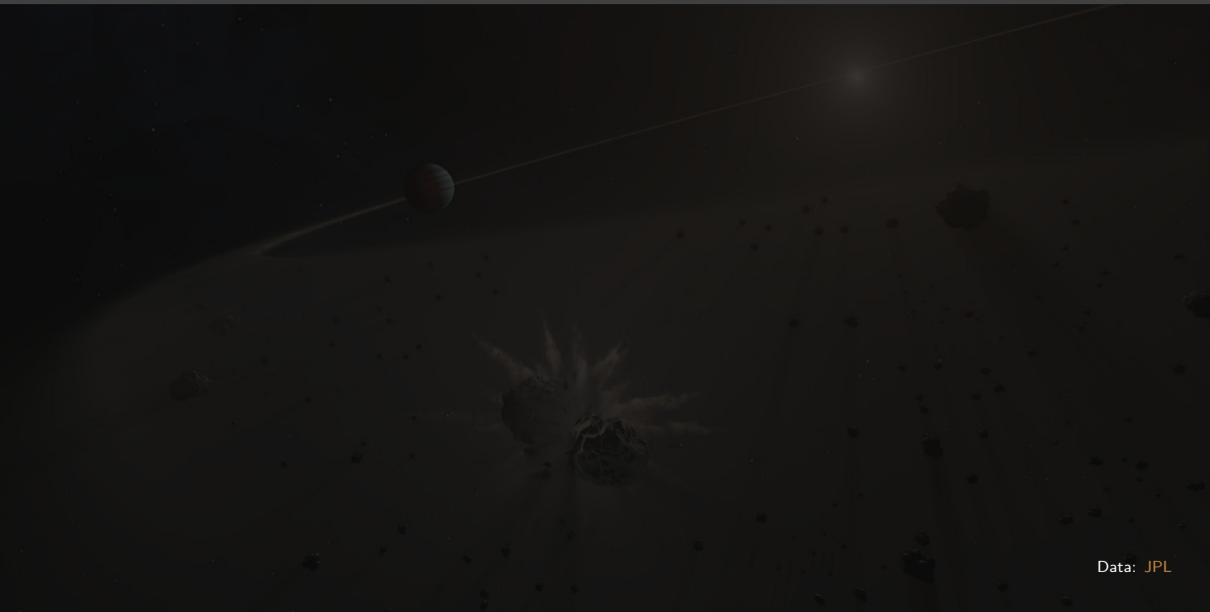


Kuiper Belts around other stars

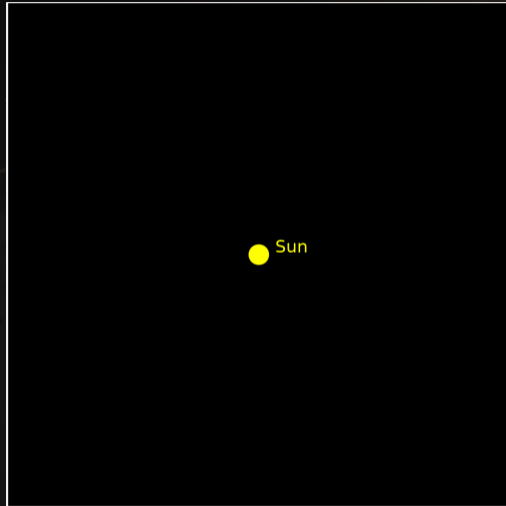


Tim Pearce

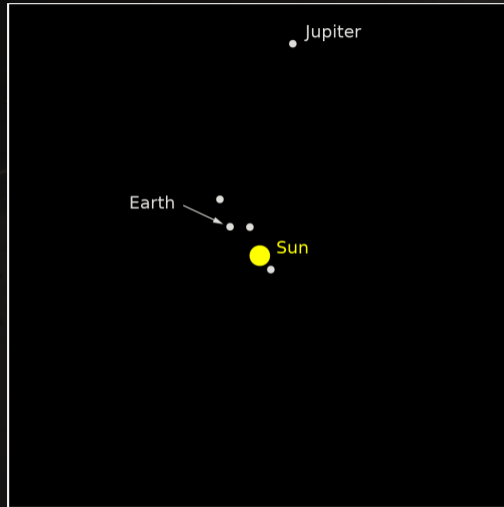
Solar System



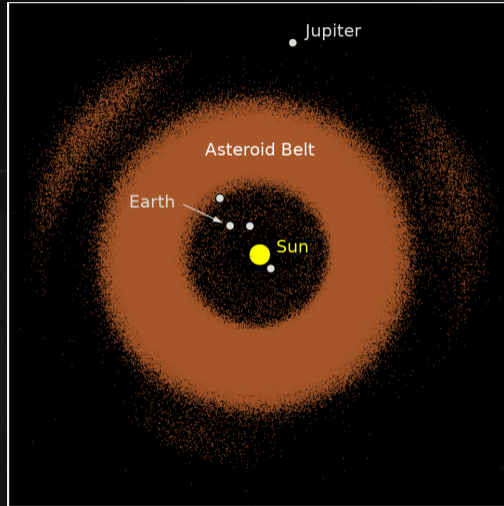
Solar System



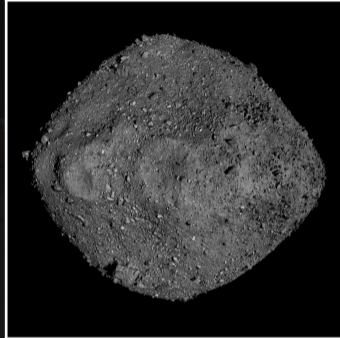
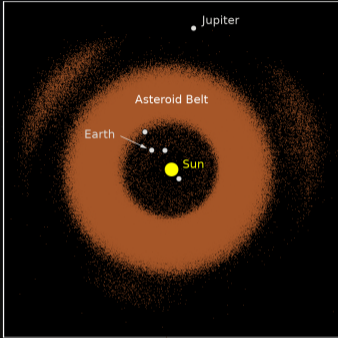
Solar System



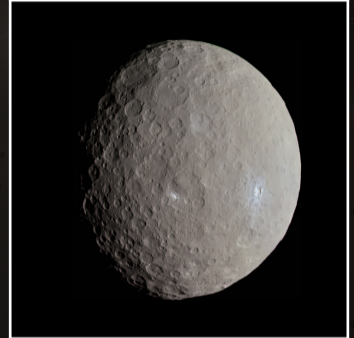
Solar System



Solar System

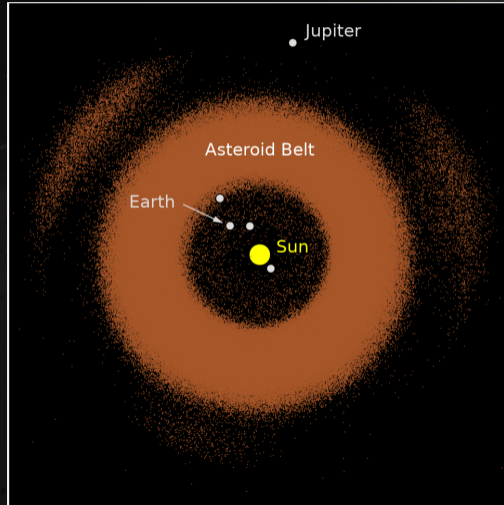


Bennu

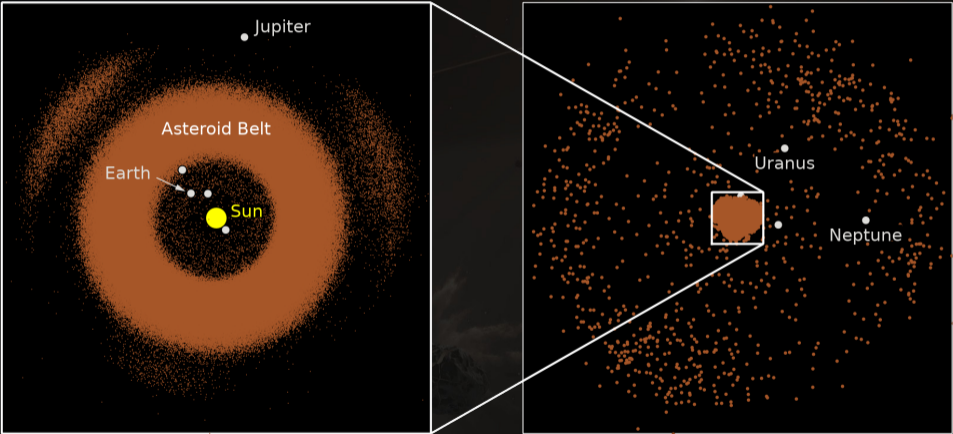


Ceres

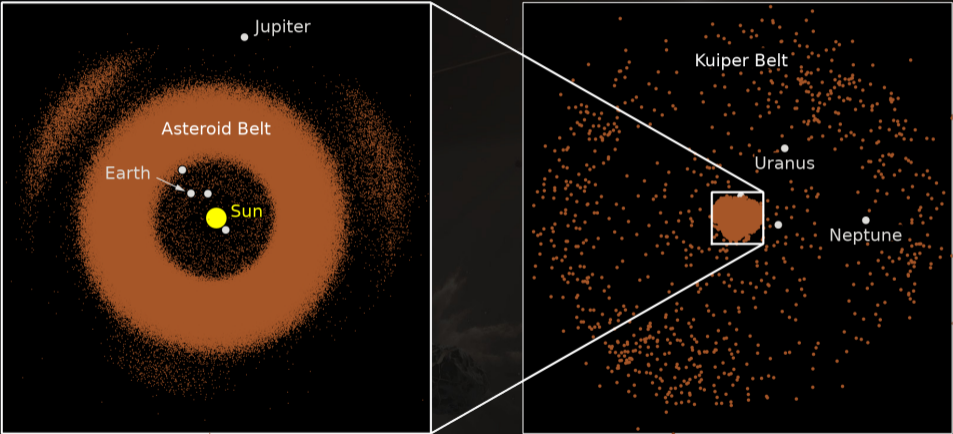
Solar System



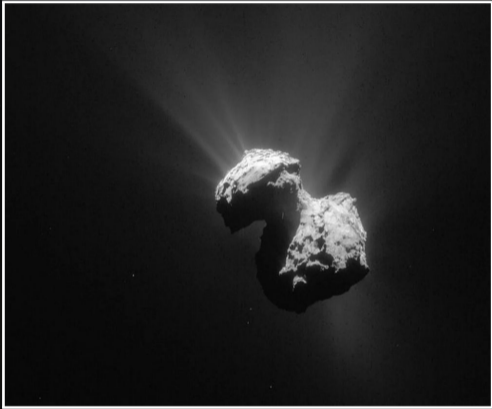
Solar System



Solar System

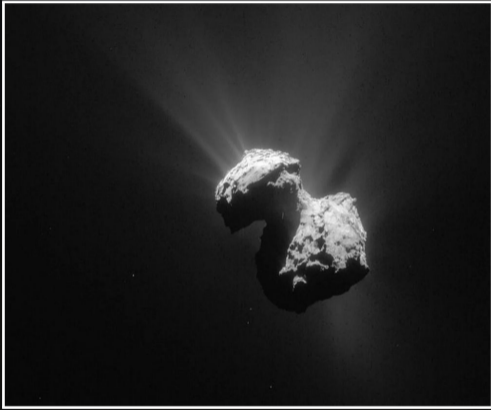


Solar System



Comet 67P / Churyumov-Gerasimenko

Solar System

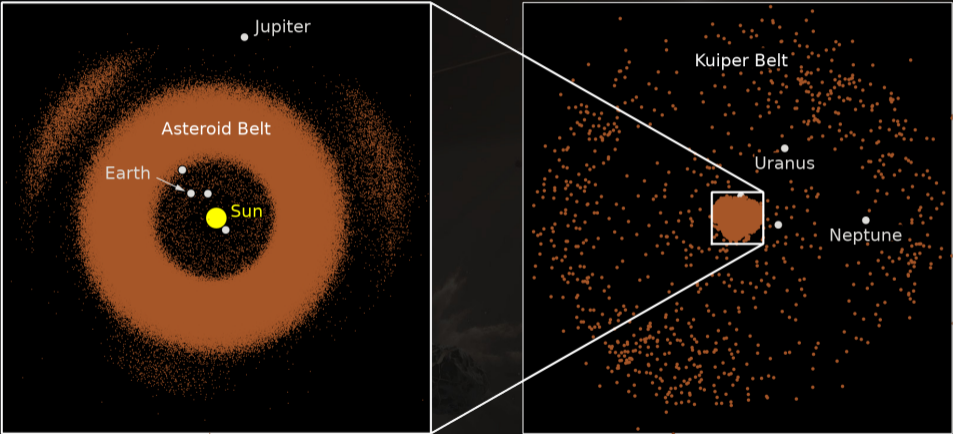


Comet 67P / Churyumov-Gerasimenko

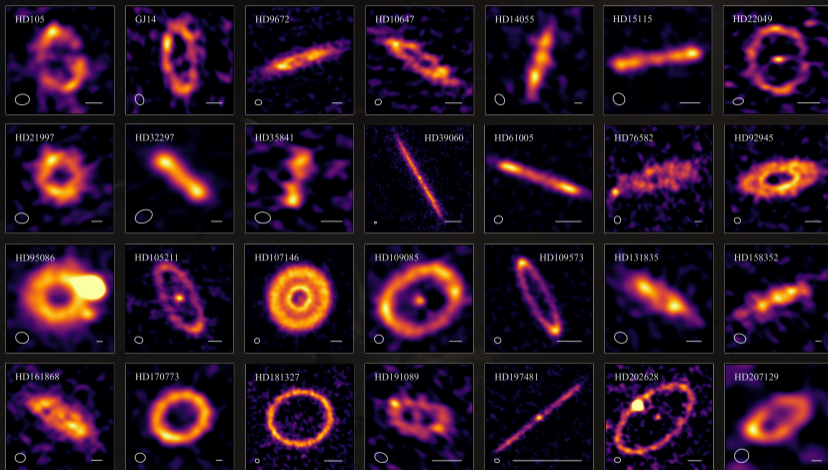


Pluto

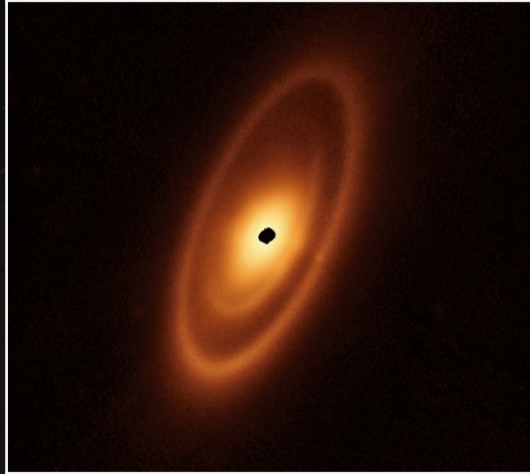
Solar System



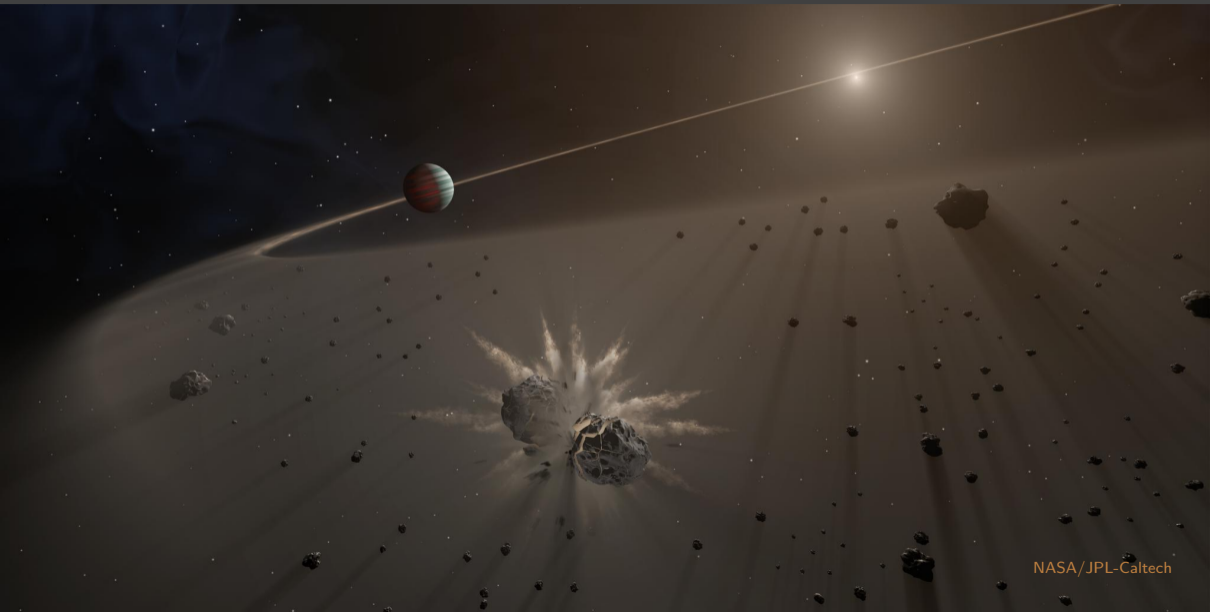
Extrasolar Kuiper Belts



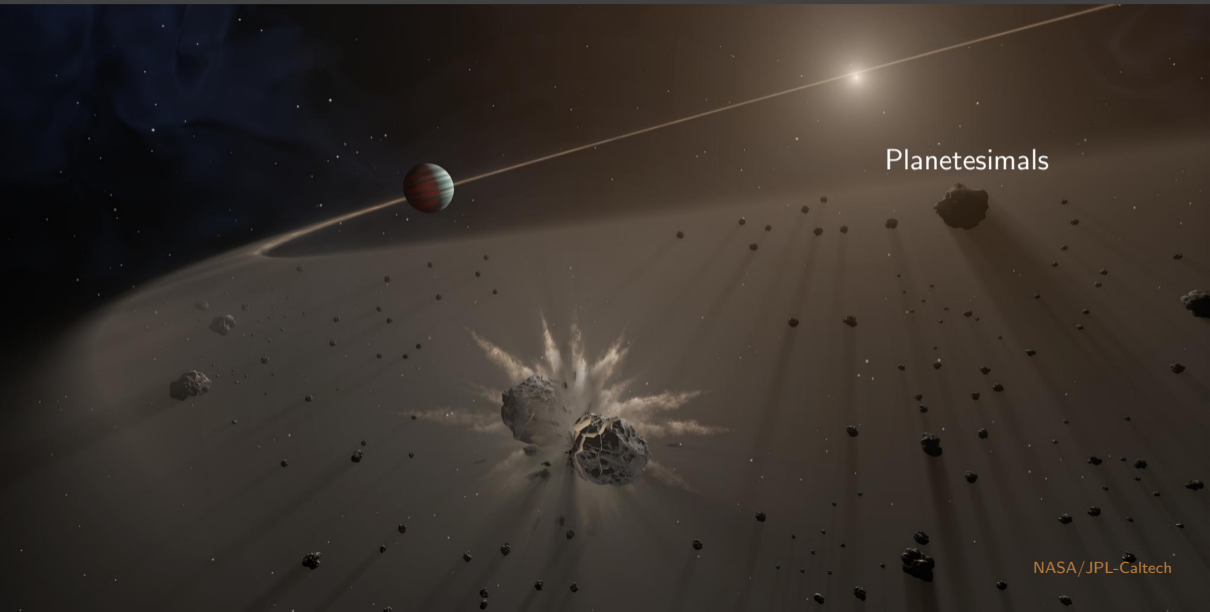
Extrasolar Kuiper Belts



What happens in Kuiper Belts?

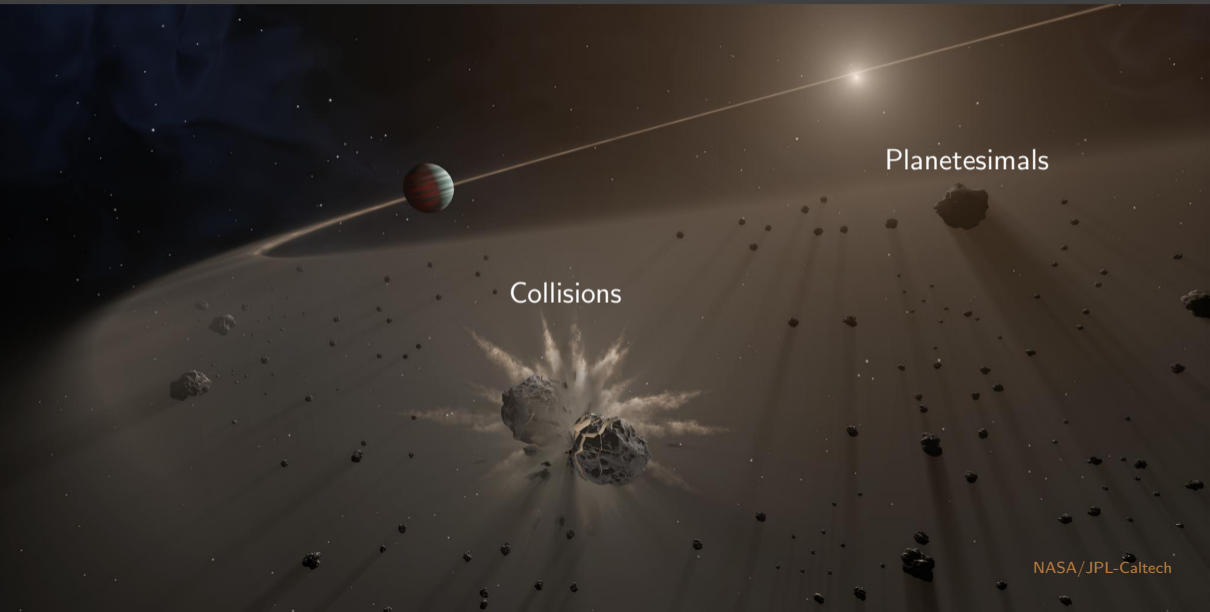


What happens in Kuiper Belts?



Planetesimals

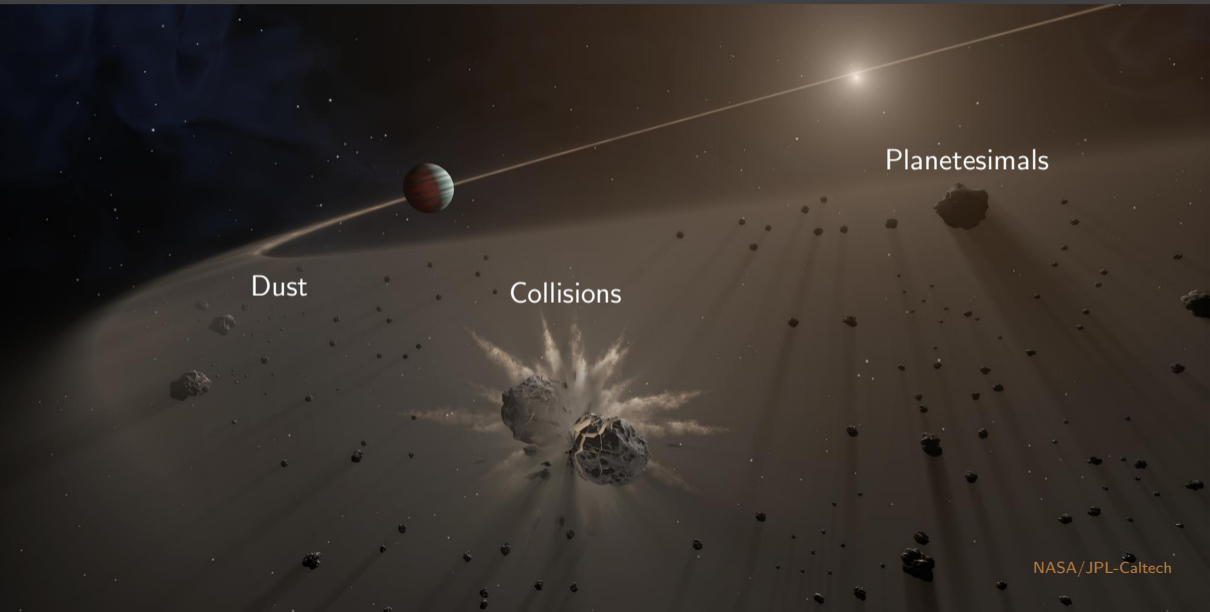
What happens in Kuiper Belts?



Planetesimals

Collisions

What happens in Kuiper Belts?

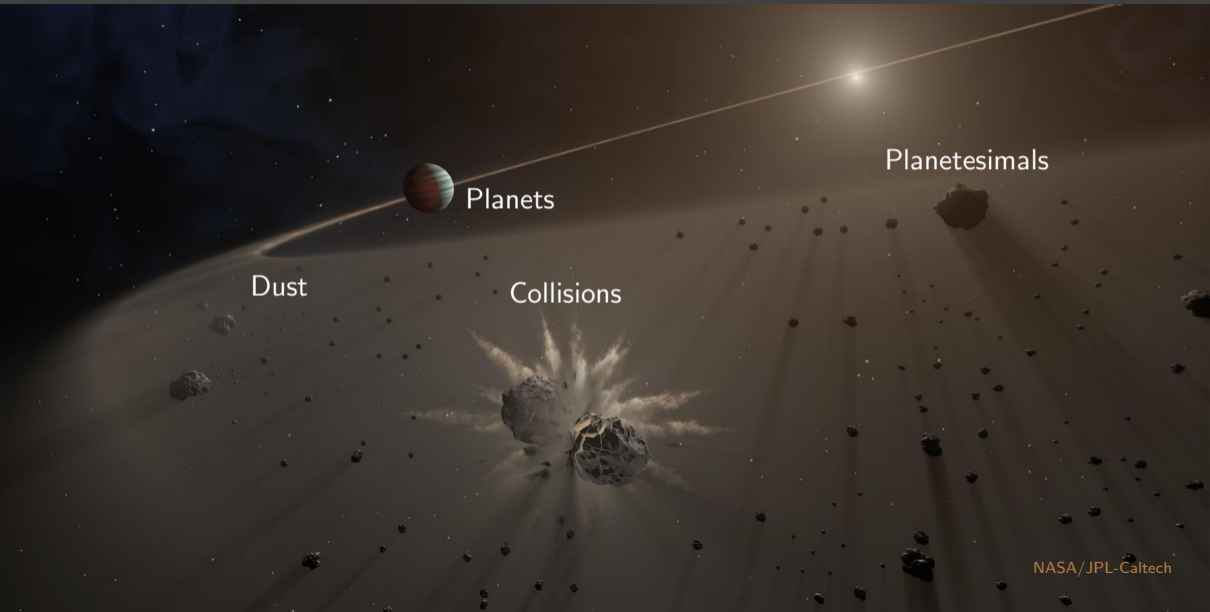


Dust

Collisions

Planetesimals

What happens in Kuiper Belts?



Dust

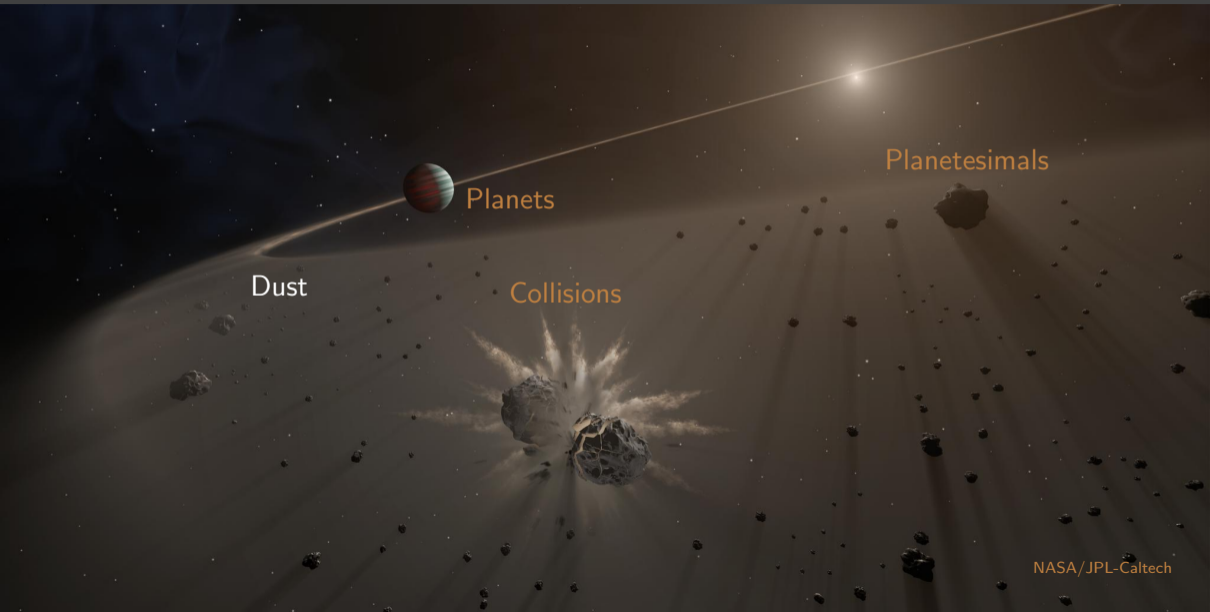


Planets

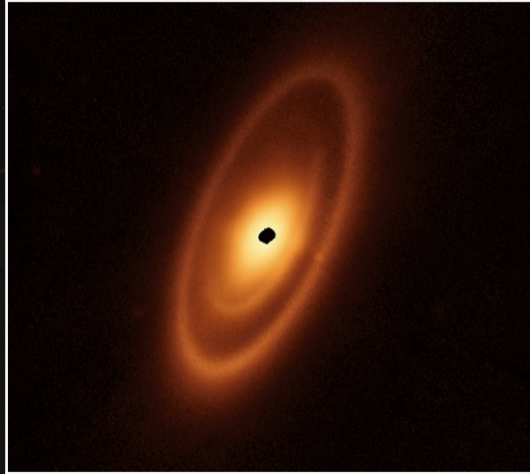
Collisions

Planetesimals

What happens in Kuiper Belts?



Extrasolar Kuiper Belts



We see dust, not planetesimals

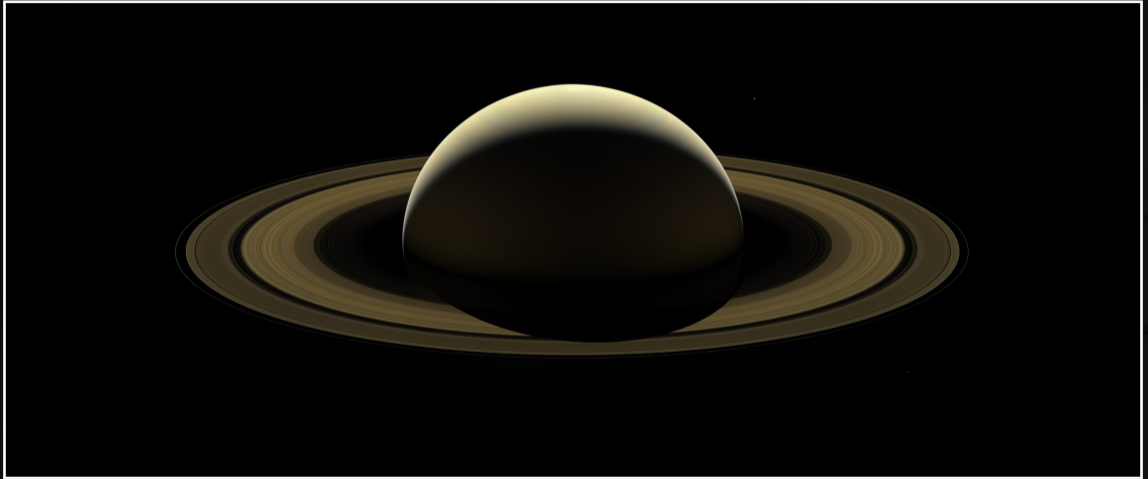
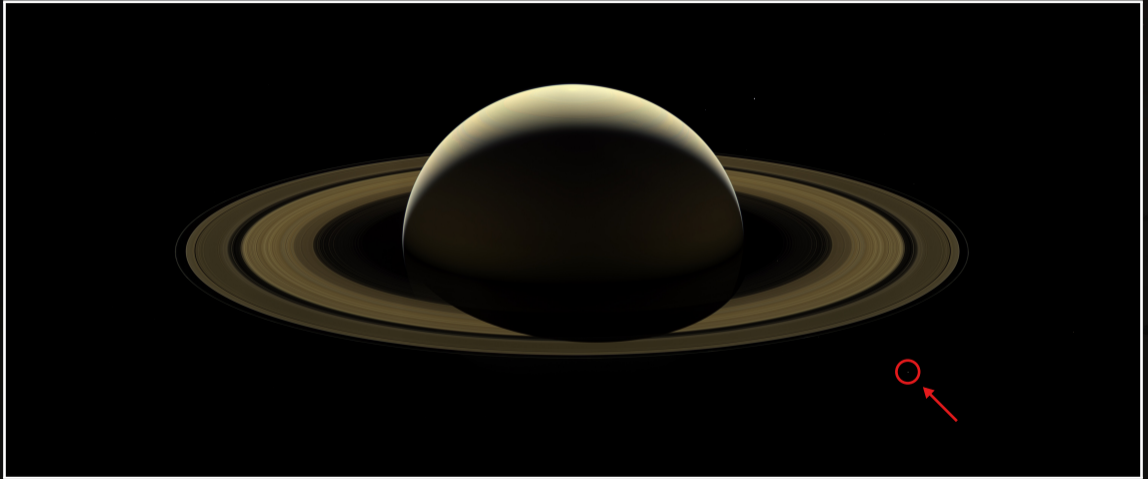
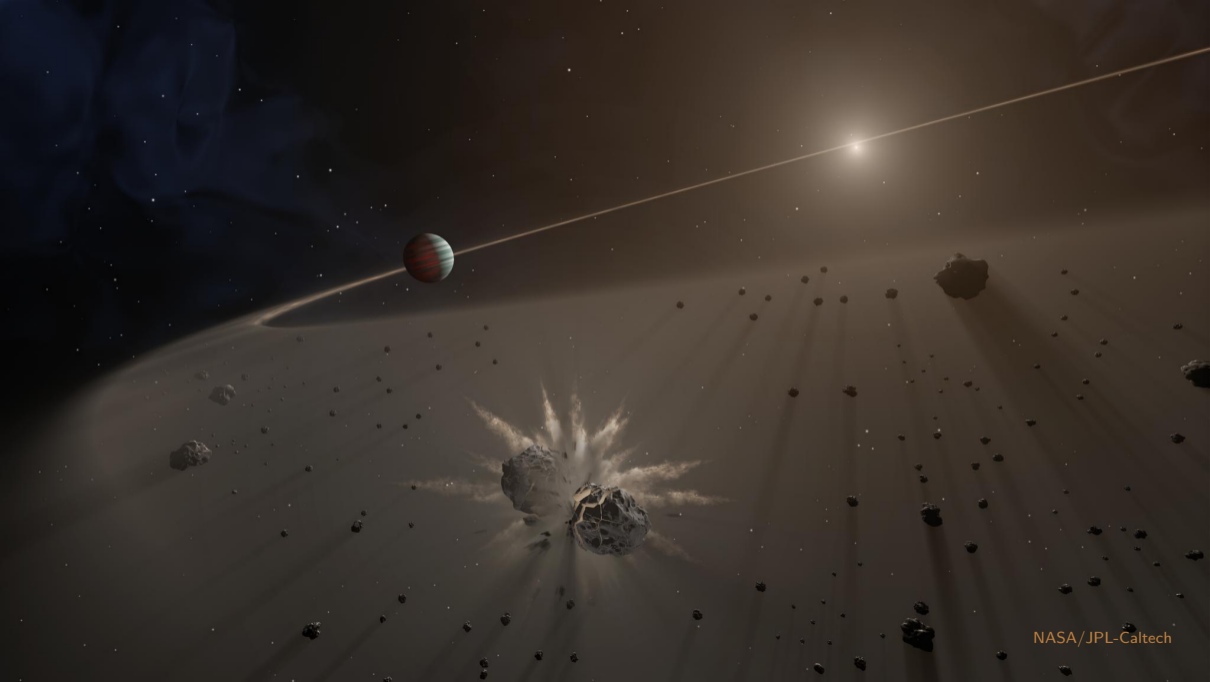


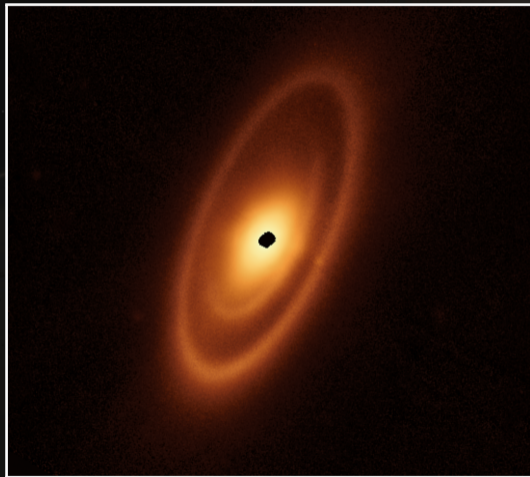
Image: NASA/JPL-Caltech/Space Science Institute

We see dust, not planetesimals



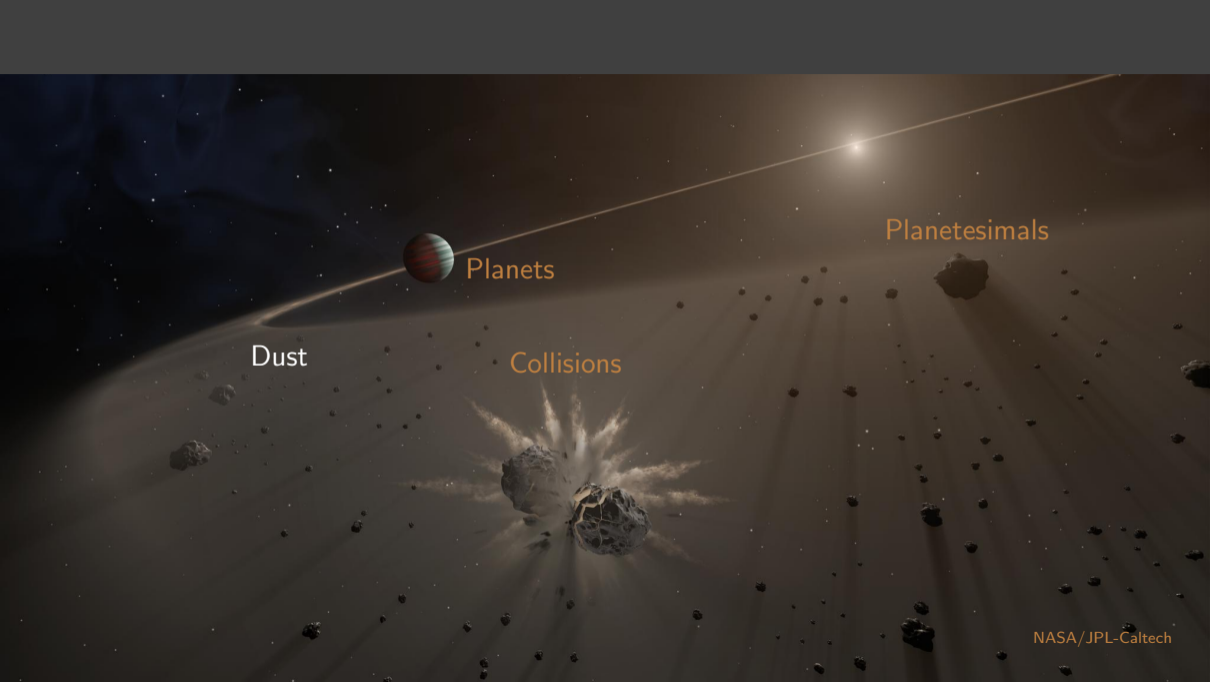


We see dust, not planetesimals



A dark space scene with a bright star in the upper right, a planet in the upper left, and a comet with a long tail in the lower center. The text "Where does the dust come from?" is centered in white.

Where does the dust come from?

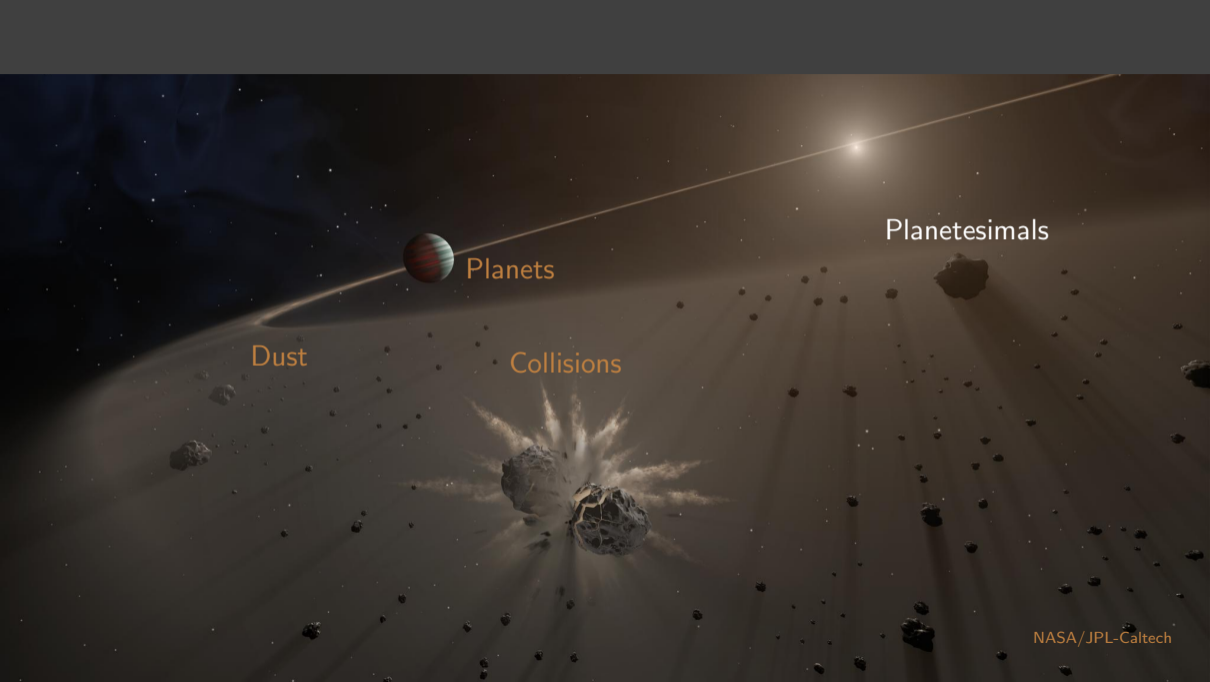


Dust

Collisions

Planets

Planetesimals



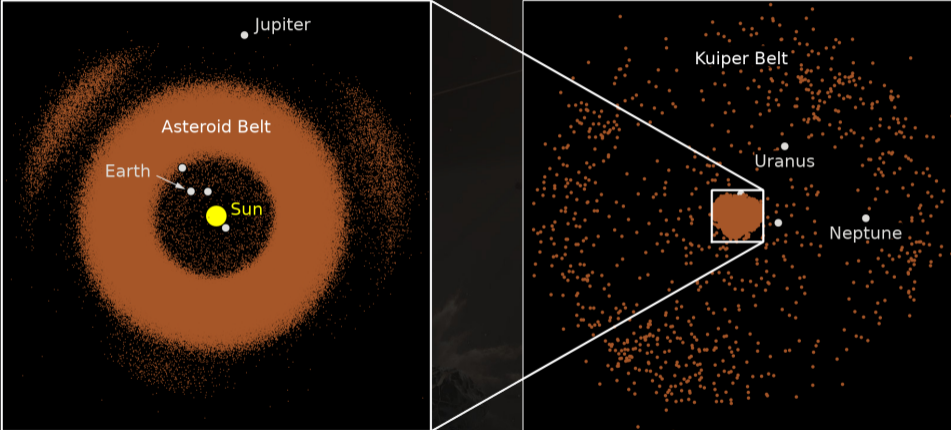
Planets

Planetesimals

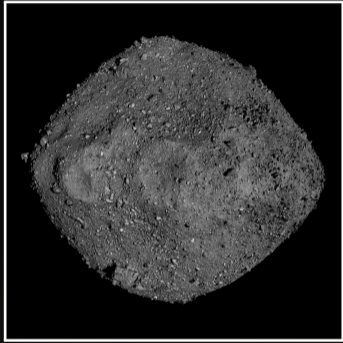
Dust

Collisions

Planetesimals in the Solar System

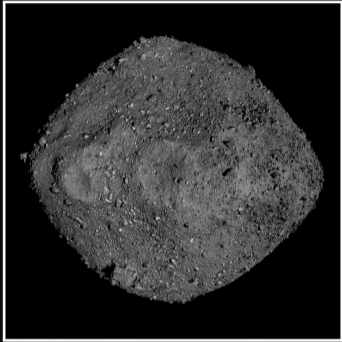


Planetesimals in the Solar System

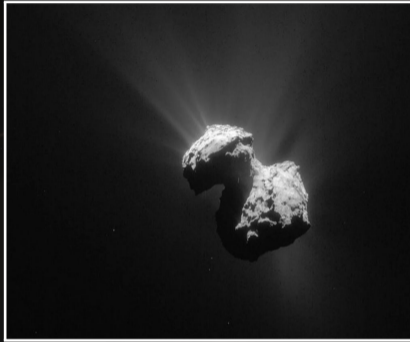


Bennu
(asteroid)

Planetesimals in the Solar System

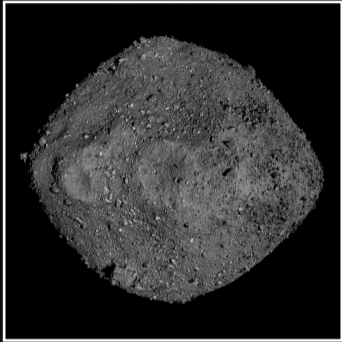


Bennu
(asteroid)

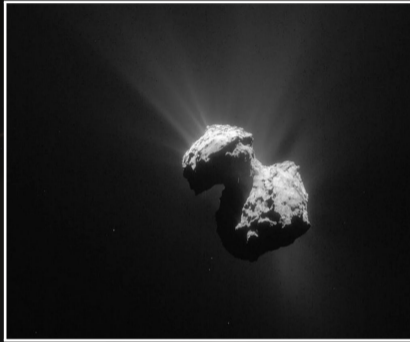


67P / Churyumov-Gerasimenko
(comet)

Planetesimals in the Solar System



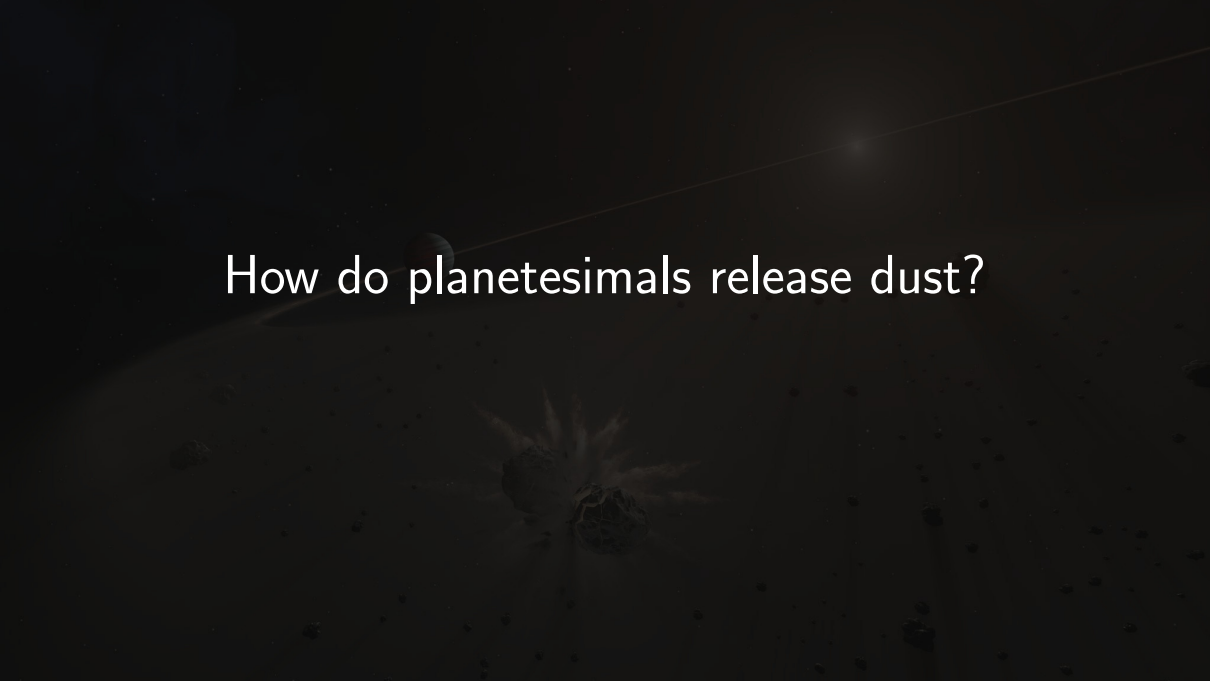
Bennu
(asteroid)



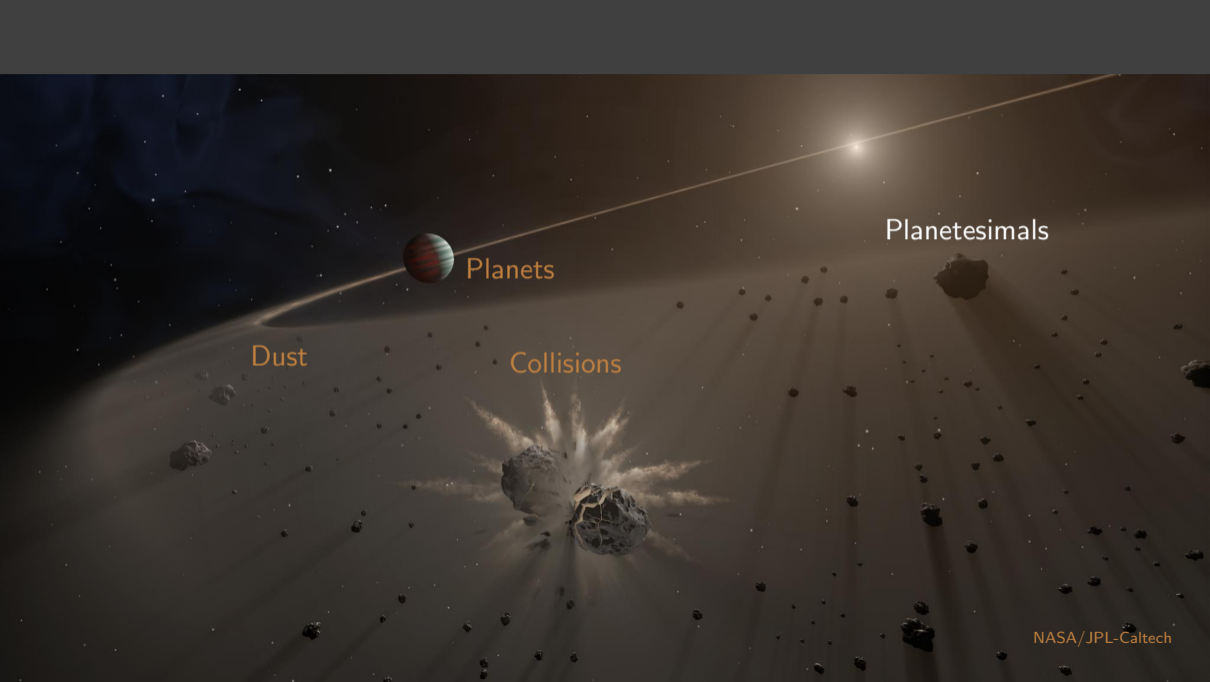
67P / Churyumov-Gerasimenko
(comet)



Pluto
(Kuiper Belt object)

A dark space scene with a bright star in the upper right, a planet in the upper left, and a comet with a long tail in the center. The text "How do planetesimals release dust?" is overlaid in white.

How do planetesimals release dust?

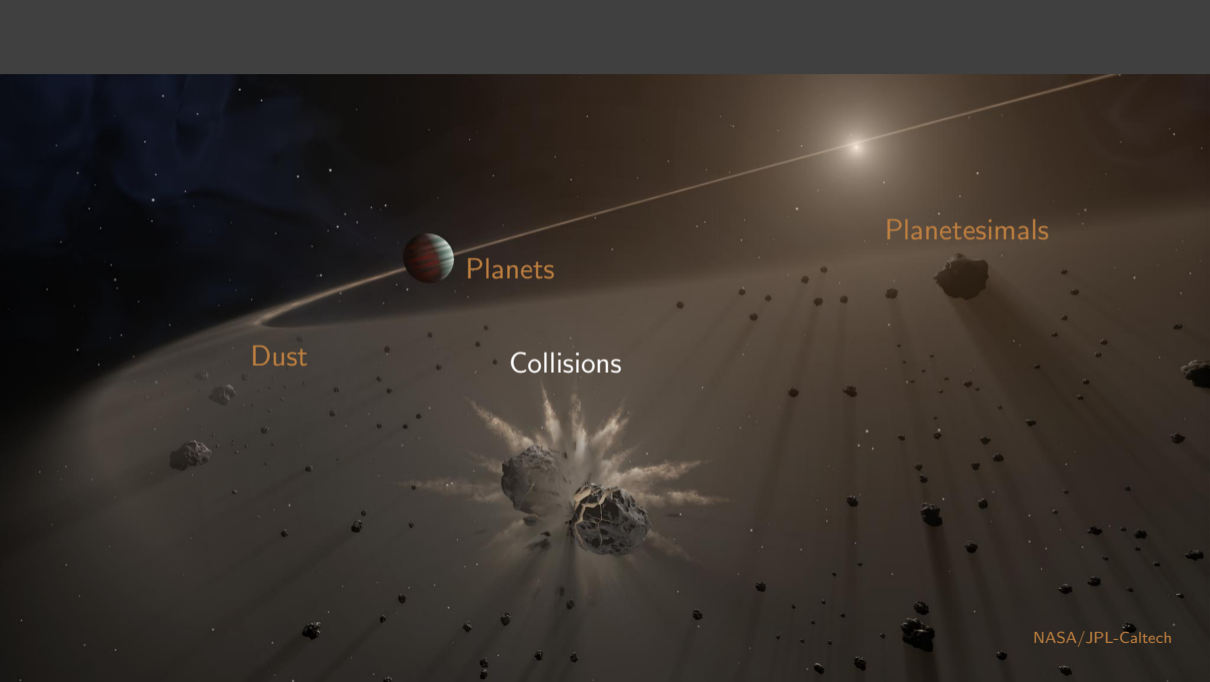


Planets

Planetesimals

Dust

Collisions



Dust

Collisions

Planets

Planetesimals

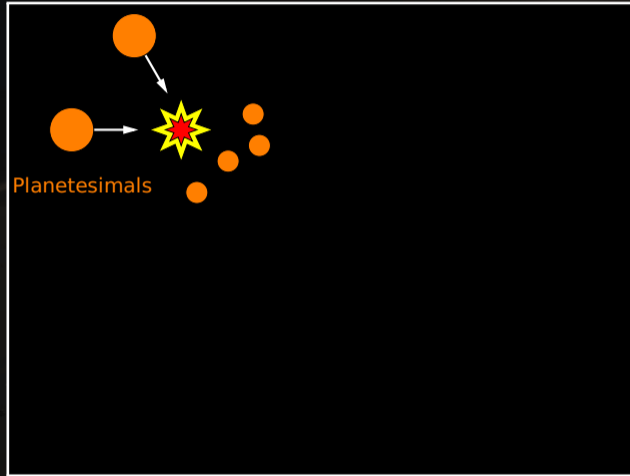
Collisional cascade



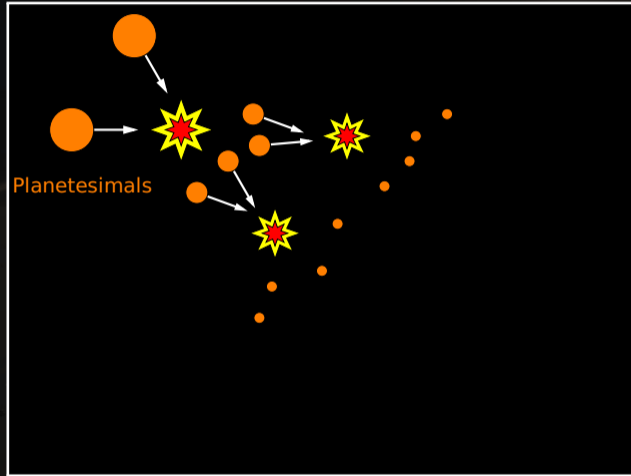
Collisional cascade



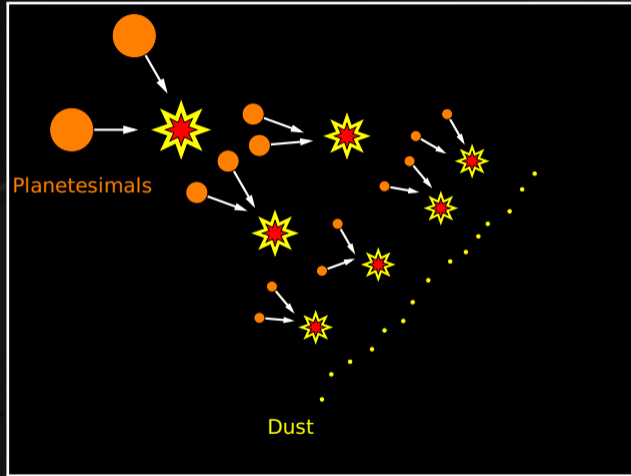
Collisional cascade



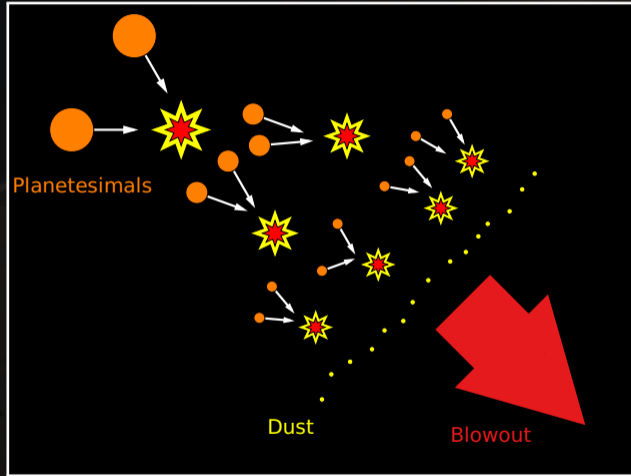
Collisional cascade



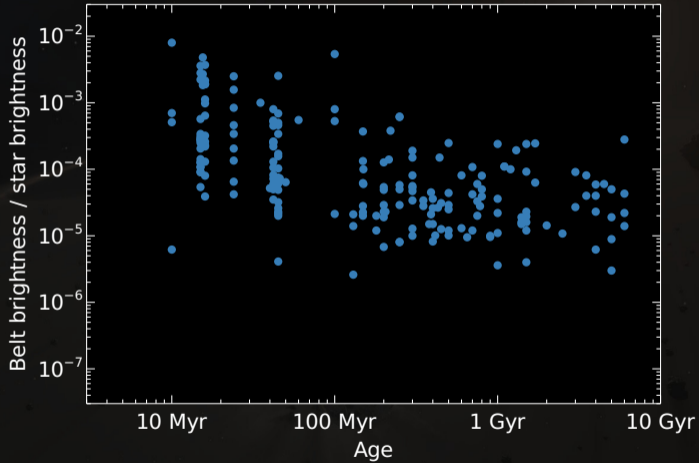
Collisional cascade



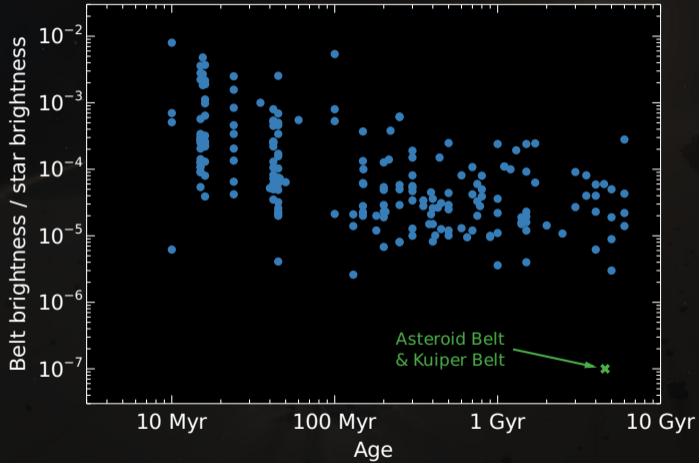
Collisional cascade



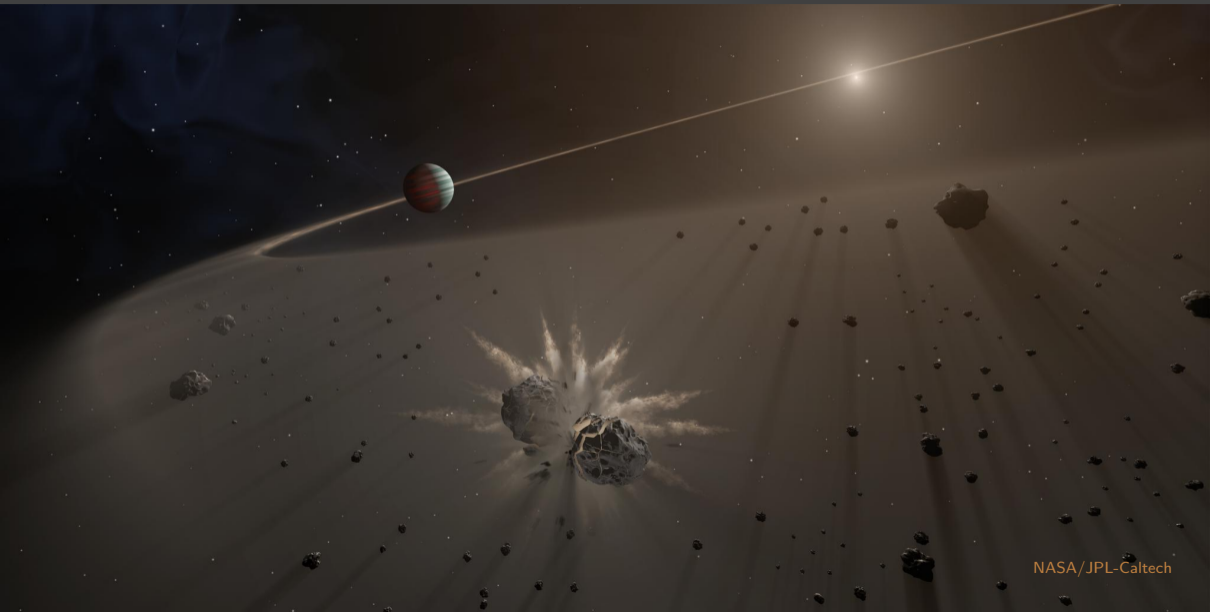
Belts lose mass over time



Belts lose mass over time



Stirring



Stirring



Stirring



Stirring mechanisms:

- Self stirring

Stirring



Stirring mechanisms:

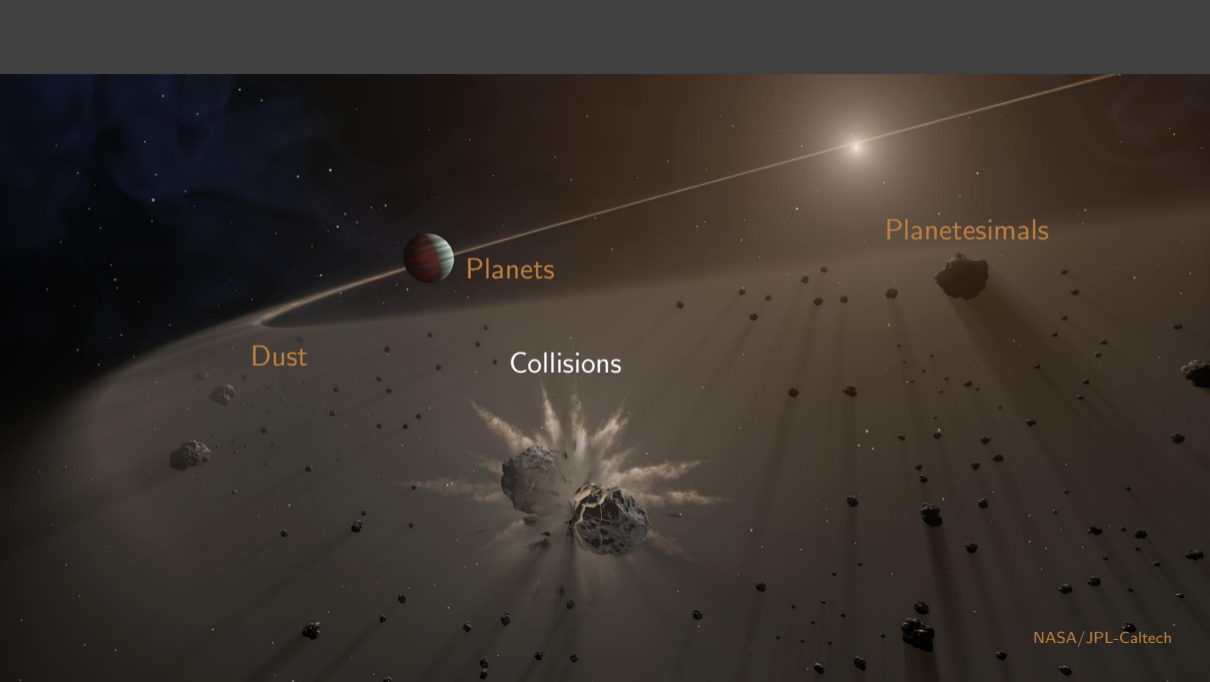
- Self stirring
- Flyby stirring

Stirring



Stirring mechanisms:

- Self stirring
- Flyby stirring
- Planet stirring

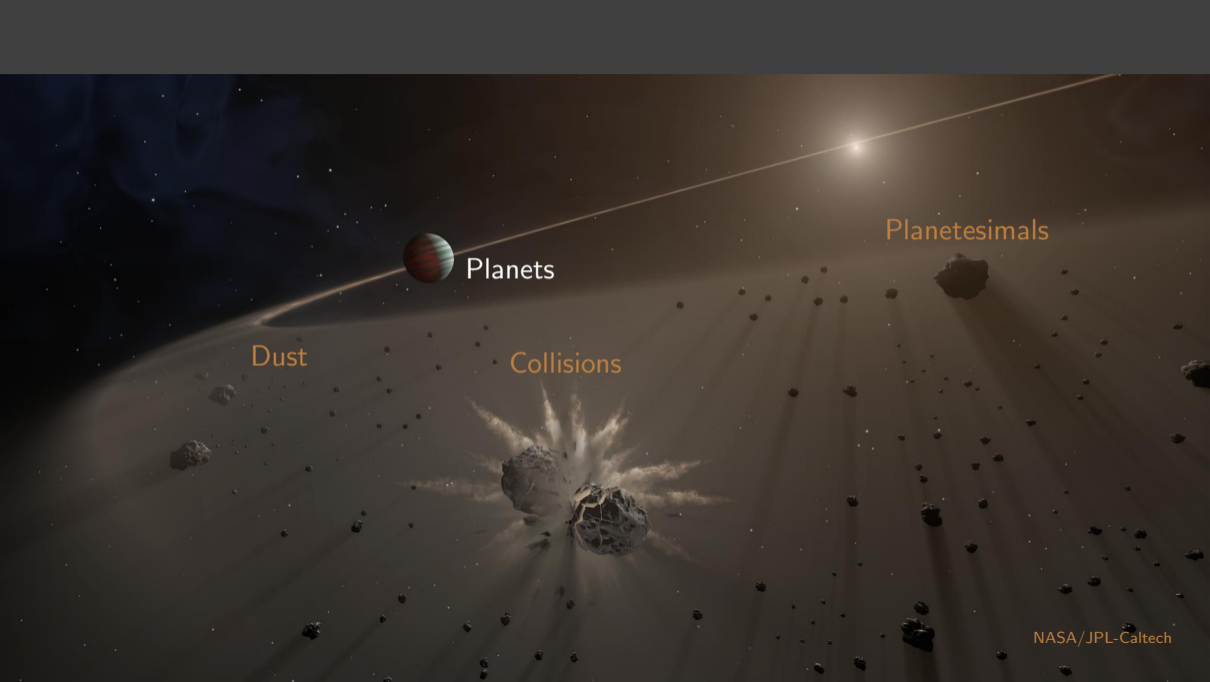


Planets

Planetesimals

Dust

Collisions



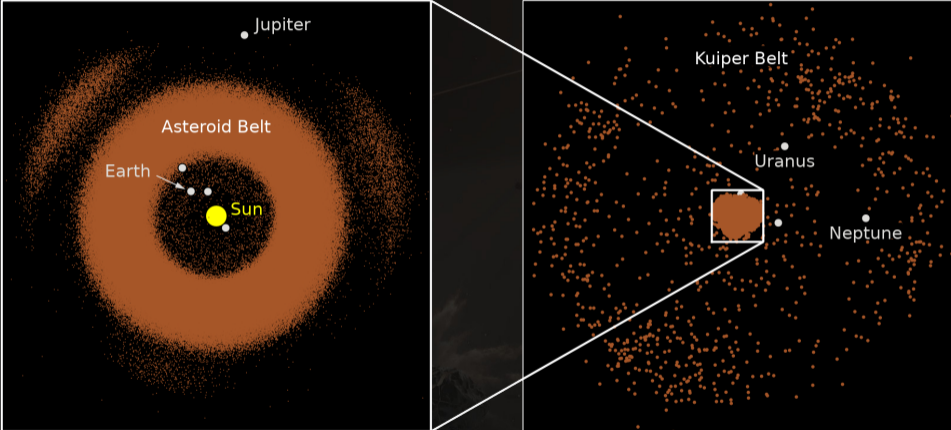
Dust

Collisions

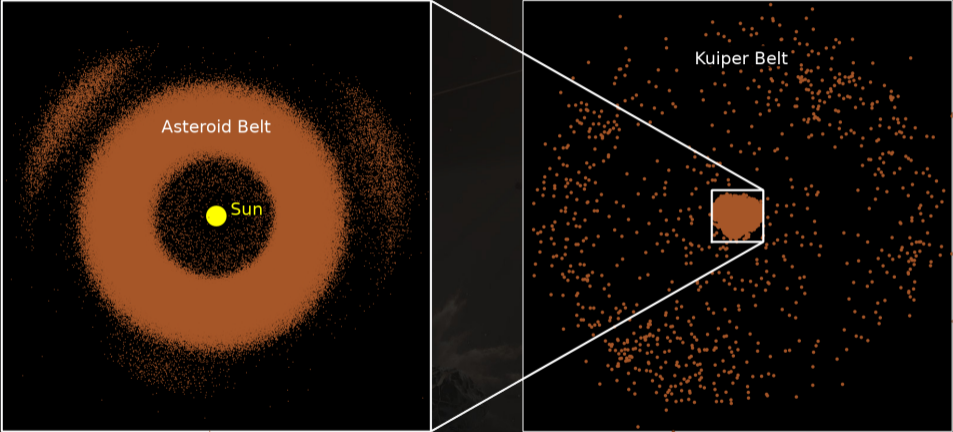
Planets

Planetesimals

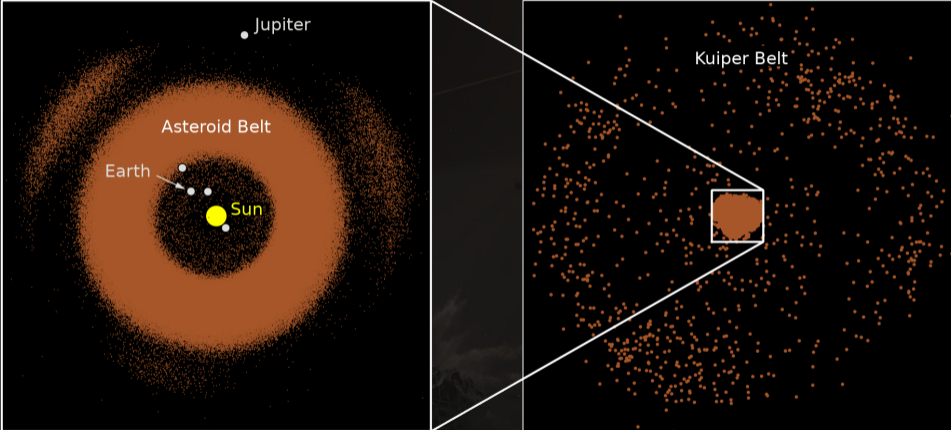
Planets and belts interact in the Solar System



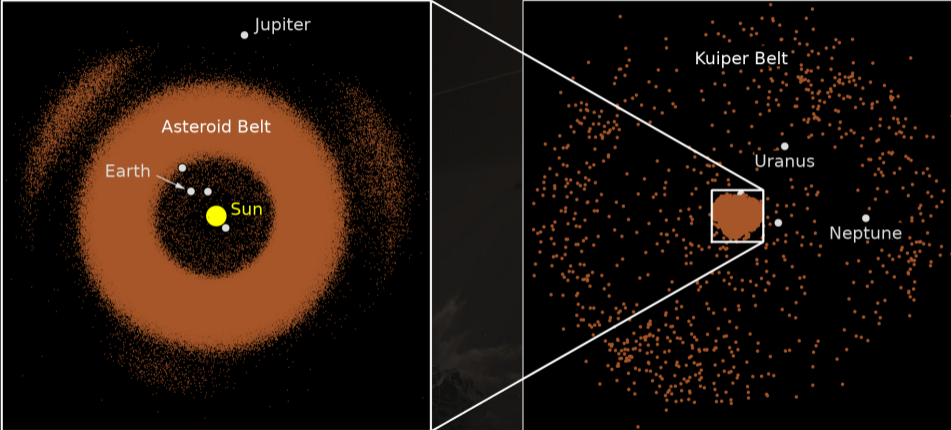
Planets and belts interact in the Solar System



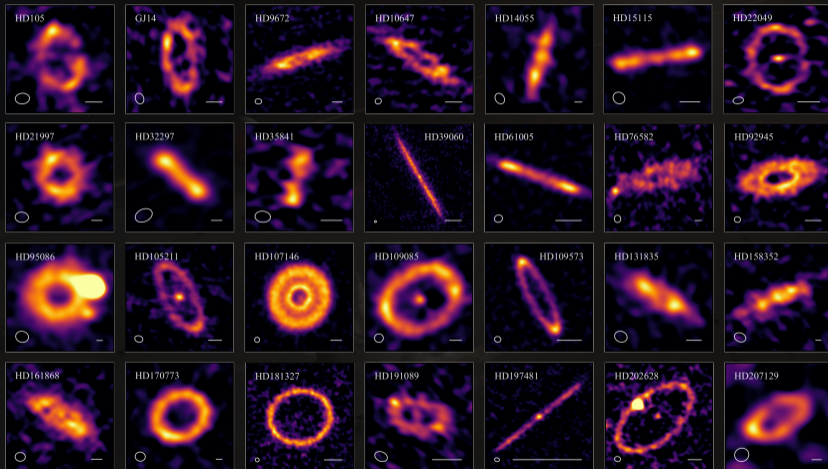
Planets and belts interact in the Solar System

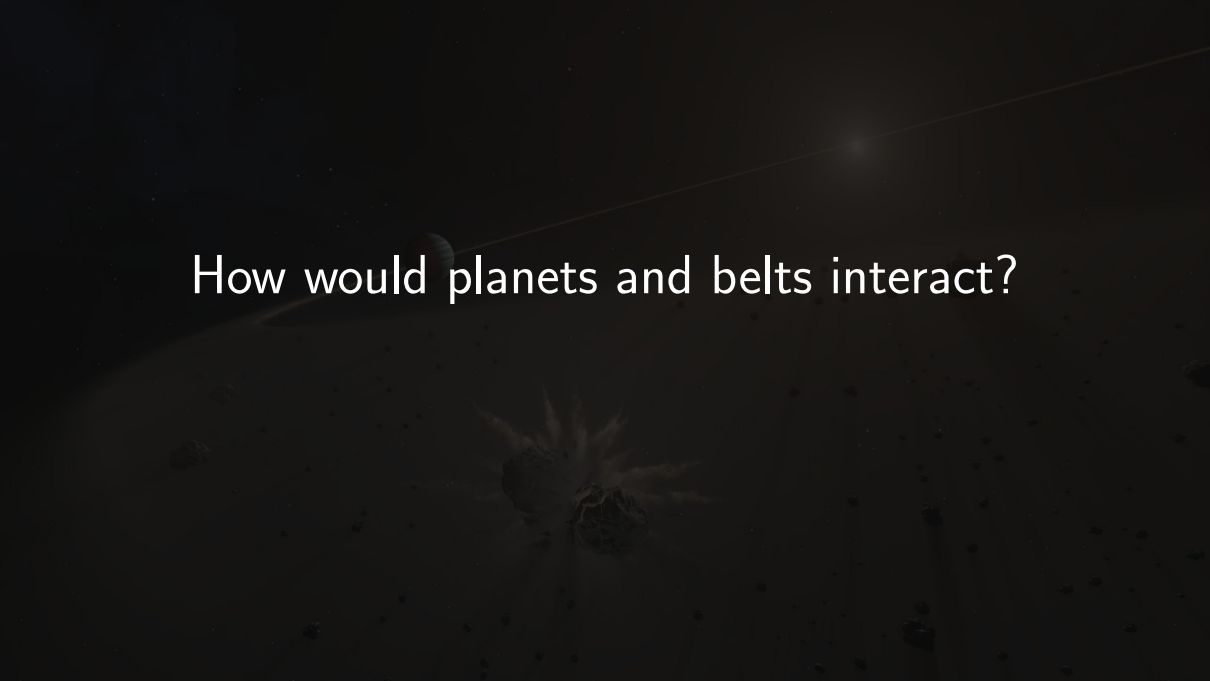


Planets and belts interact in the Solar System



Do planets interact with extrasolar belts too?



A dark space scene featuring a bright star in the upper right, a planet in the upper left, and a protoplanetary disk in the center. The text "How would planets and belts interact?" is overlaid in white.

How would planets and belts interact?

Planets interact with belts

Carve gaps



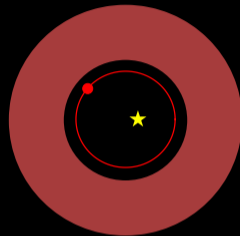
Warp belts



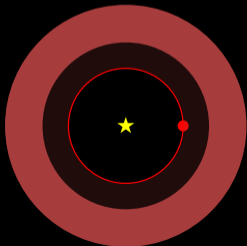
Pass bodies inward



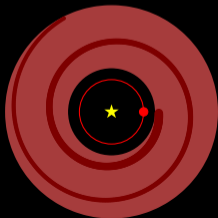
Make belts eccentric



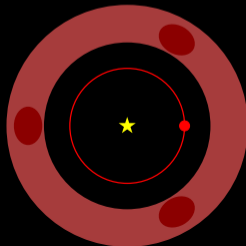
Sculpt disc edges



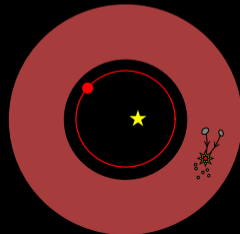
Drive spirals



Make clumps

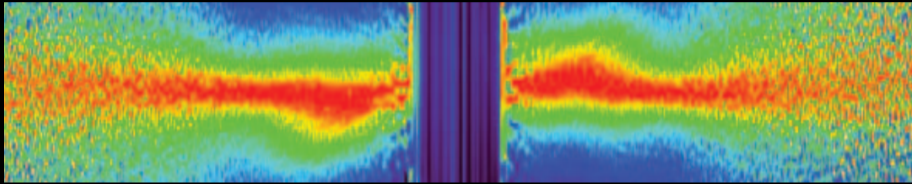


Stir debris

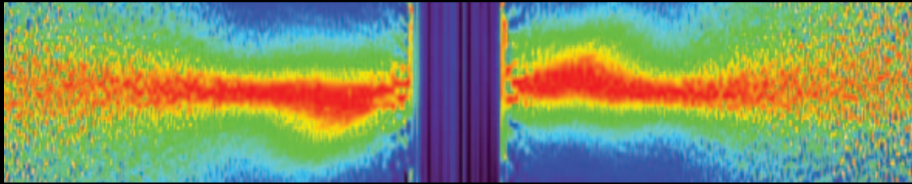


Planets interact with belts

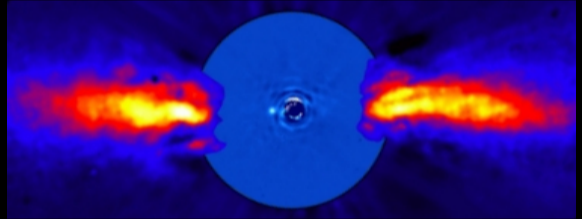
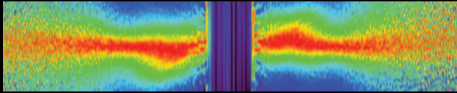
Planets interact with belts



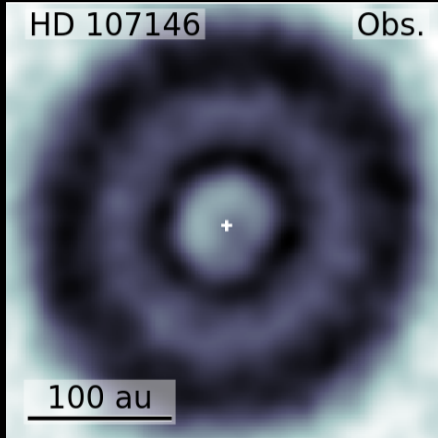
Planets interact with belts



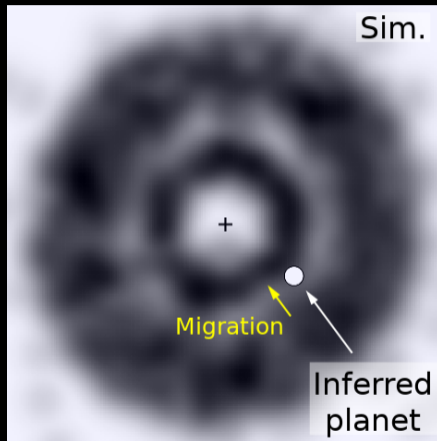
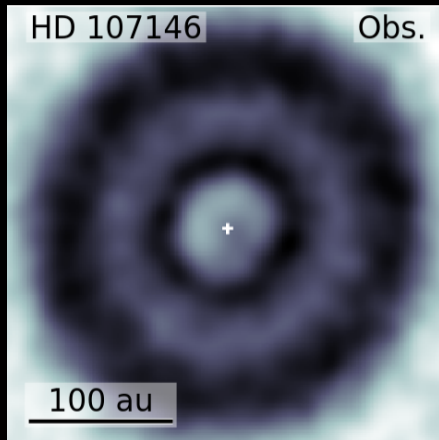
Planets interact with belts



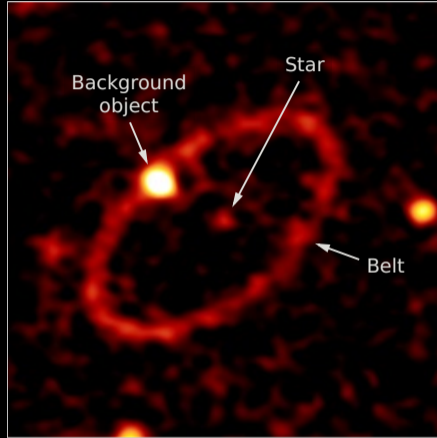
Planets interact with belts



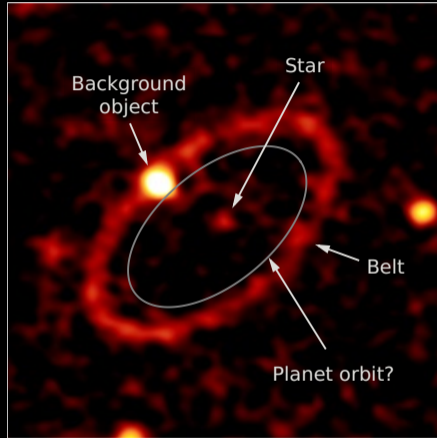
Planets interact with belts



Planets interact with belts

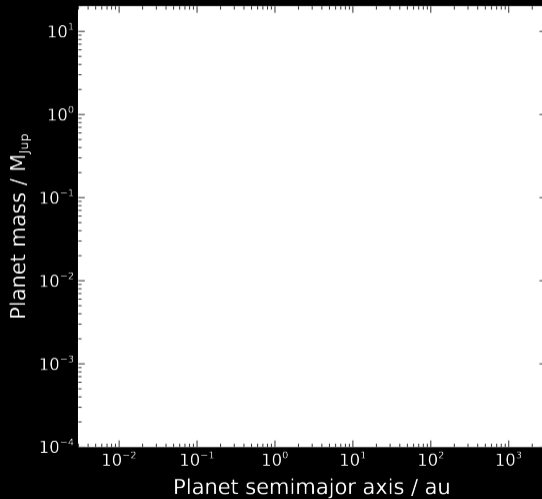


Planets interact with belts

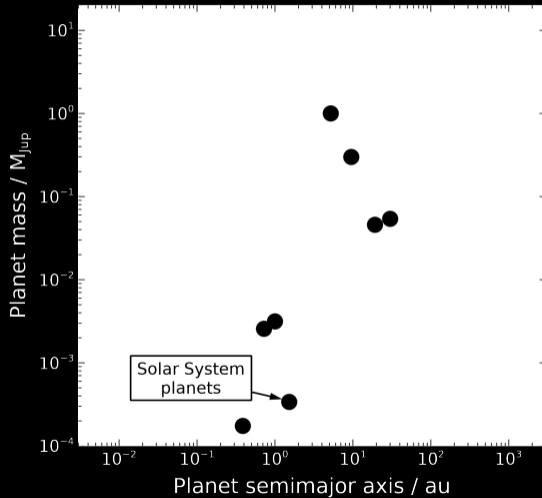


Belts help us find exoplanets

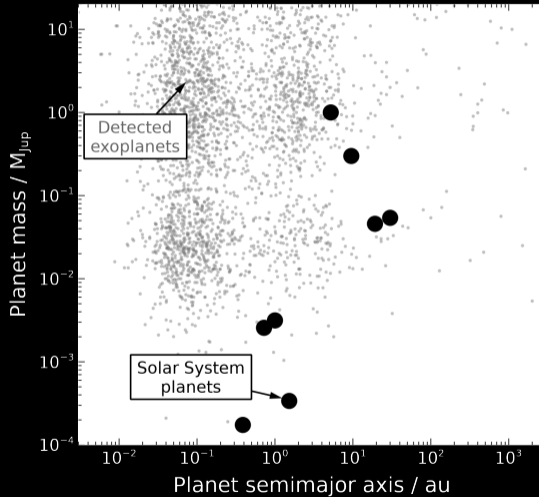
Belts help us find exoplanets



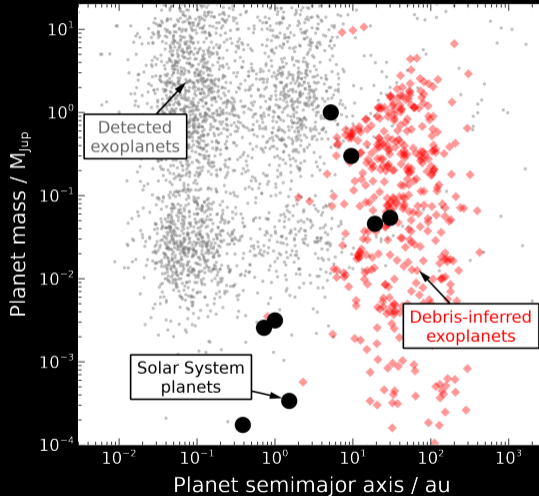
Belts help us find exoplanets



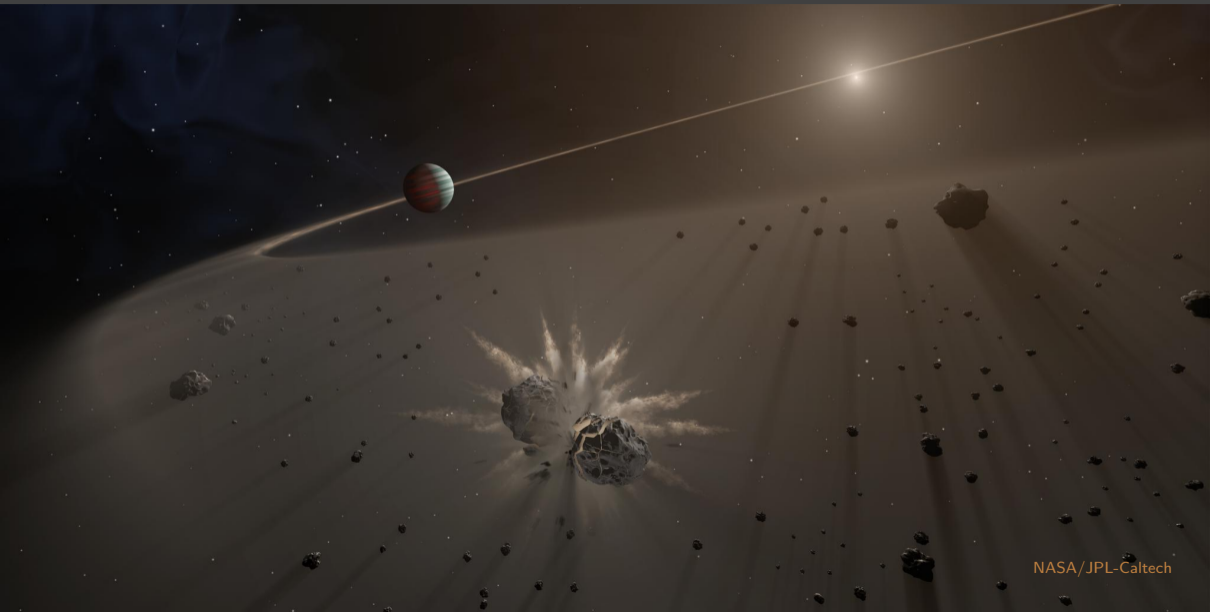
Belts help us find exoplanets



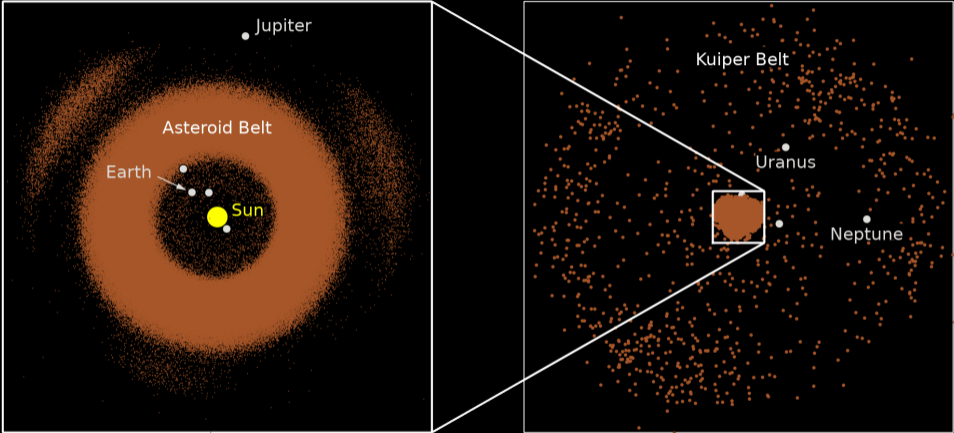
Belts help us find exoplanets



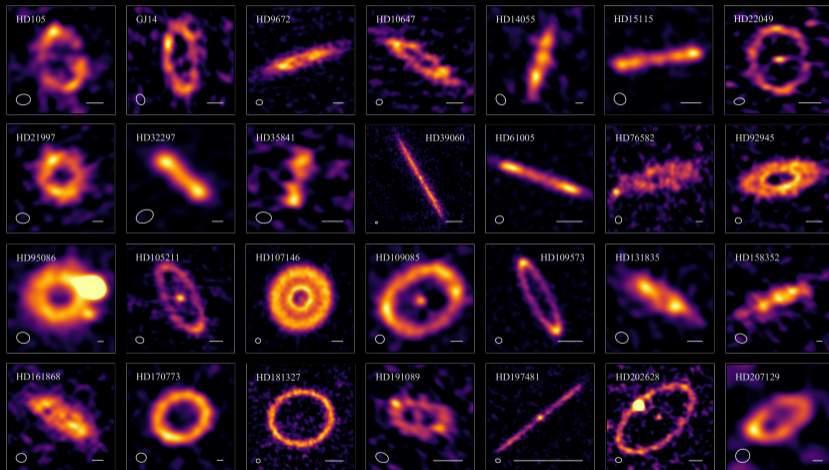
Conclusions



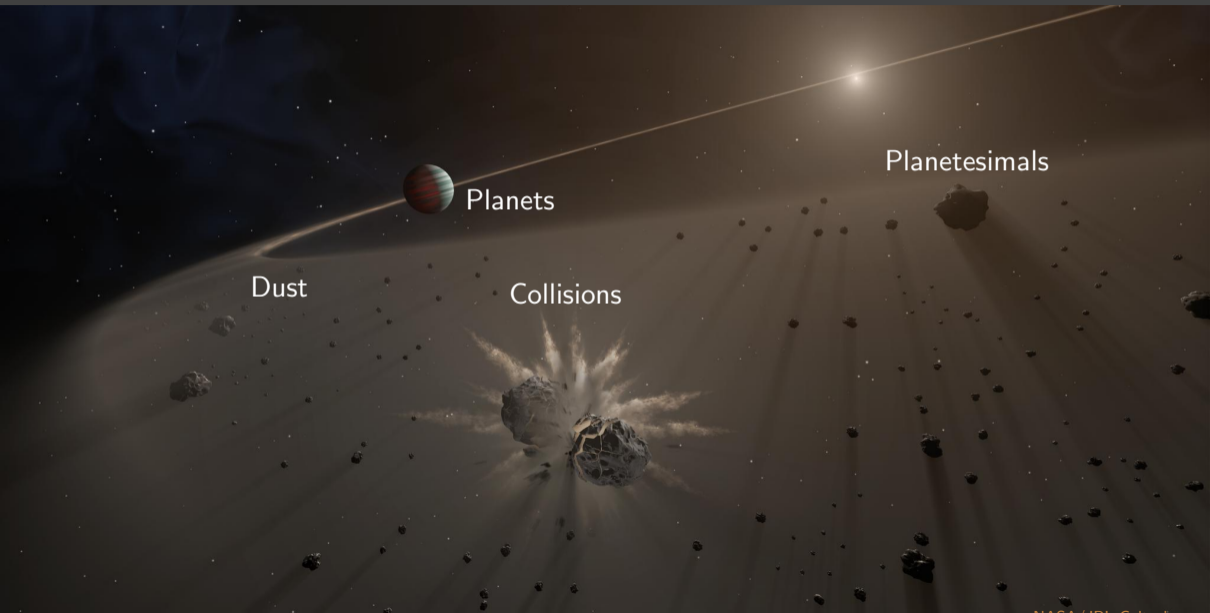
Conclusions



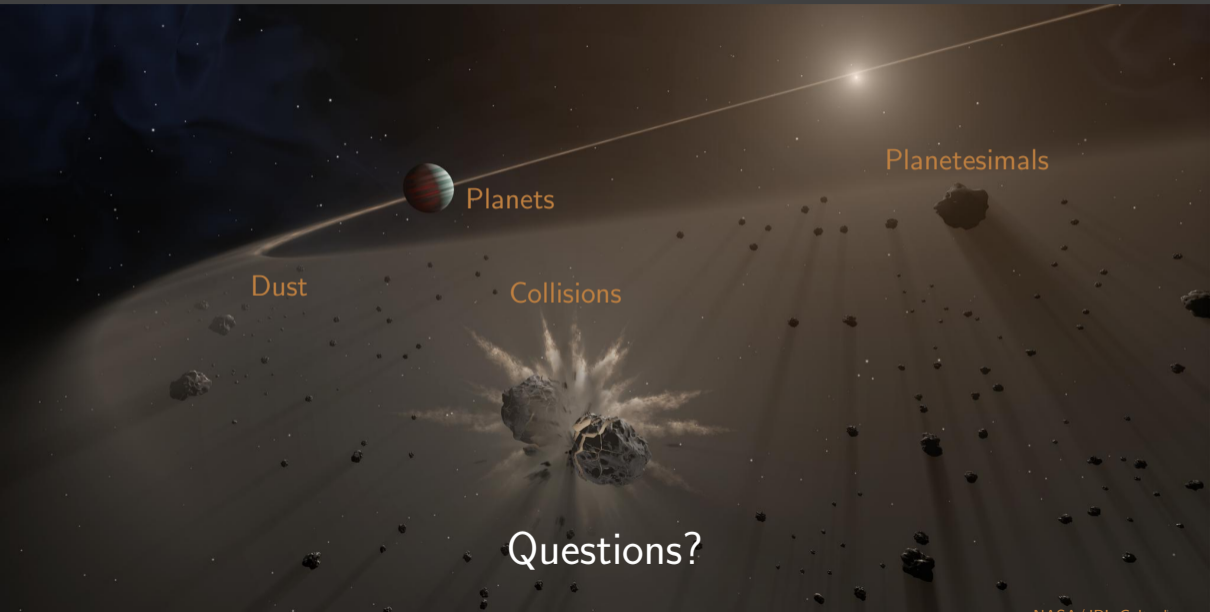
Conclusions



Conclusions



Conclusions



Dust

Planets

Planetesimals

Collisions

Questions?

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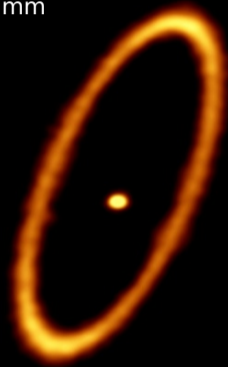
Sefilian A. A., Rafikov R. R., Wyatt M. C., 2021, *ApJ*, 910, 13

Extra slides

Different dust grains have different distributions



ALMA
1.3 mm



Fomalhaut

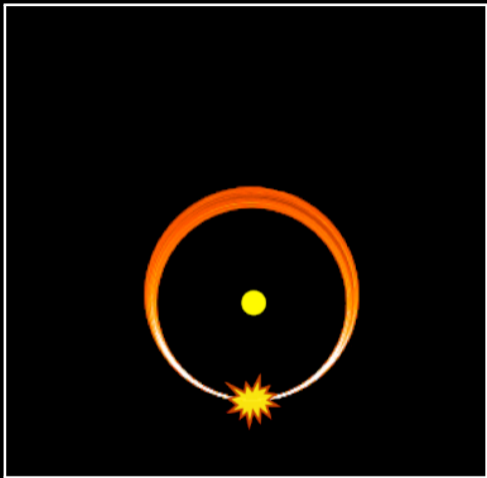
Small dust and large dust behave differently

Small dust and large dust behave differently

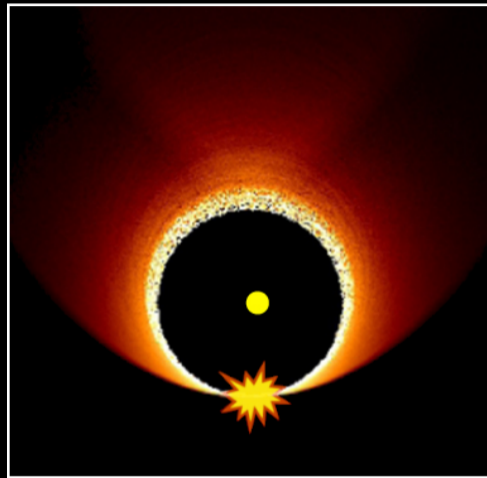


Large grains

Small dust and large dust behave differently



Large grains



Small grains