

# High Speed Dust Collisions and their consequences on planetesimal formation

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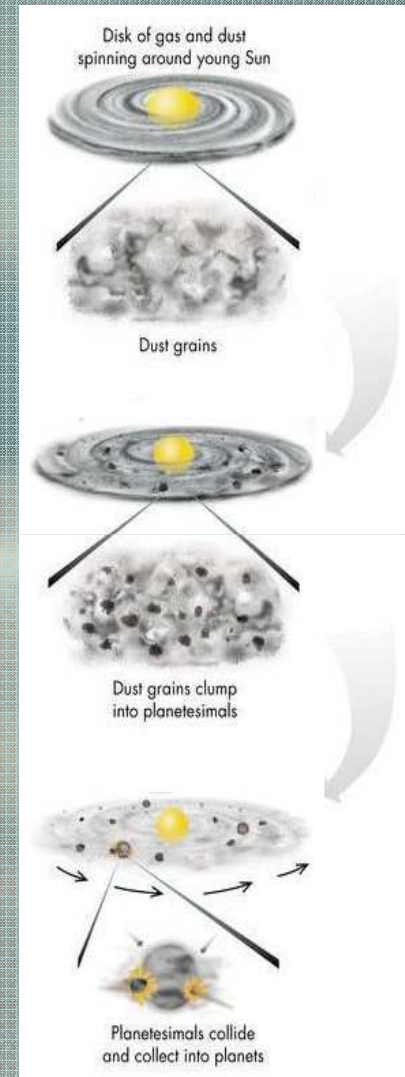
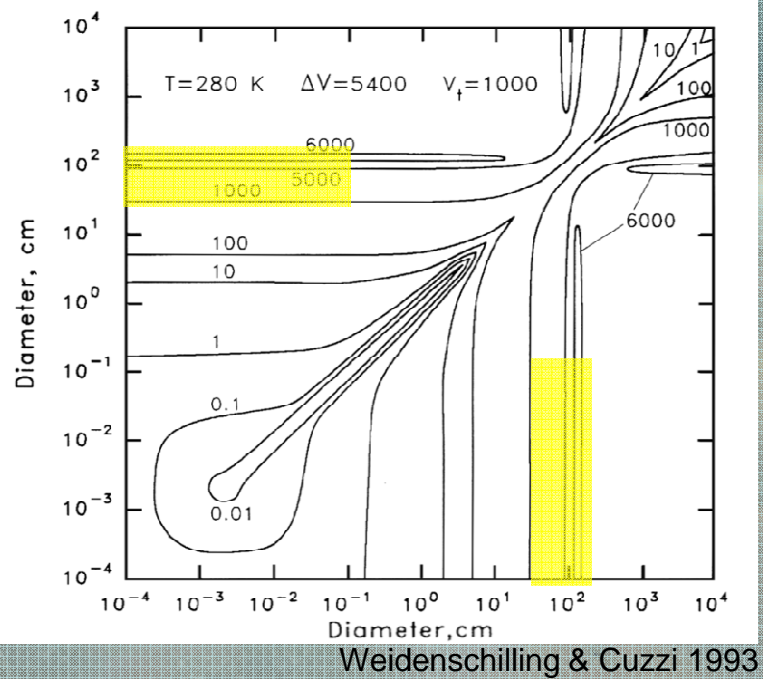


- Why?
- Experimental setup
- Setup in action
- Velocity of dust particles
- Size of dust particles
- First analysis of agglomerates
- First (preliminary) results

## High Speed Dust Collisions: consequences on planetesimal formation

Planet formation through coagulation of dust aggregates

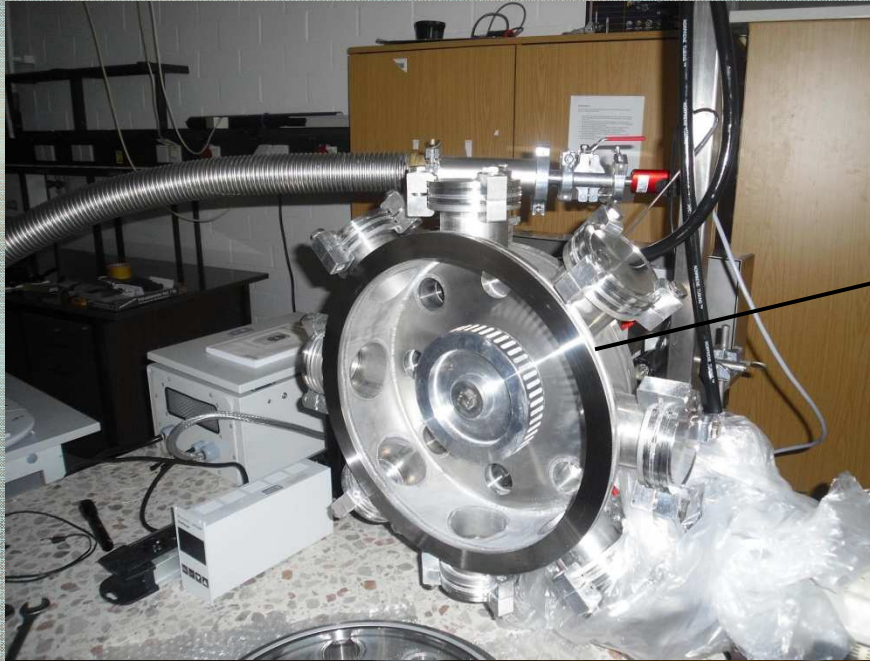
In protoplanetary disks relative velocities of dust aggregates can reach 60m/s





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Centrifuge rotates within evacuated bowl, dust spins around towards wall of bowl



Centrifuge can be filled with dust

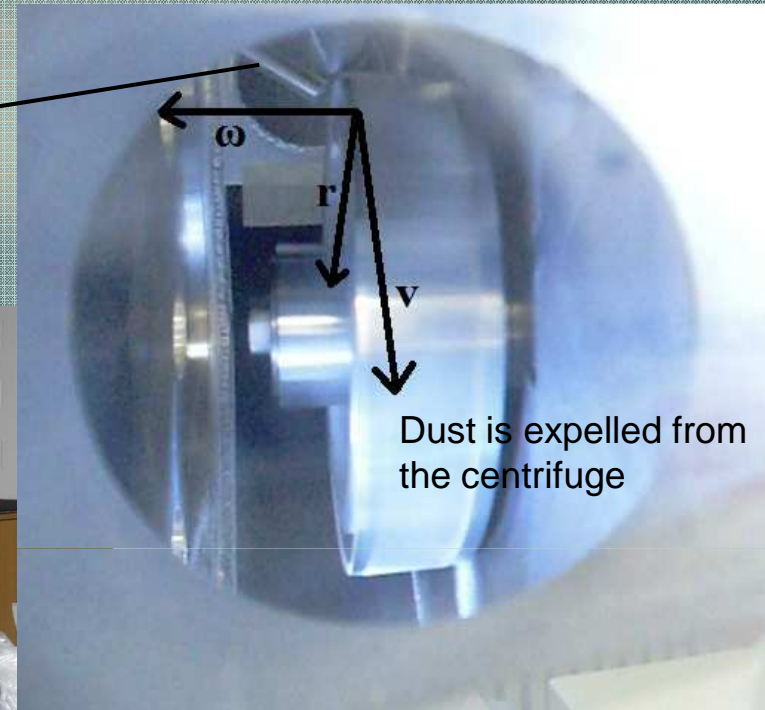
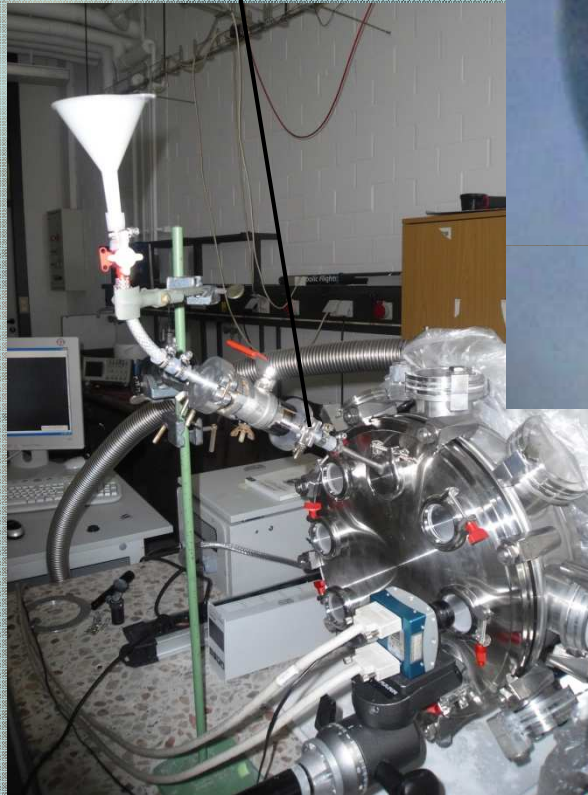
Grid has a mesh size of 0.5mm



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## High Speed Dust Collisions: consequences on planetesimal formation

Dust is sucked through a pipe in the channel of the centrifuge



At suction process pressure inside the bowl increases for short time from 0.7mbar up to 1.1mbar



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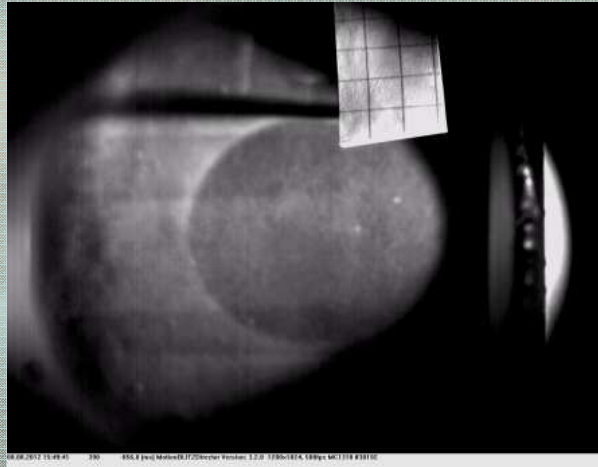


- Centrifuge is acting like a pulverizer
- Dust is fractionalized



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Velocities of expelled dust aggregates can be visualized on images/movies using

continuous light

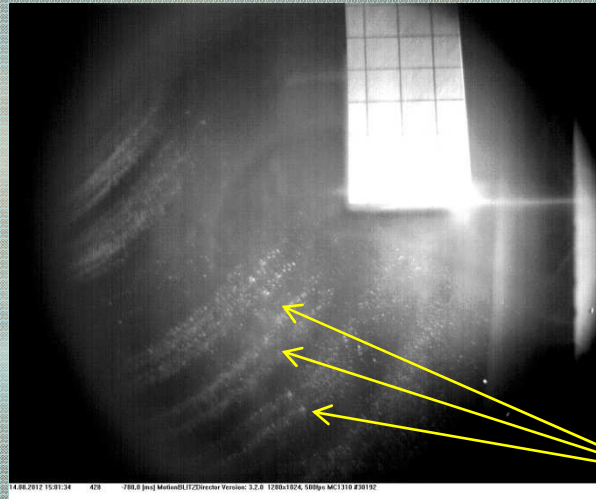
Length of lines correspond to exposure time of the camera:

—————→ Only recommended for small velocities



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## High Speed Dust Collisions: consequences on planetesimal formation



Large velocities of dust grains must be detected with stroboscopic images using flash lamps

Time delay of flashes: 100μs  
 → v = 27m/s



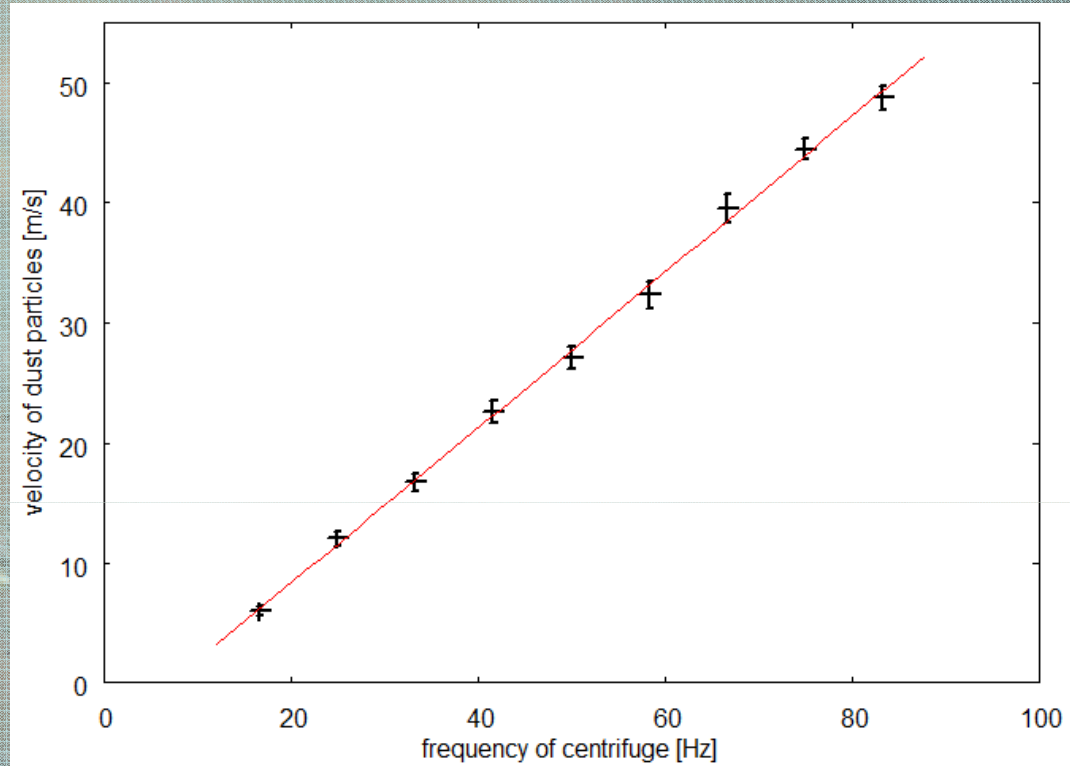
Time delay of flashes: 60μs  
 → v = 49m/s

With help of time delay of two flash lamps, velocities of dust aggregates could be determined



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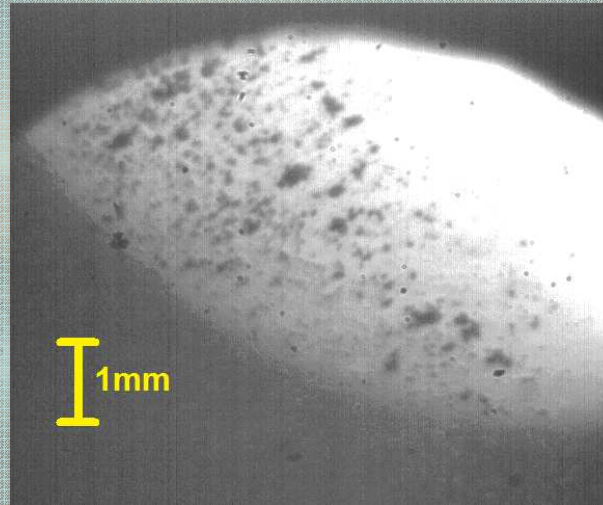


To any given frequency of centrifuge we now know the tangential velocity of dust grains leaving the centrifuge

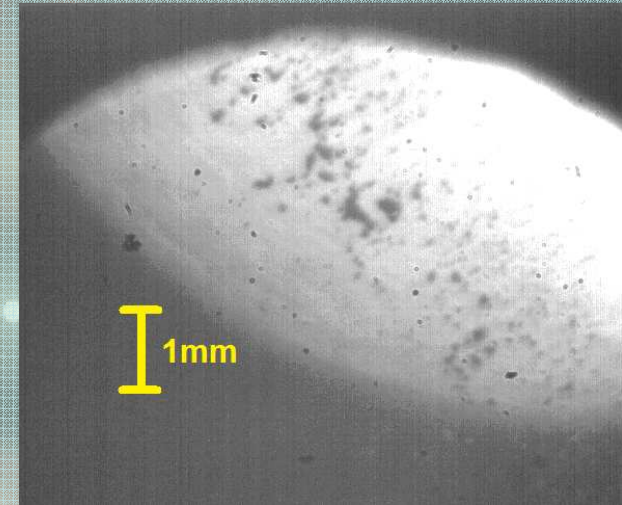


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## High Speed Dust Collisions: consequences on planetesimal formation



A volley of aggregates observed at  $v = 27\text{m/s}$



A volley of aggregates observed at  $v = 49\text{m/s}$

Using image processing for both cases mean value of diameter of aggregates is determined around  $d = 170\mu\text{m}$



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First growth of agglomerates could be already observed

Mass and density could be determined:

Volume filling factor:  $\Phi = 0.315$

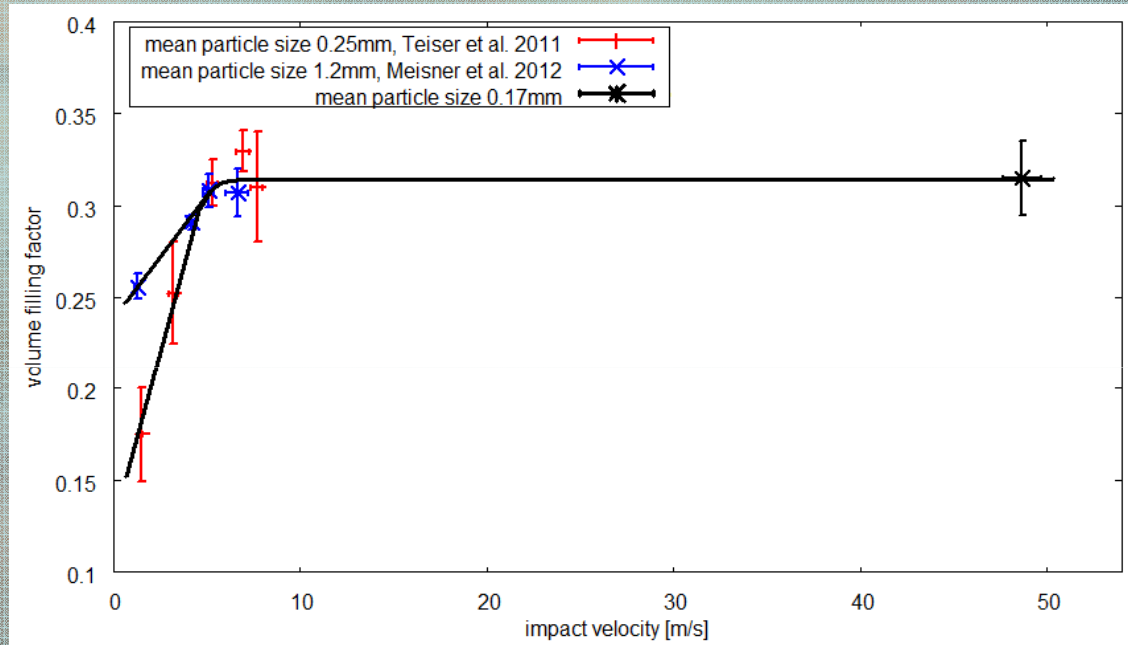


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What you should remember about this talk:

We are able to add some additional data points in existing work



Is there further growth of volume filling factor with increasing collision velocity? ... it seems ...

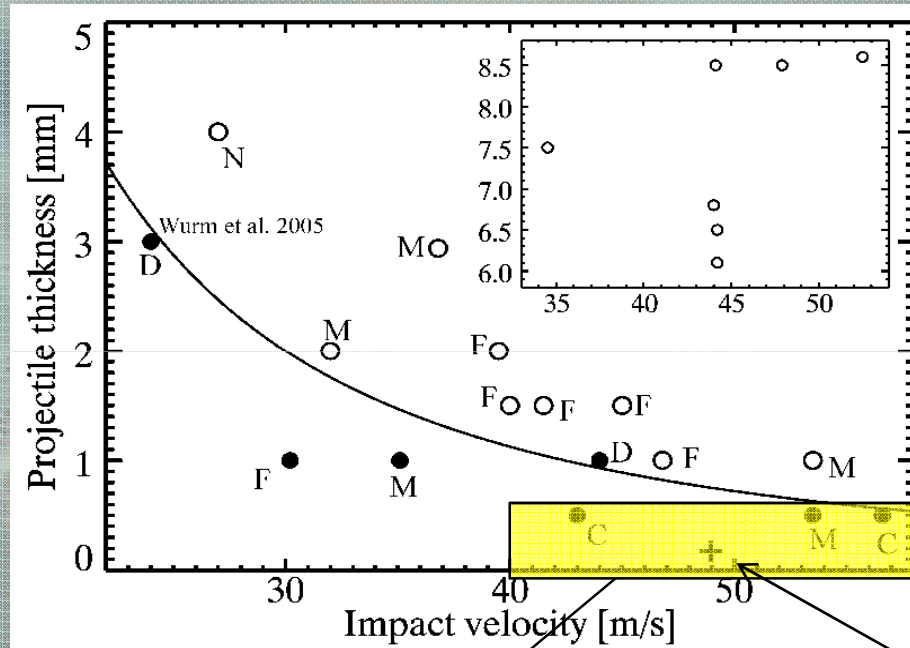


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Teiser & Wurm 2009

First developed agglomerate

Outlook: we will investigate this area concerning erosion/accretion more precisely