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Supernovae as Sources of Interstellar Dust

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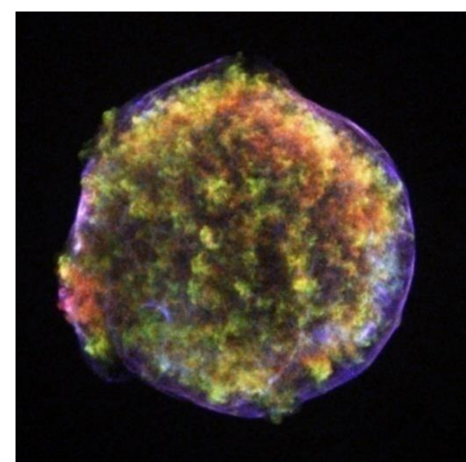
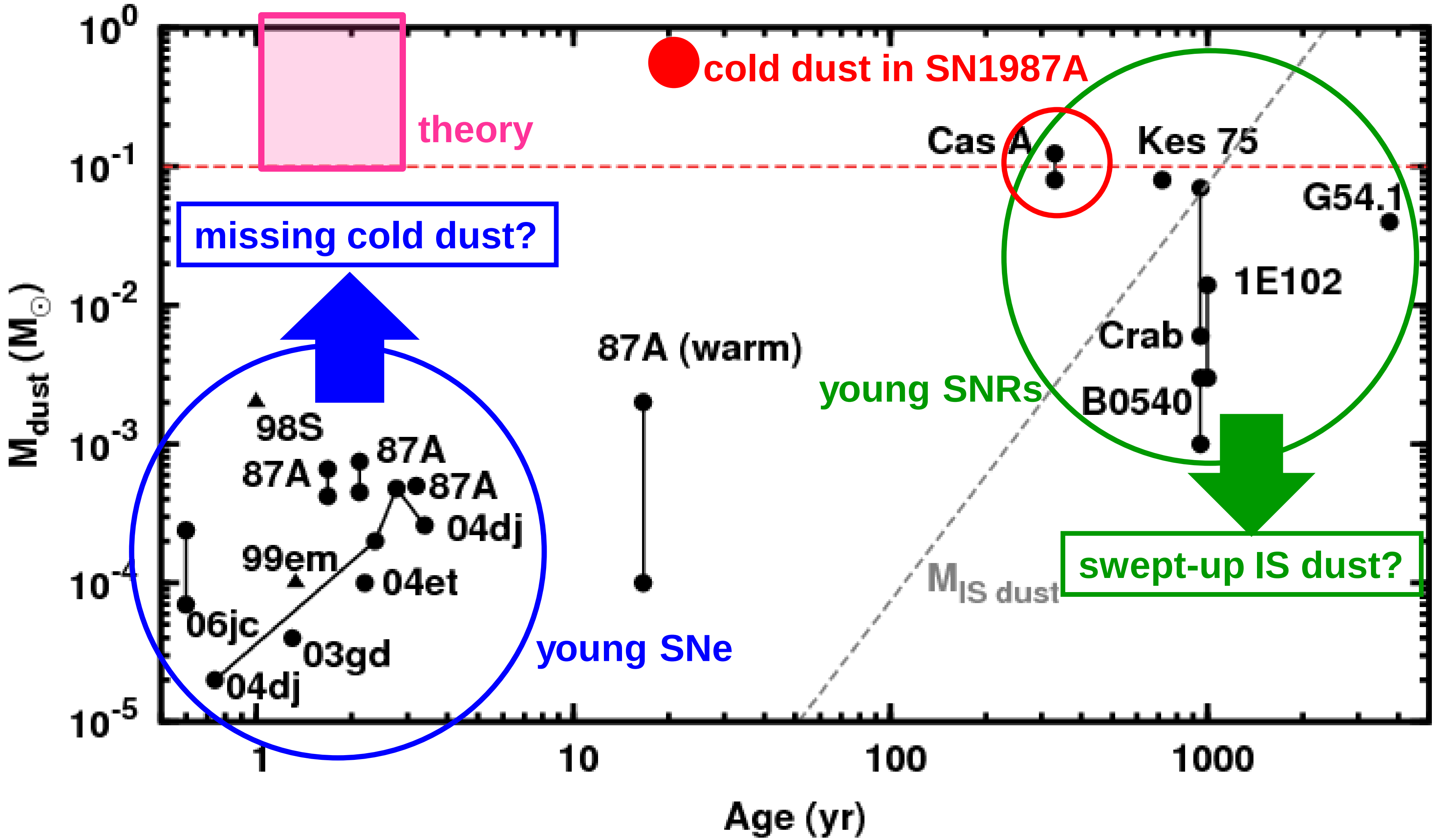
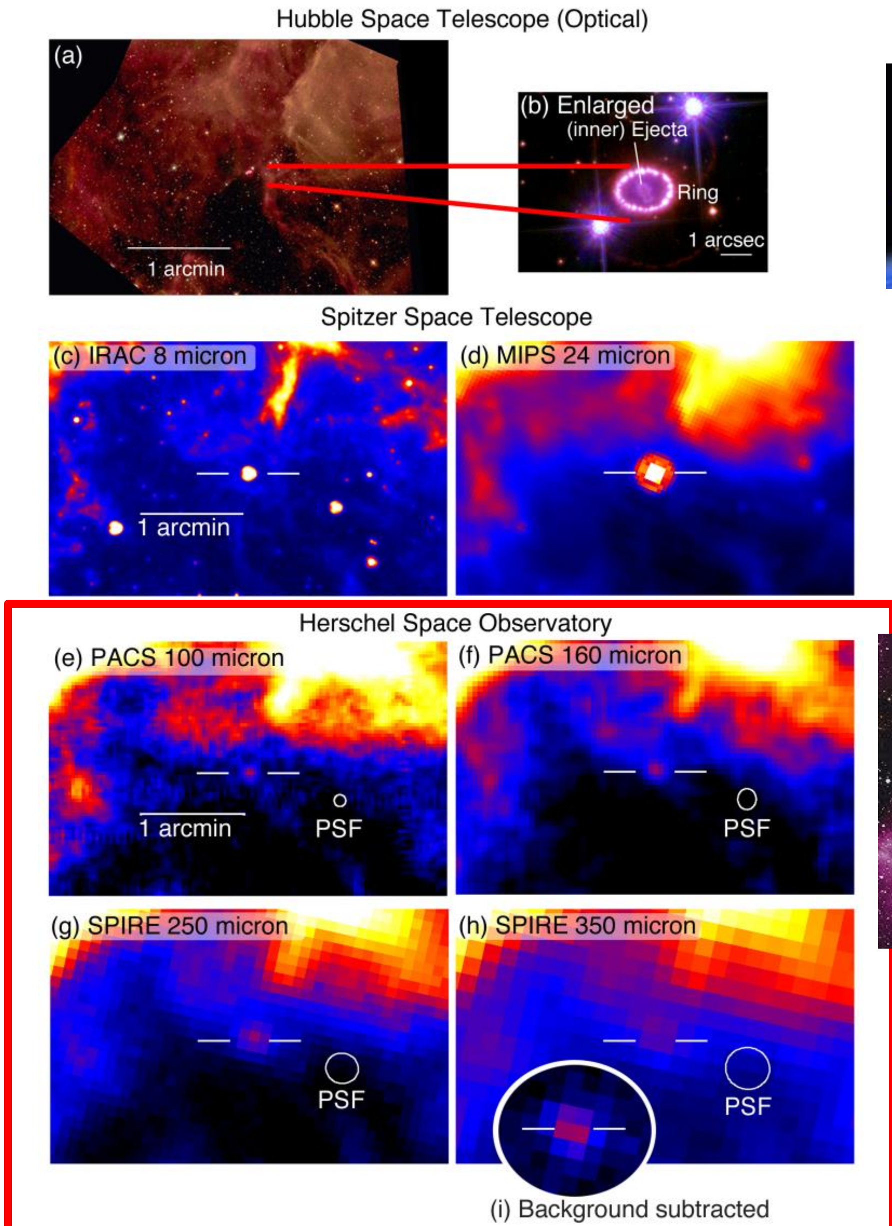


1. Missing-dust problem in core-collapse SNe

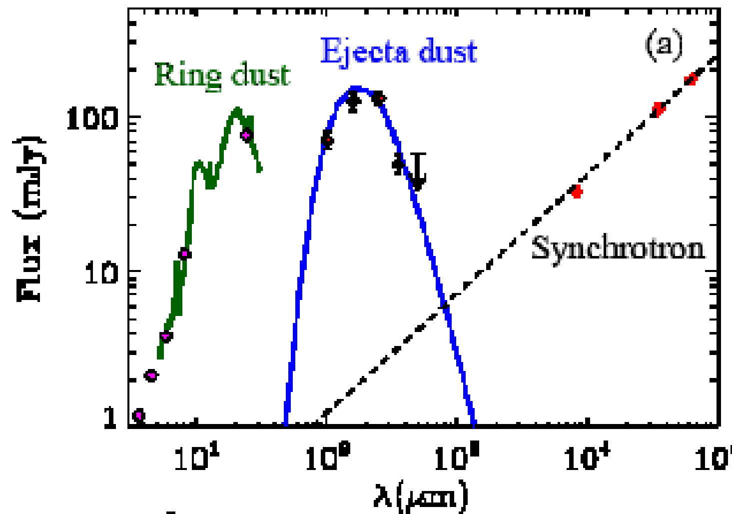


There is a big difference in the mass of dust between observational estimates and theoretical predictions!!

2. Herschel detects cold dust in SN 1987A



Matsuura, … TN, et al. 2011

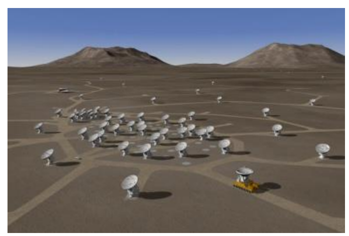


Herschel detects cold (~20K) dust of ~0.4-0.7 Msun toward SN 1987A!

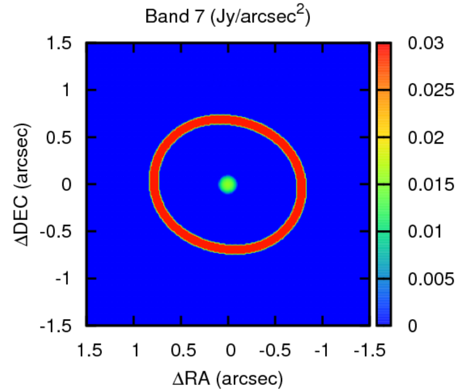
3. Resolving cold dust in SN 1987A with ALMA

ALMA Cycle 0 Proposal
'Detecting cool dust in SN1987A'
(TN, Tanaka, Moriya et al.)

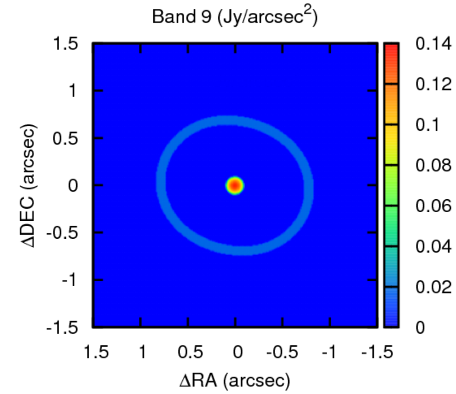
2 arcsec



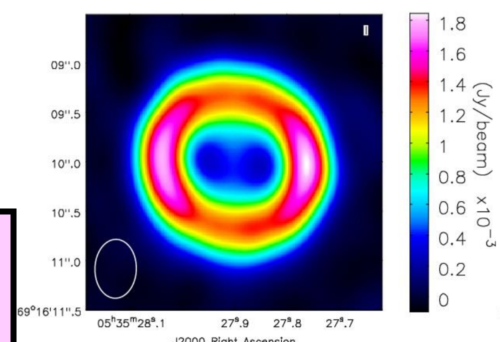
Band 7 (850 μm)

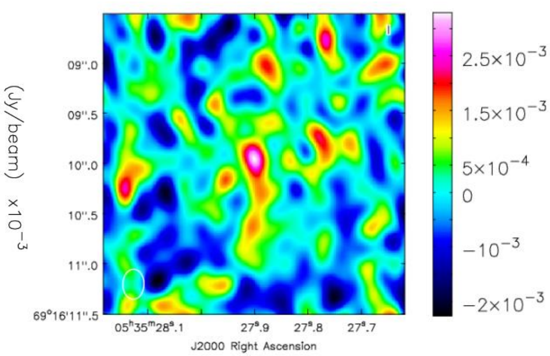


Band 9 (450 μm)



CASA simulation with extended configuration



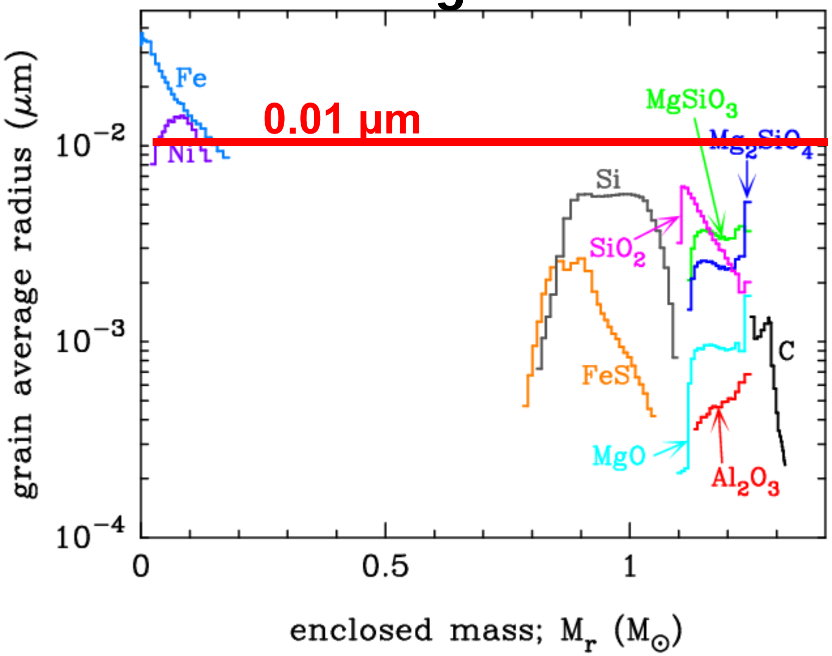


This proposal was ranked in the highest priority, to be observed this summer

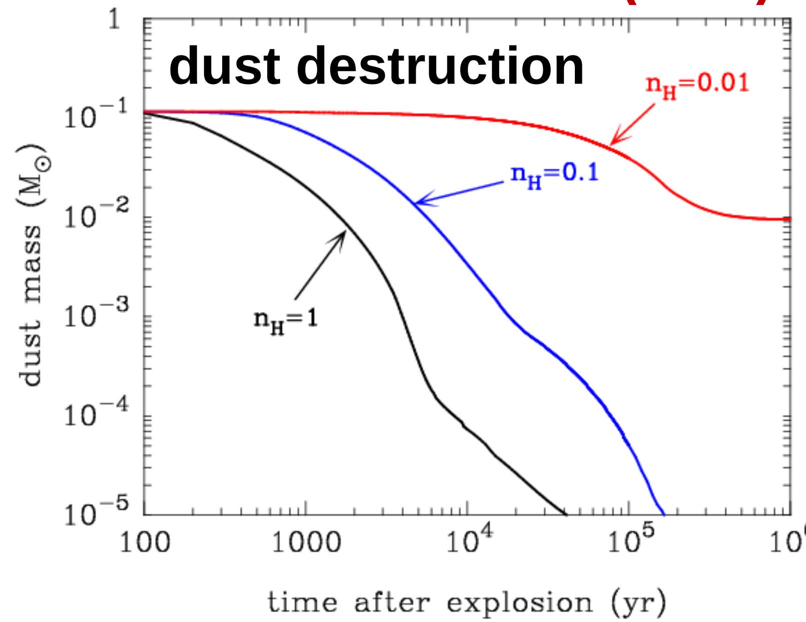
0.1 Msun of silicate
➔ 5σ detection at Band 9 !!

4. Dust formation and evolution in SNe Ia

average radius

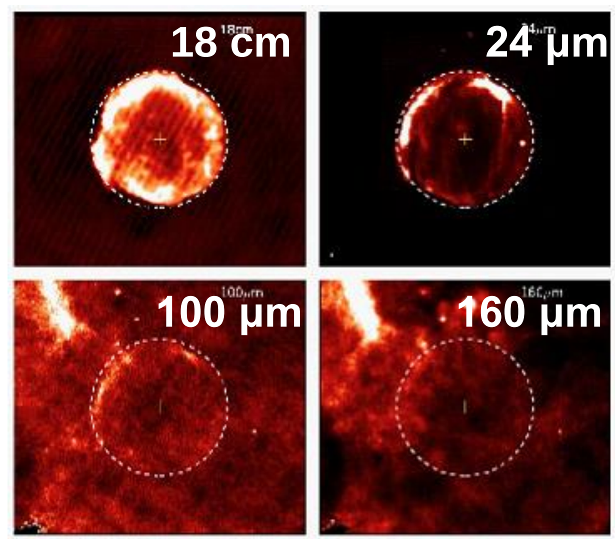


Nozawa et al. (2011)



- **average radius of dust :**
  a_{ave} <~ 0.01 μm
- **total dust mass :**
  M_{dust} = 0.1-0.2 M_{sun}

SNe Ia are unlikely to be major sources of dust



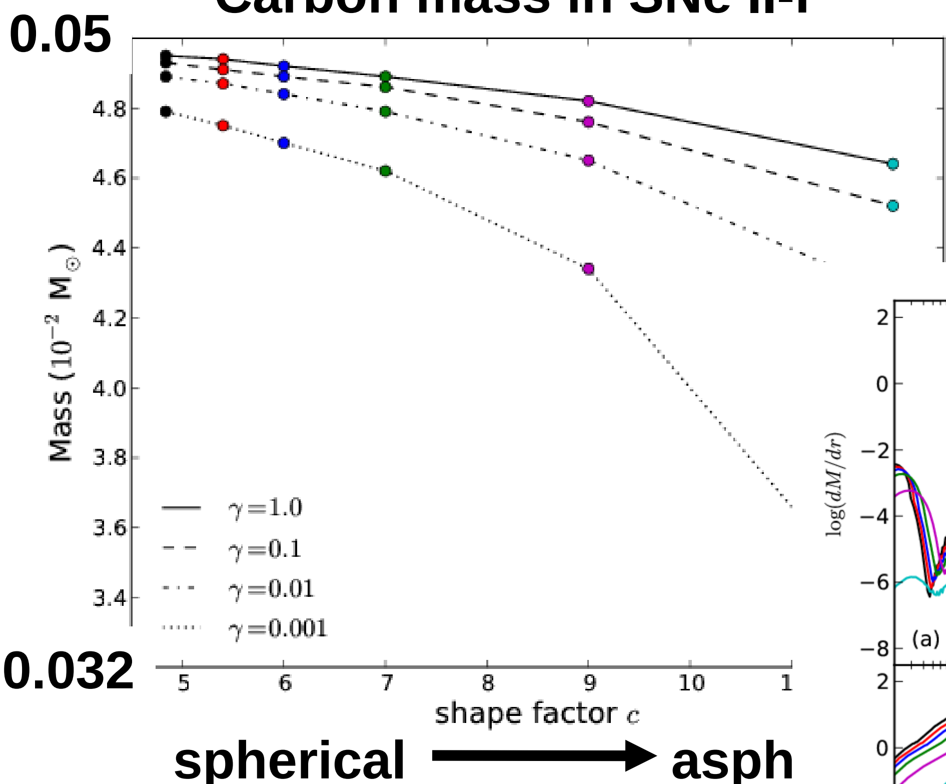
Tycho SNR

Gomez, Clark, TN, et al. (2011)

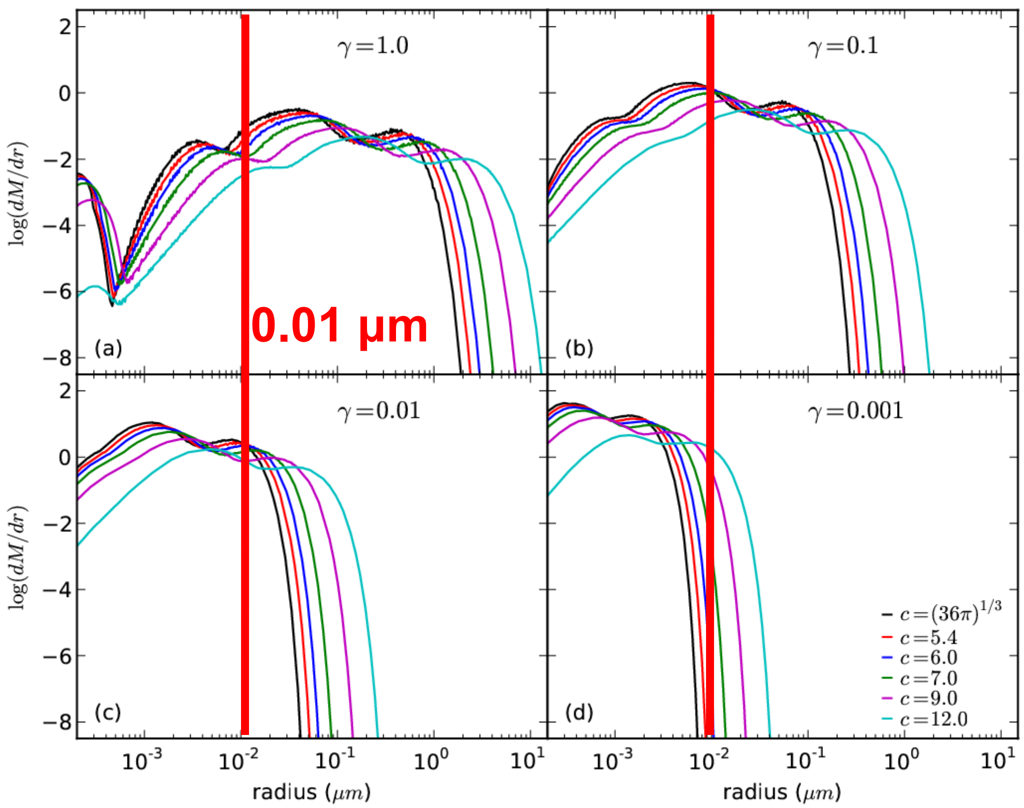
5. Effects of nano-properties on dust formation

Fallest, TN, et al. (2011)

Carbon mass in SNe II-P



Size distribution of carbon grains



Mass of carbon grains formed in SNe II-P is insensitive to sticking probability of >=0.001