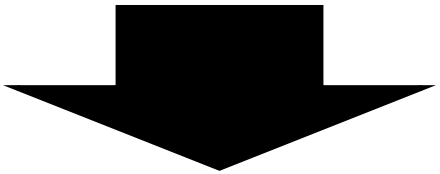
Unburned carbon in SNe Ia as viewed from (non-)formation of C grains



Condensation efficiency of carbon grains in SNe Ia

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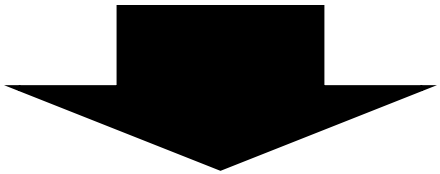
1. Introduction

- **Unburned carbon in SNe Ia has a key information on the explosion mechanism and progenitor composition**

– **unburned carbon surely exists in outer layer of SNe Ia**
– **SNe Ia are quite homogeneous objects**

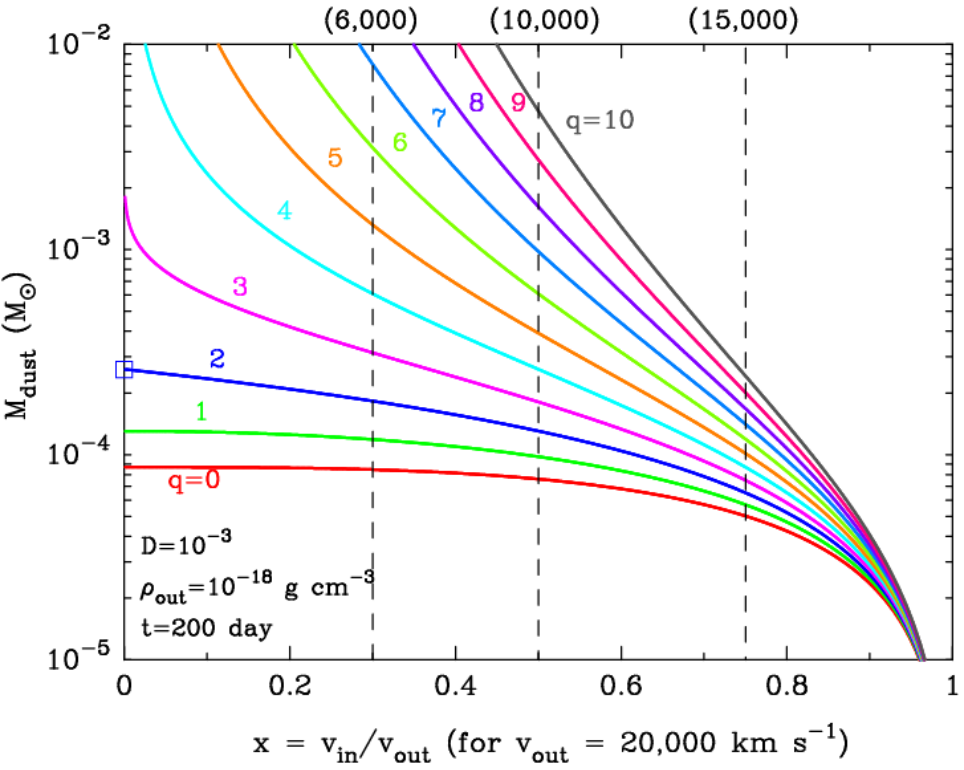
– **there is no sign of dust formation in normal SNe Ia**
– **sign of dust formation appears in Super-Chandra SNe**

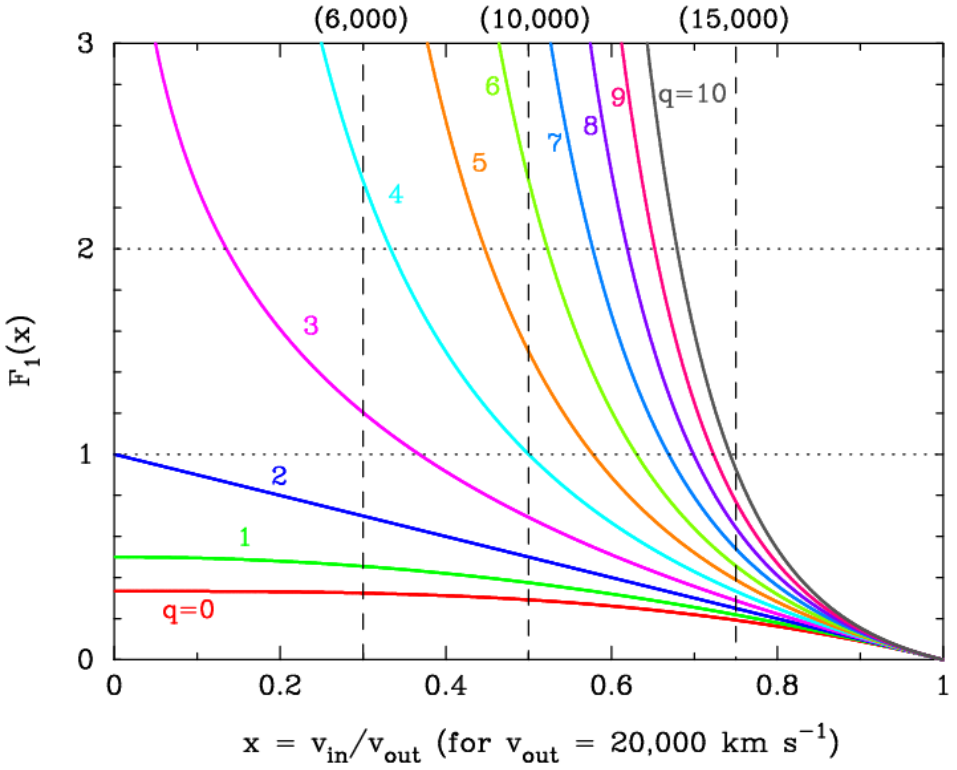


– **Do these facts enable us to put constraints on the condensation efficiency of C grains formed in SNe Ia?**

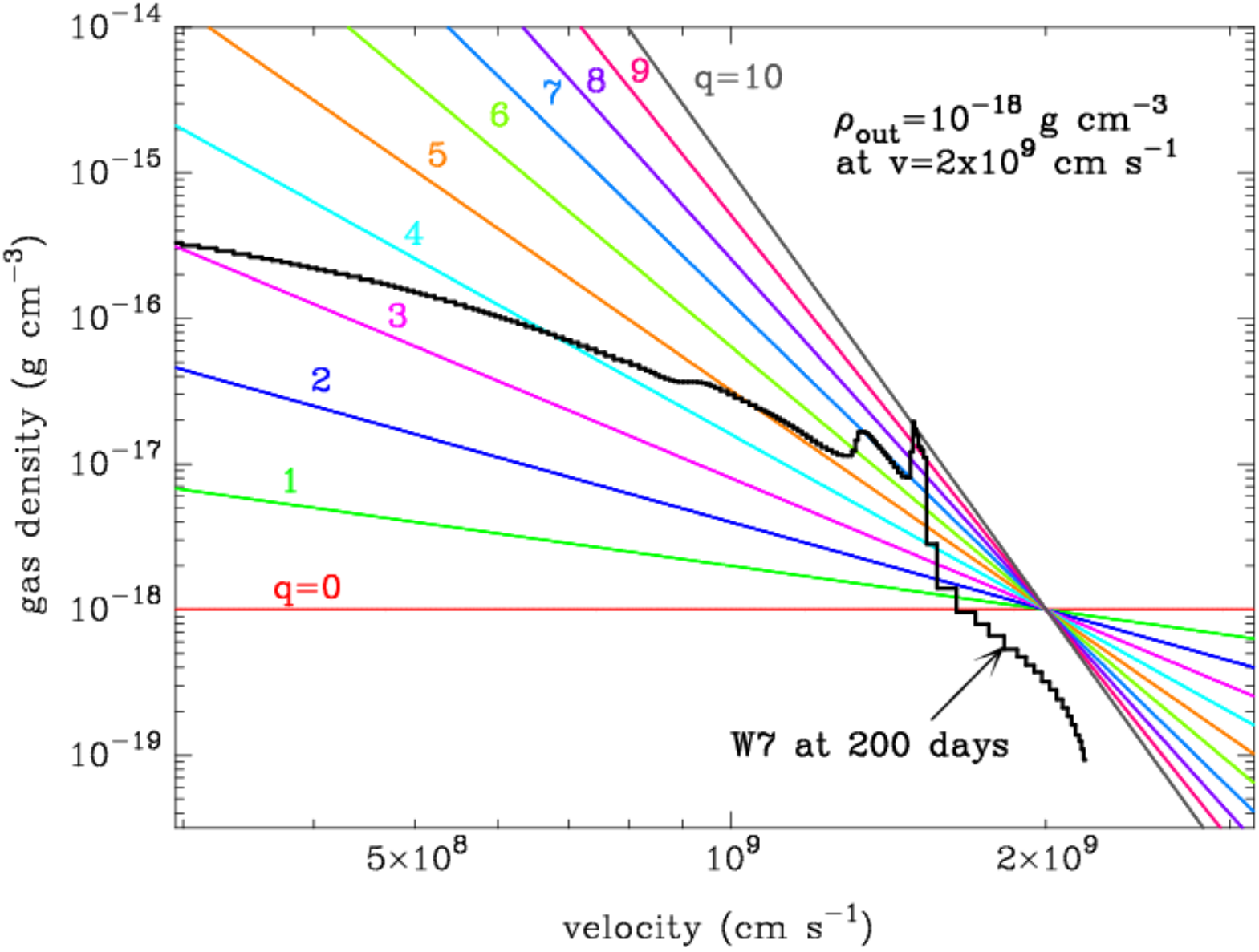
– **From these, can we say something about the velocity distribution and mass of unburned carbon in SNe Ia?**

2. Mass estimates of C grains in normal SNe Ia

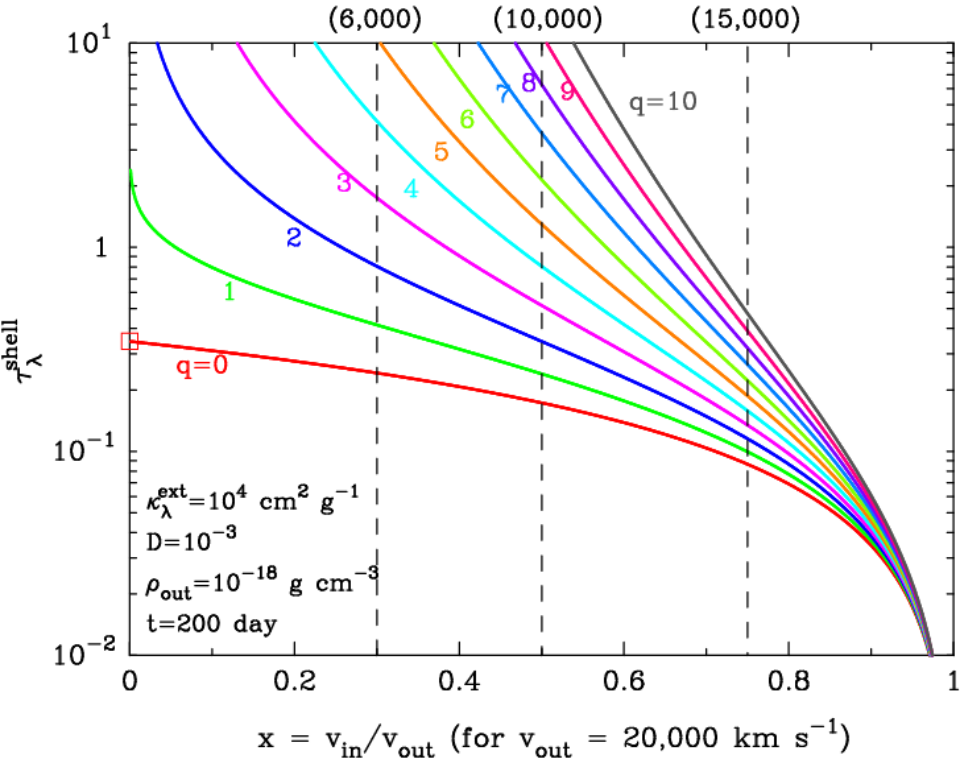


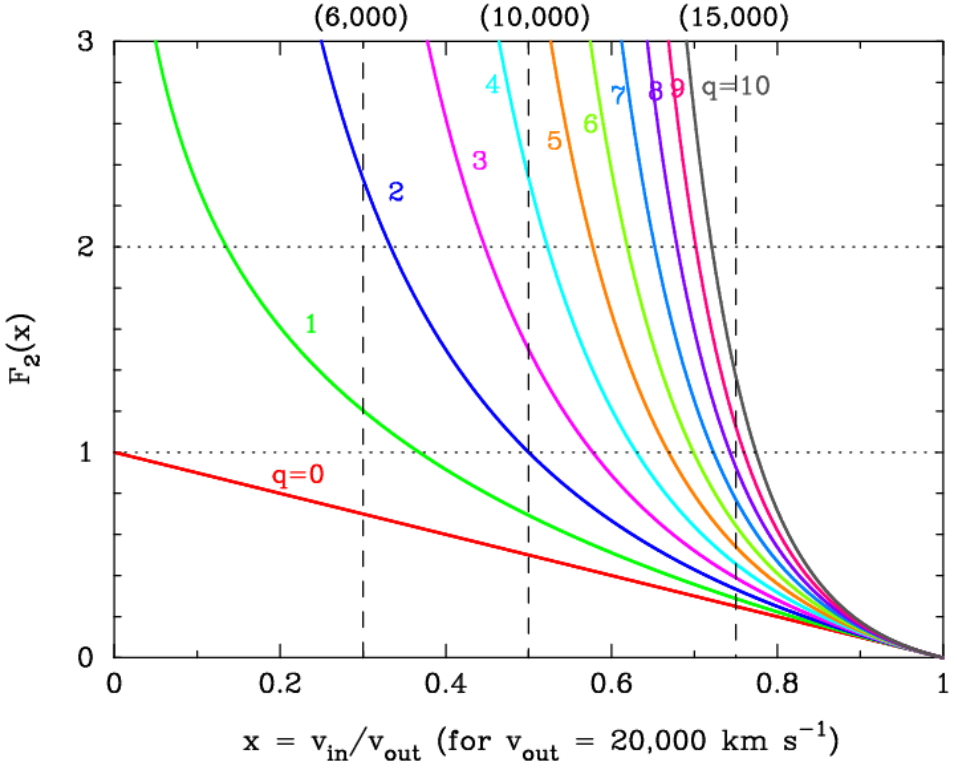


3. Density structure in the outermost shell

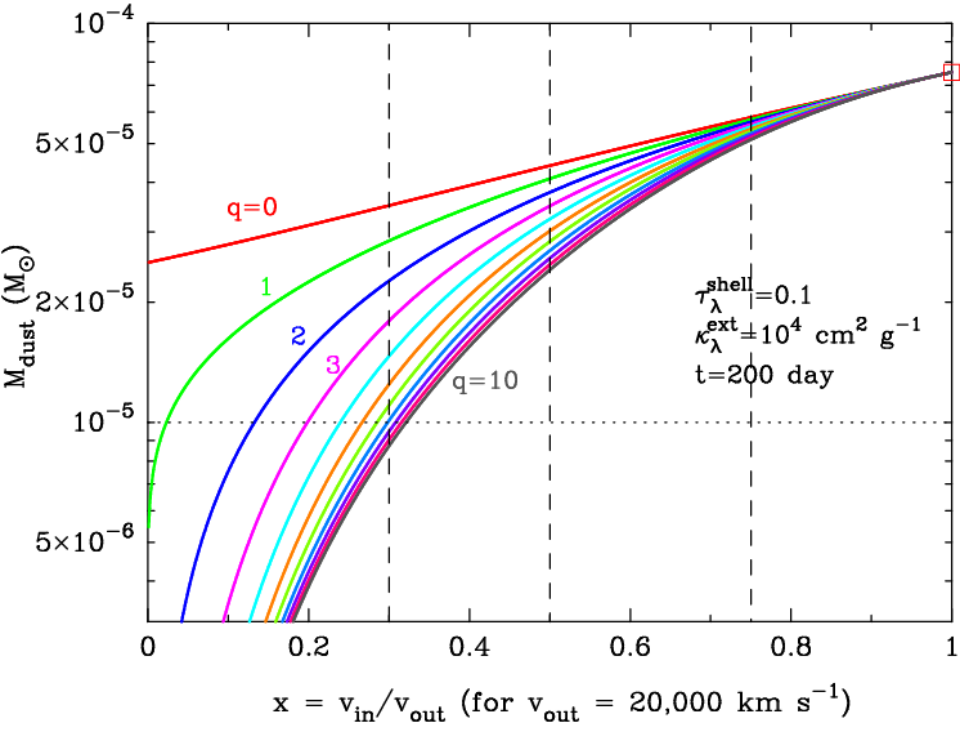


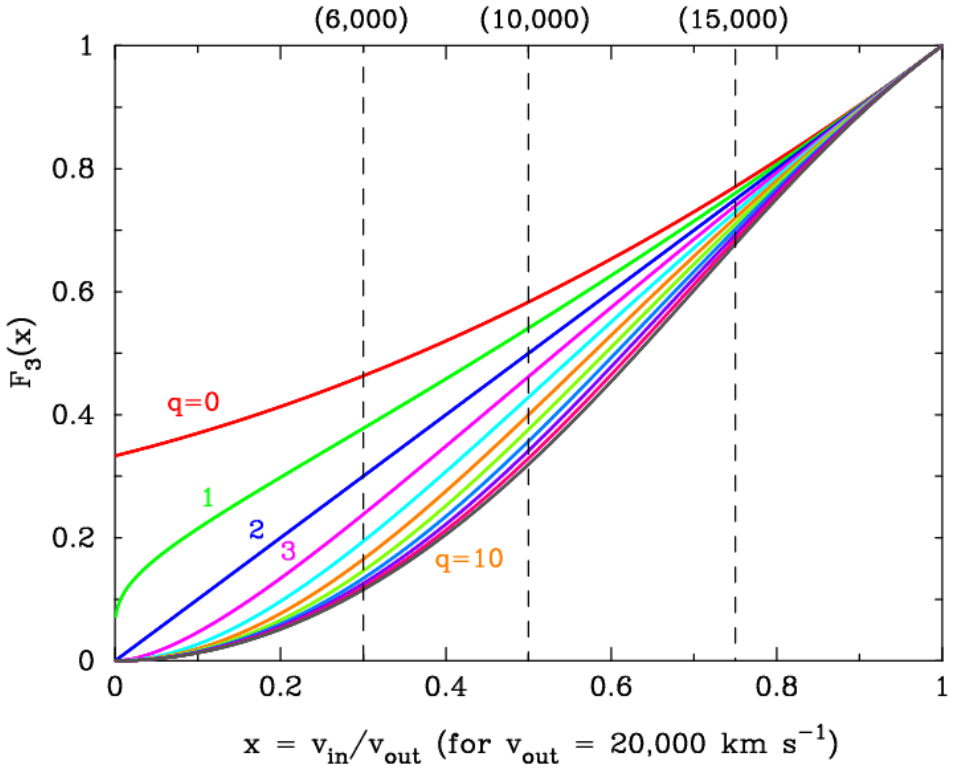
4. Optical depths caused by C grains



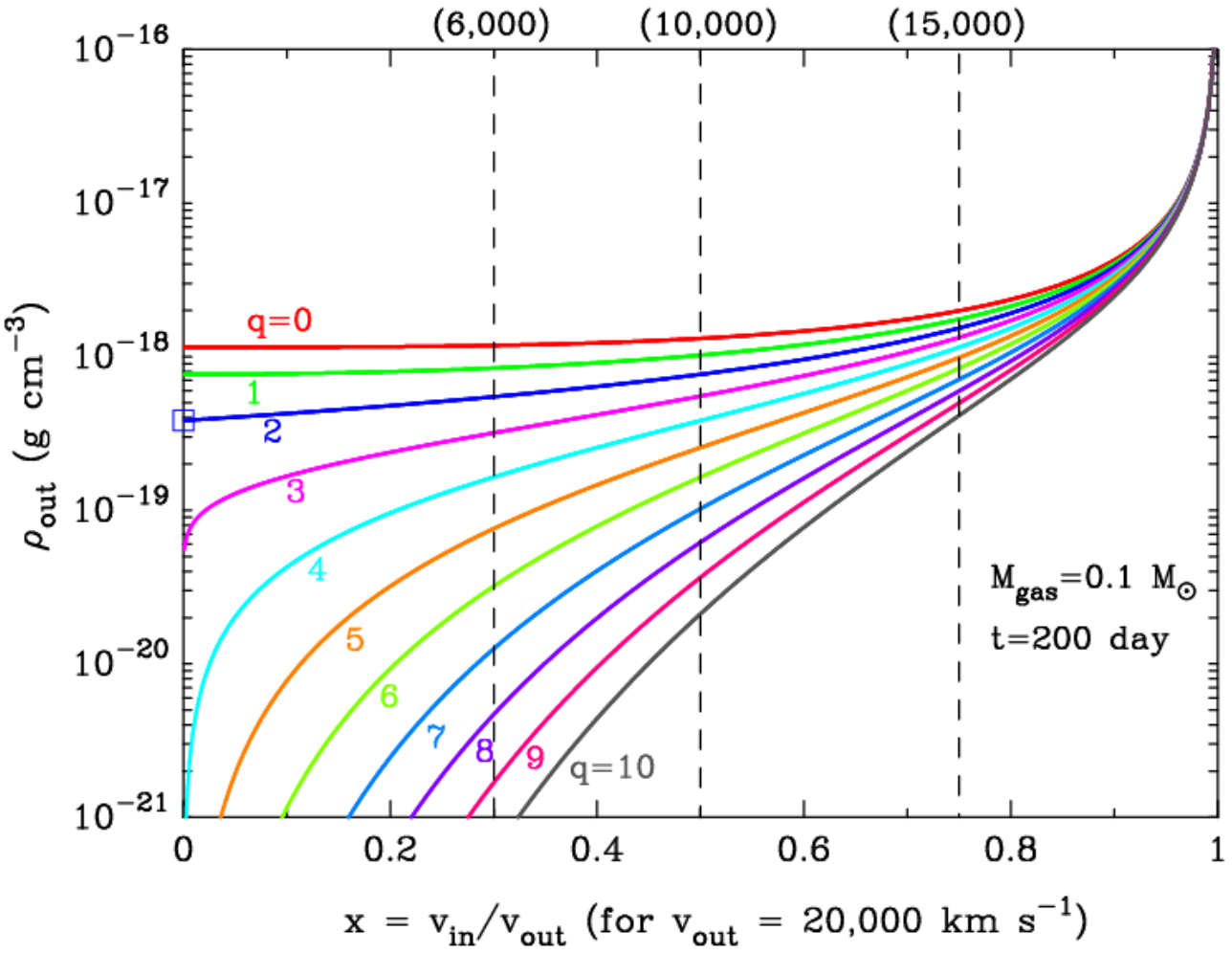


5. Upper mass limit of C grains in SNe Ia





6. Gas density at the outermost shell

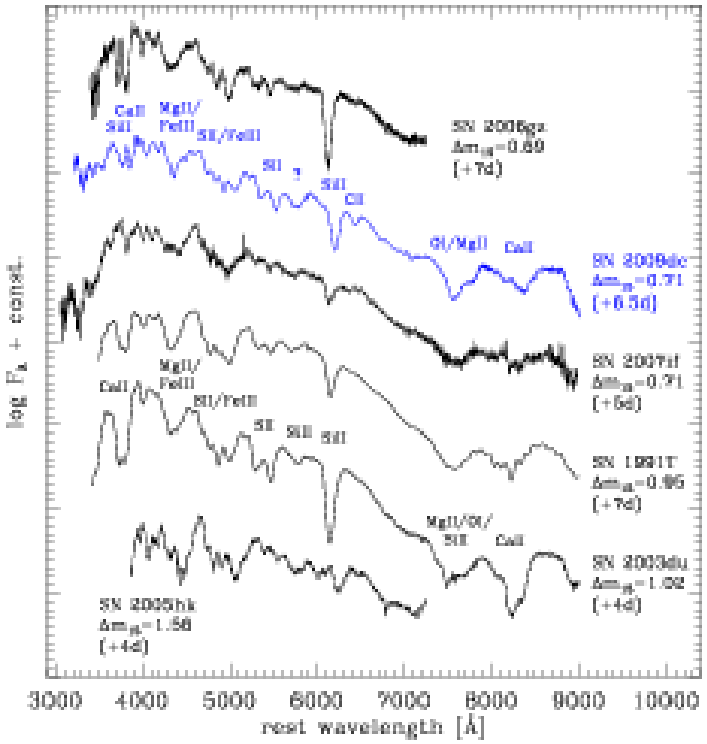


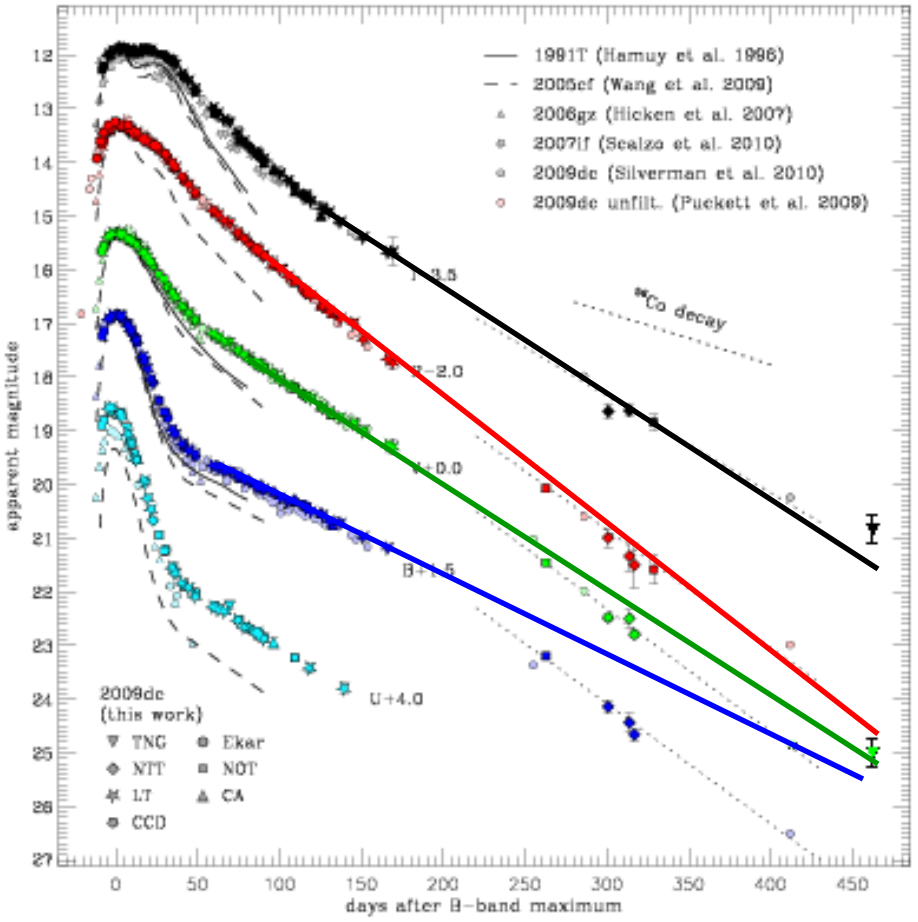
size distribution of surviving dust is <u>domimated by large grains (> 0.01 μm)</u>

7. Dust formation in super-Chandra SNe?

– super-Chandra SNe :
M(56Ni) > ~0.8 Msun

detection of CII line
➔ presence of massive unburned carbon





enhanced fading at ~200 day
➔ formation of carbon dust?

SN 2009dc, Tarbenberger+10