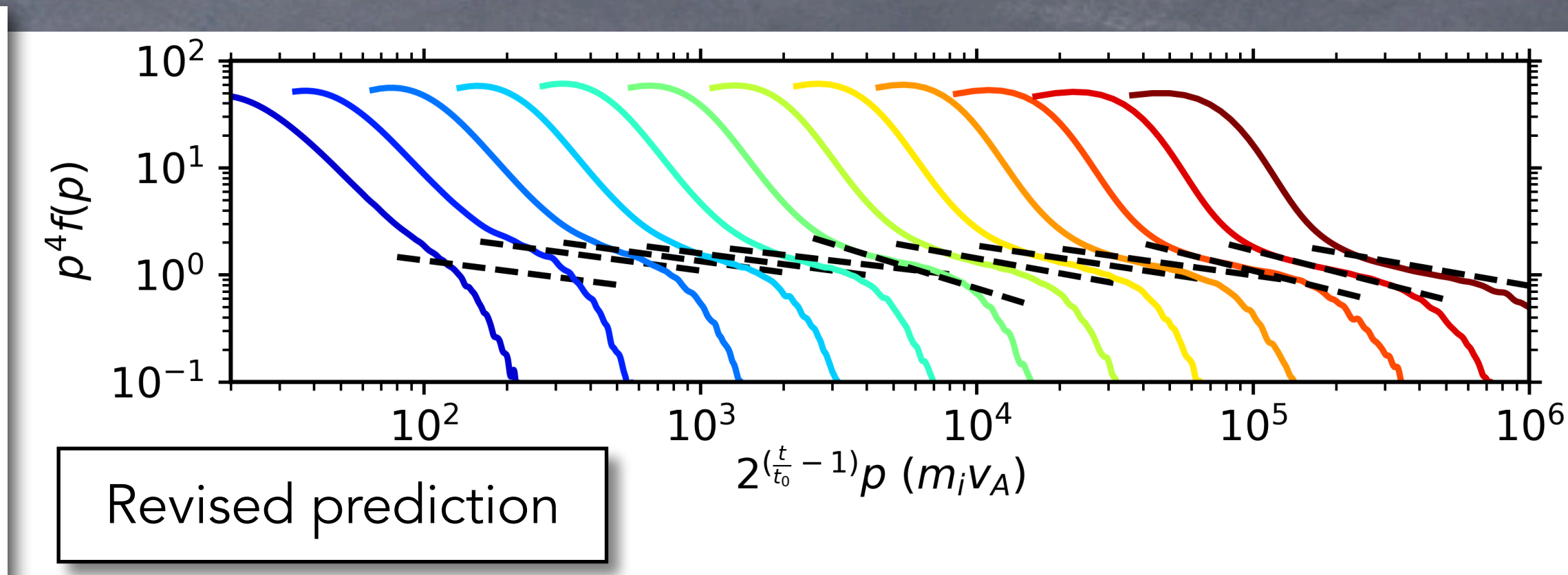
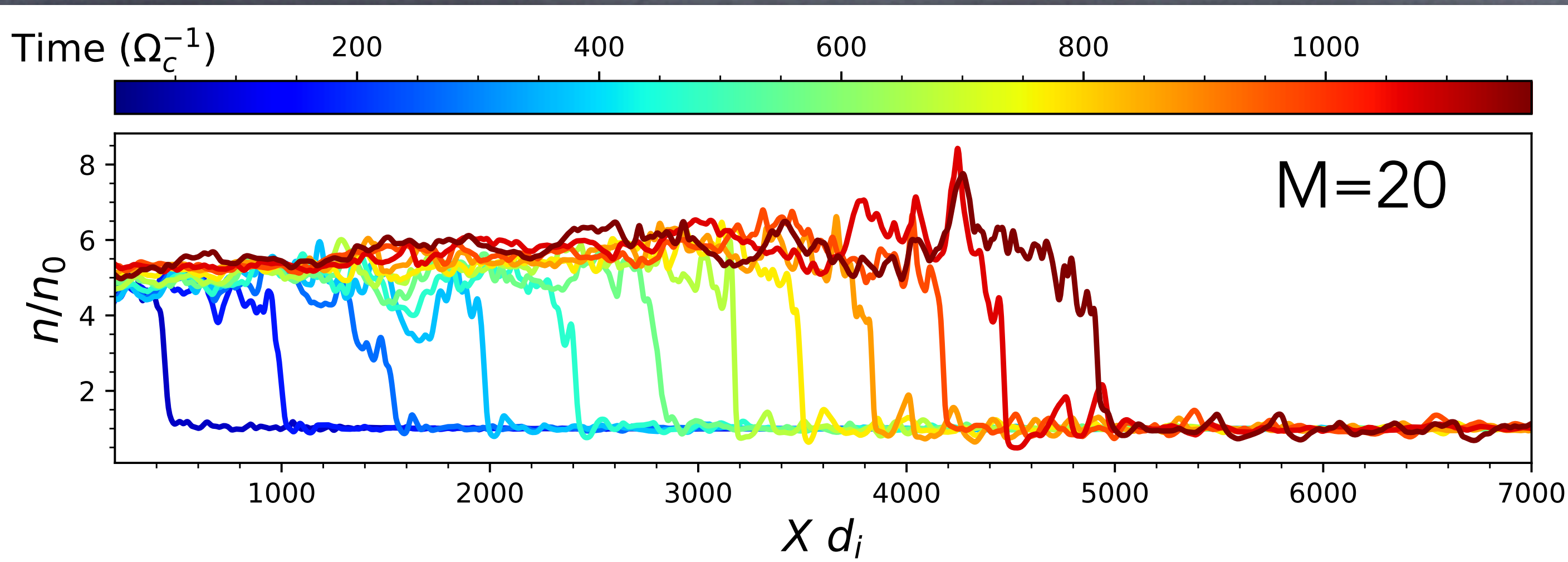


The Theory of Efficient Particle Acceleration at Shocks



Haggerty-Caprioli20; Caprioli, Haggerty & Blasi20

- Self-consistent **hybrid simulations** with *dHybridR*: DSA leads to power laws with efficiency $\sim 10\%$
- CR-modified shocks**: precursor, *postcursor* and increased compression ratio $R_{gas} \simeq 6 - 7$
- However, CRs feel $R_{cr} < R_{gas}$: CR spectra are steeper than p^{-4} in momentum, rather than flatter
 - The CR power-law index is *not universal*, but depends on *B field*
- Explains the **steep spectra observed** in SNRs, radio SNe, CRs... See talk by R. Diesing (ID:488)