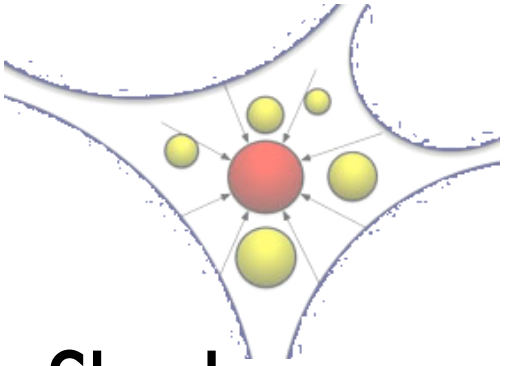

Analytical Modeling of Cosmic Accretion Shocks: The Role Of Environment

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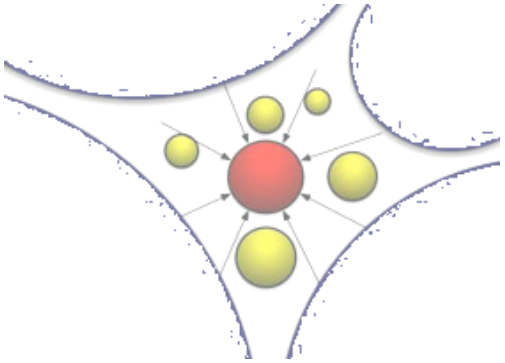
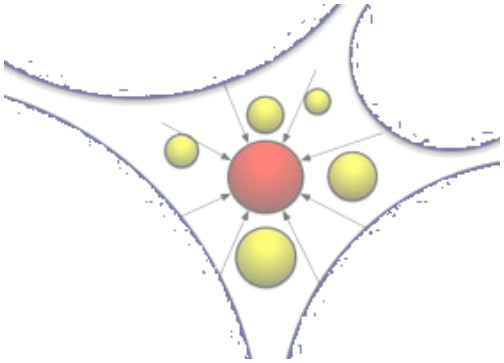
Preview

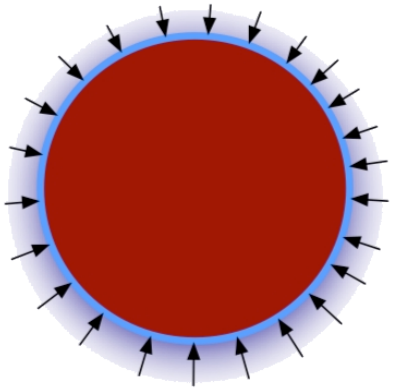
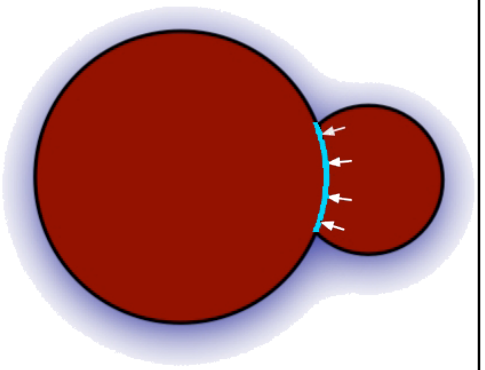
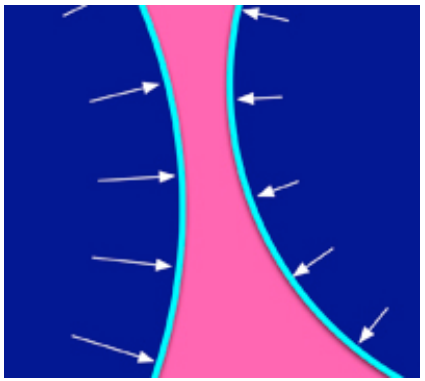


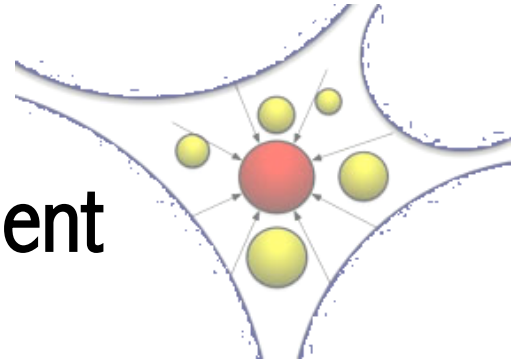
- ✓ Accretion Shocks: Why Environment Matters
- ✓ The Double Distribution:
  An Analytical Statistical Tool for Cosmic Ecology
- ✓ Results



Cosmic Shock Taxonomy

Classification according to driving mechanism

shock type	Accretion	Merger	Filament
driving mechanism	gravity of accretor	mutual gravitational attraction	expansion of void
artist's impression			



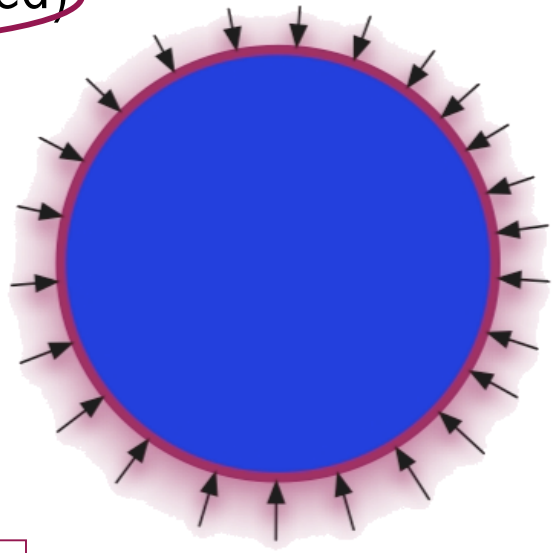
Accretion Shocks and Environment

Properties of single shock:

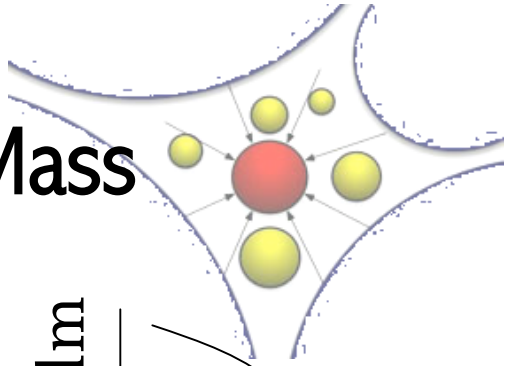
- **Mach number**
  $= f$(accretion velocity, external sound speed)
- **Mass current**
  $= f$(accretion velocity, external density)
- **Kinetic power**
  $= f$(accretion velocity, external density)

accretor mass

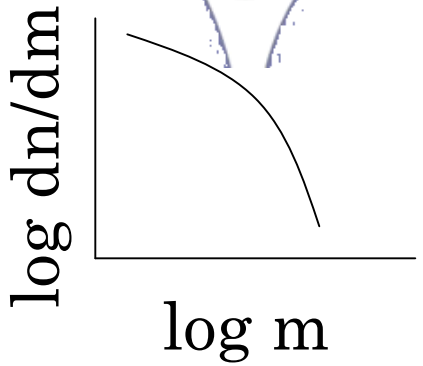
accretor environment



Analytic Description of Accretor Mass and Environment

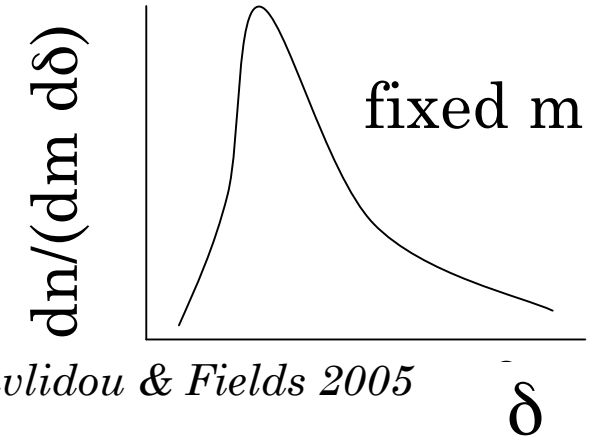


✓ Analytic description of **mass** distribution:
Press-Schechter mass function



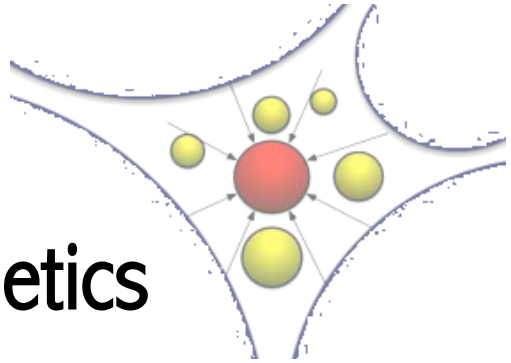
✓ Analytic Description of **mass**+**environment** distribution:
Double Distribution of cosmic structures

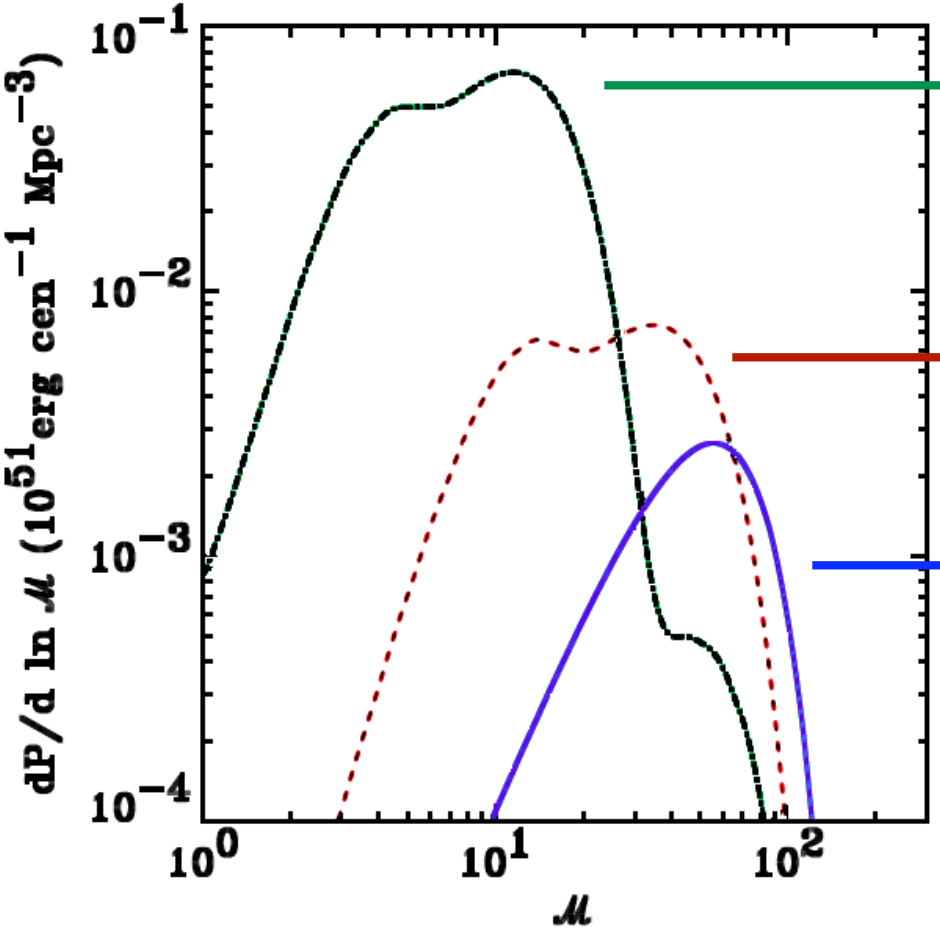
- Parametrizes "environment" using local overdensity, $\delta = \rho_{local}/\rho_{cosmic} - 1$
- Integrates back to Press-Schechter



Pavlidou & Fields 2005

Three Models for Cosmic Accretion Shock Energetics



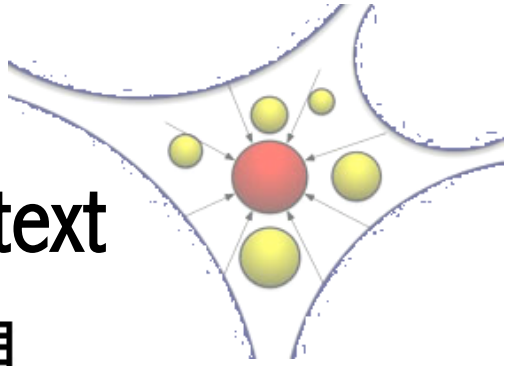


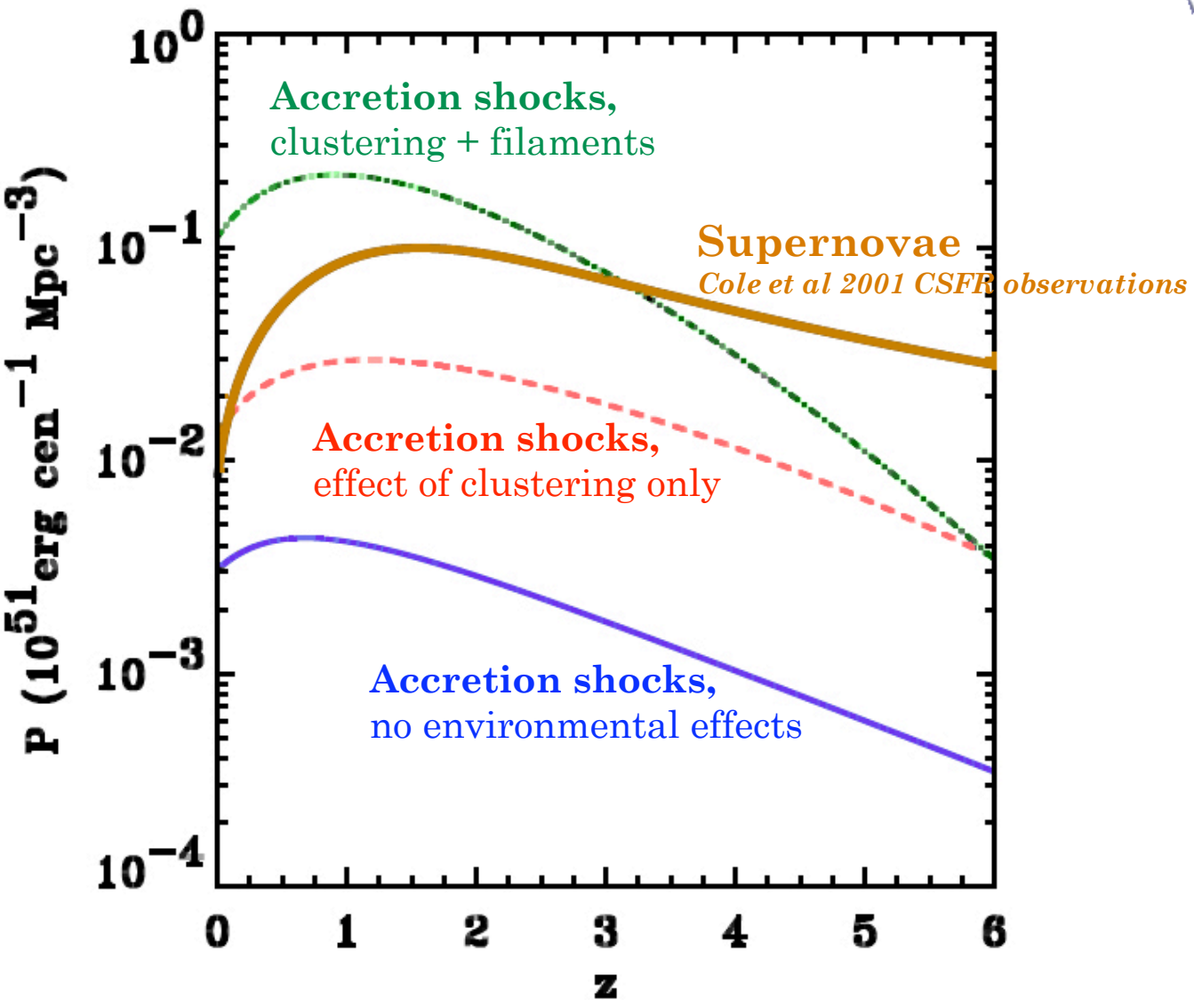
Full Model
(effects of clustering + filament preheating)

Double Distribution
(effects of clustering)

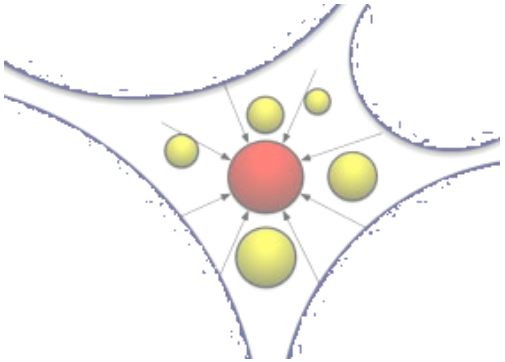
Press-Schechter
(no environmental effects)

Cosmic Accretion Shocks in Context





Conclusions



- ✓ Double distribution of cosmic structures can be used to investigate effect of environment on cosmic accretion shocks,
  + a multitude of environmental effects on cosmic structure formation
- ✓ Inclusion of environmental effects increases energy processed by shocks by more than an order of magnitude, distributes energy among broader range of Mach numbers
- ✓ Energy processed by accretion shocks ≈ supernova energy output at $z\sim3$, overtakes supernovae output in local universe by more than an order of magnitude!