

Galaxy Group Assembly

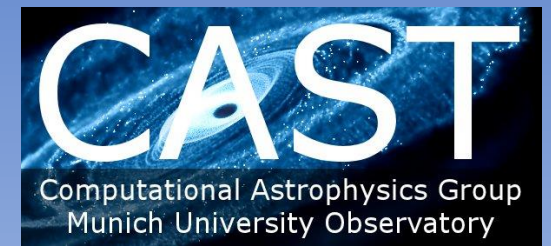
The Different Paths to Group Formation and their Connection to the Type of Group

Rhea-Silvia Remus

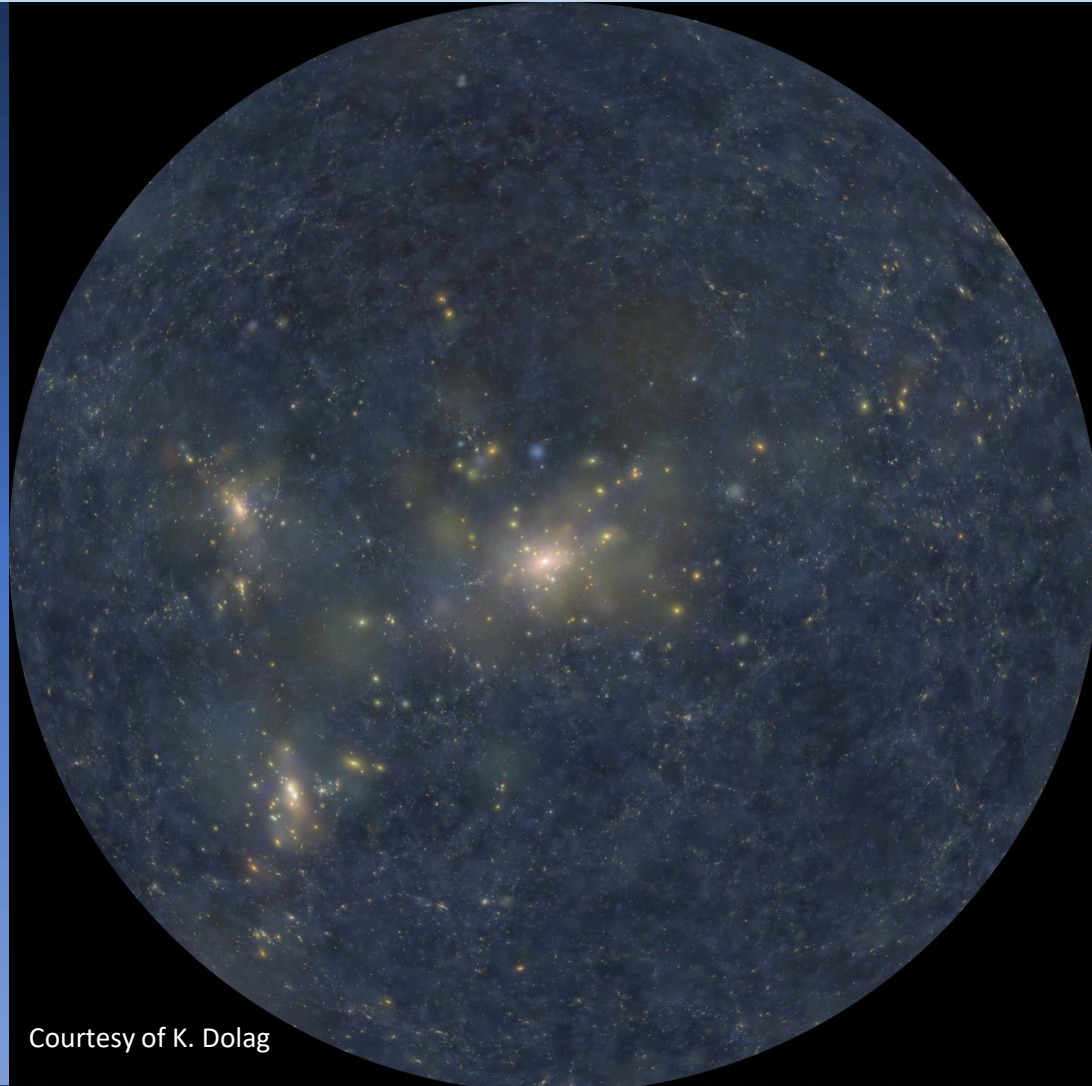
with Klaus Dolag, Michaela Hirschmann, Thorsten Naab, Andreas Burkert
& the Magneticum Pathfinder Team



Galaxy Groups 2016, Paris, 13.12.2016



The Simulations: Magneticum



Courtesy of K. Dolag

www.magneticum.org

Box	Mpc/h	mr	hr	uhr
0	2688	y		
1	896	y		
2	352	y	y	
3	128	y	y	(z=2)
4	48	y	y	y

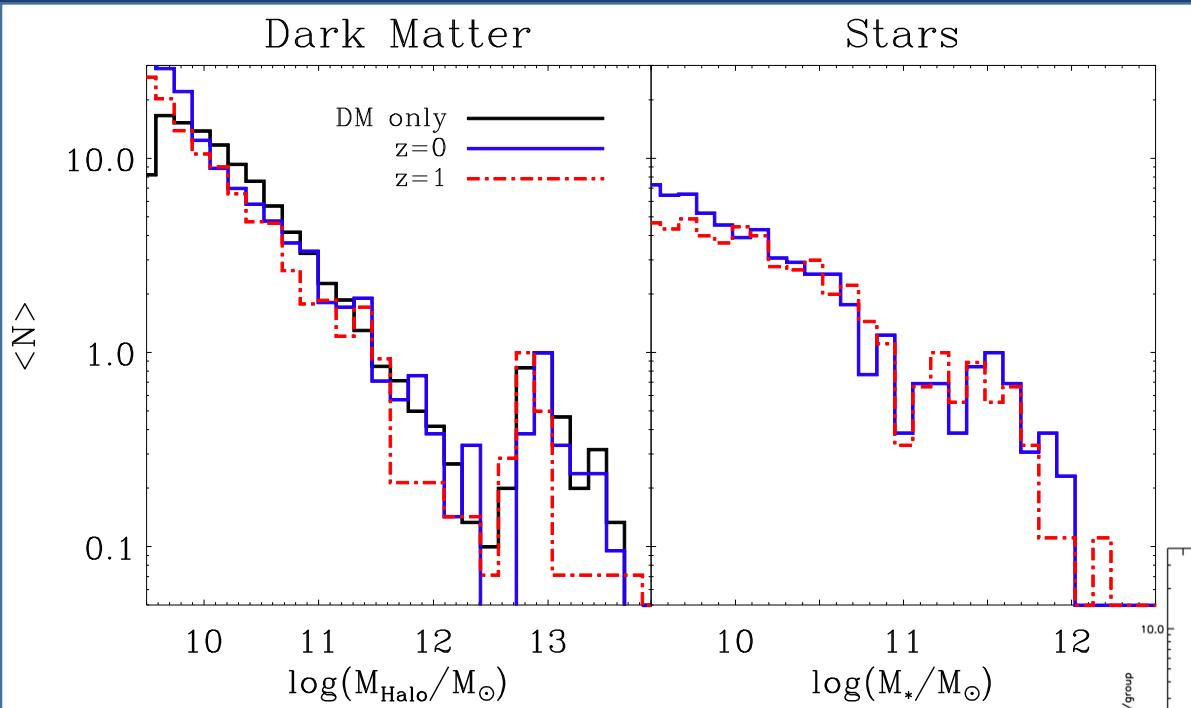
	mr	hr	uhr
$m_{DM} (M_{\odot}/h)$	$1.3 \cdot 10^{10}$	$6.9 \cdot 10^8$	$3.7 \cdot 10^7$
$m_{Gas} (M_{\odot}/h)$	$2.6 \cdot 10^9$	$1.4 \cdot 10^7$	$7.3 \cdot 10^6$

- Modified SPH version of GADGET-3
- Feedback from stellar winds
- Feedback from AGN
- Metal enrichment and star formation follow pattern of metal production from SNIa, SNII & AGB
- Gas cooling depends on local metallicity

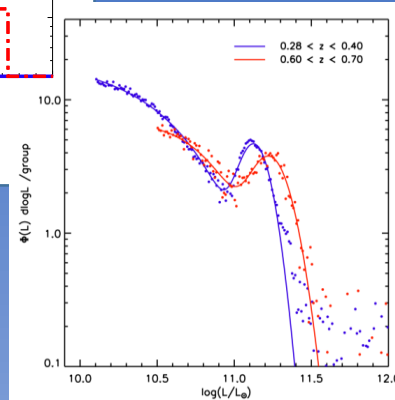
See Hirschmann et al., 2014, Teklu et al., 2015; Remus et al., 2017; Remus et al., 2014; DM only run this work: Oser et al., 2010

Global Properties of Galaxy Group Halos

Subhalo Mass Function

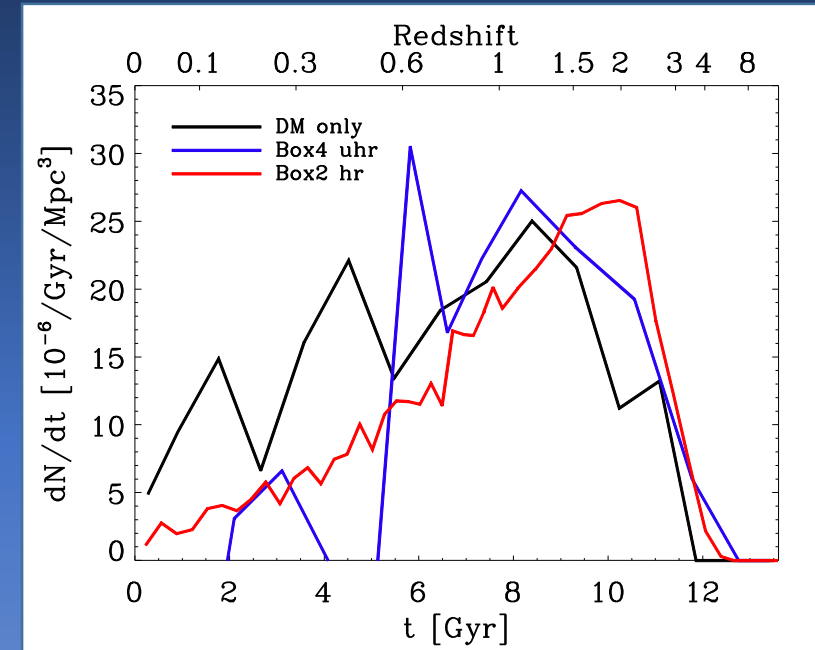


Dip in the subhalo mass function at $M_{*} \approx 10^{11} M_{\odot}$ in agreement with observations. Dip even more pronounced in the DM subhalo mass function.



SDSS: Tal et al. 2012

Group Halo Formation Time



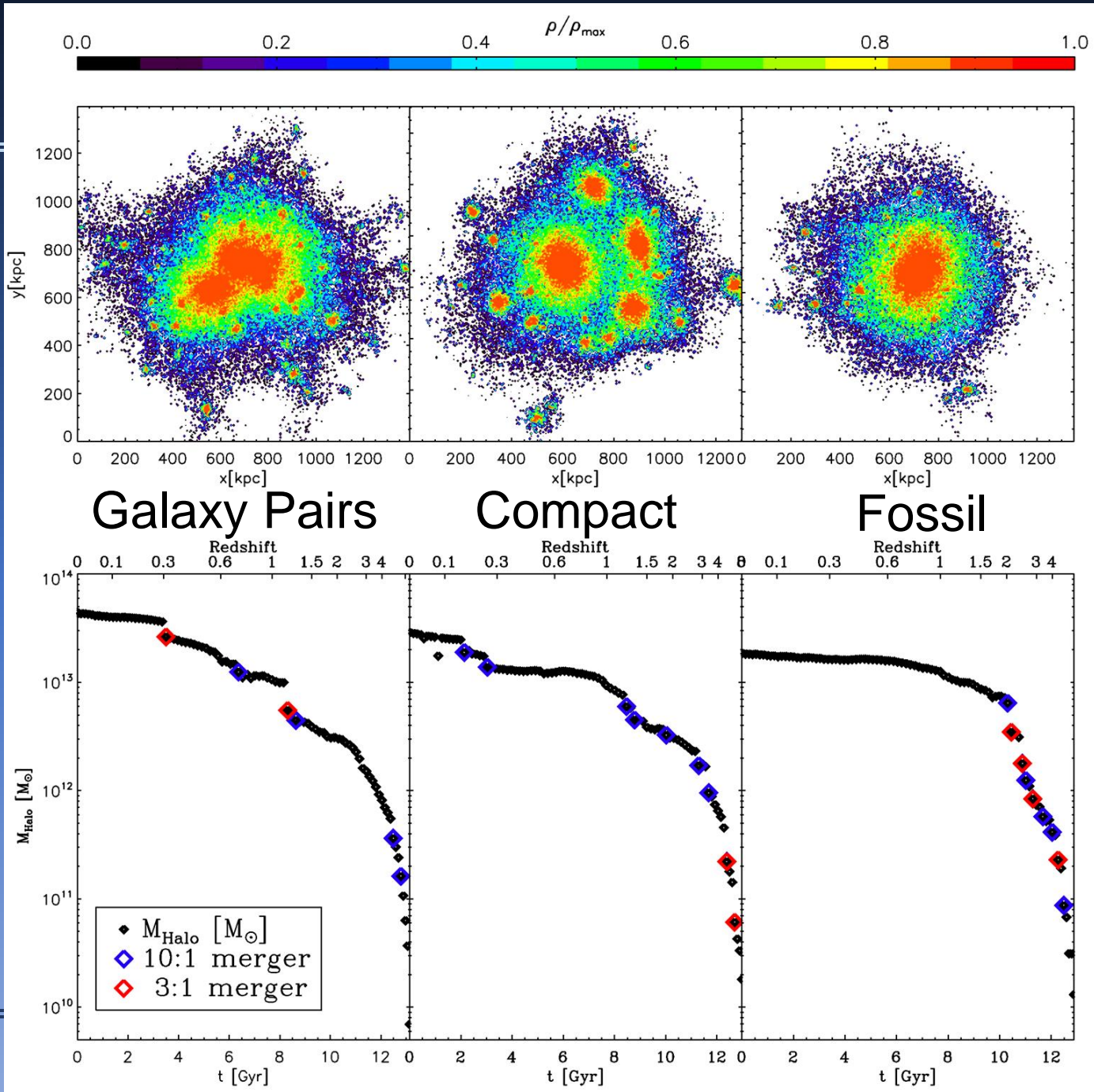
Formation peak for galaxy groups at $z=2-1$, decreasing formation rate with decreasing redshift

Galaxy Group Types

From Dark Matter Only Simulations:

- 70% Fossil Groups
- 15% close Pairs
- 14% Triplets
- 1 single Compact Group

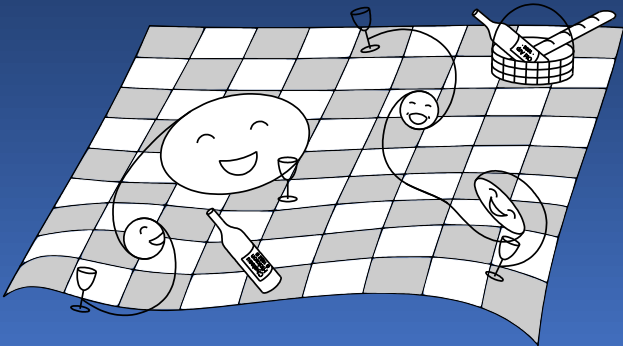
Man et al., 2011: Pair fraction of 15% at $1.7 < z < 3.0$ from the COSMOS survey



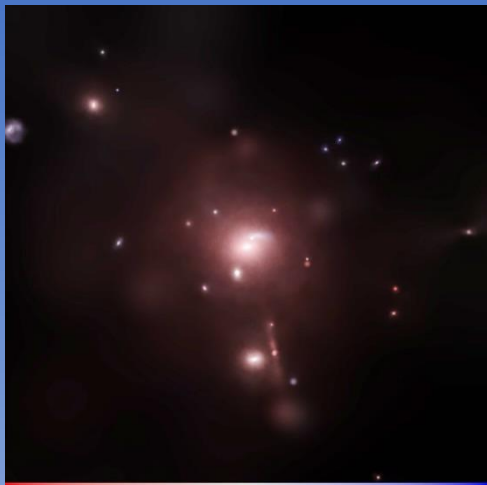
Compact Groups and Fossil Groups

From Baryonic Simulations:

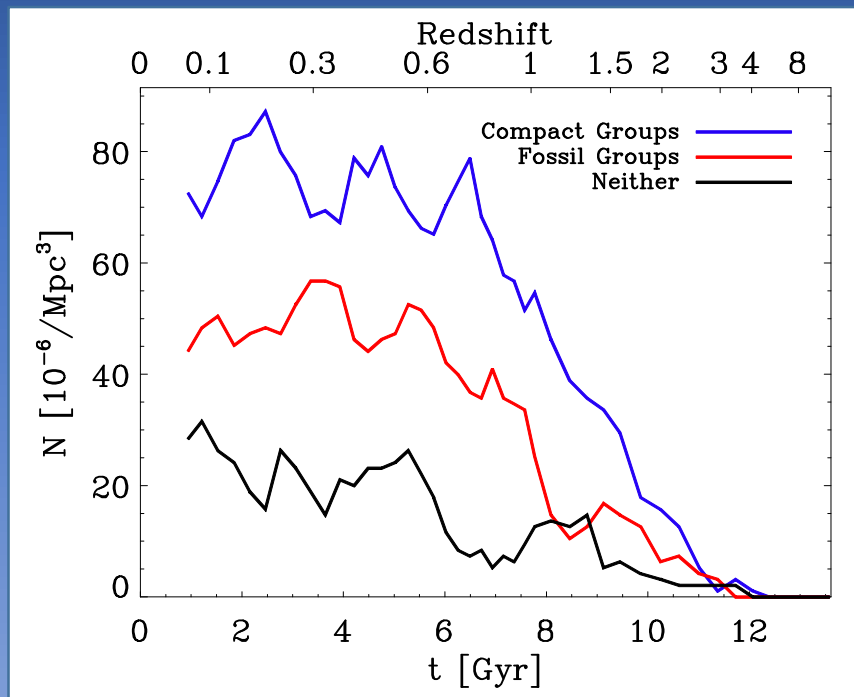
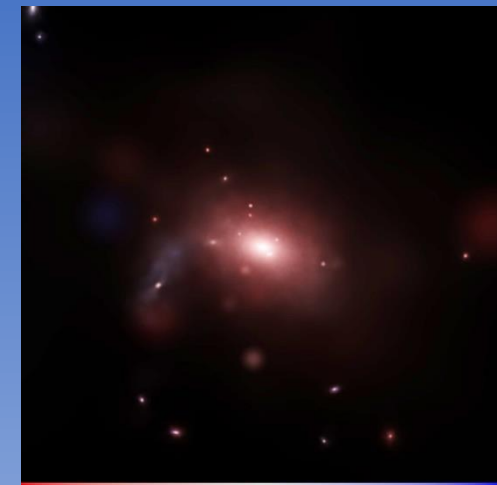
- 28% Fossil Groups
- 18% Pairs & Triplets
- 53% Compact Groups



R_{ep}R



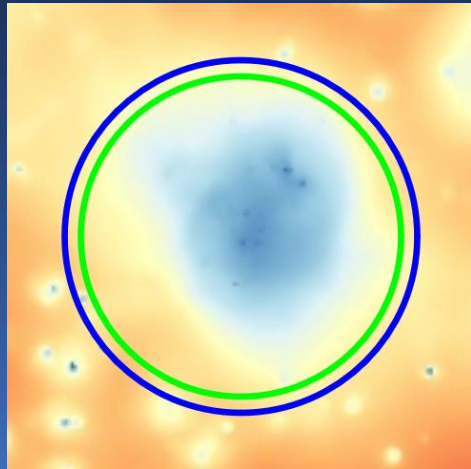
R_{ep}R



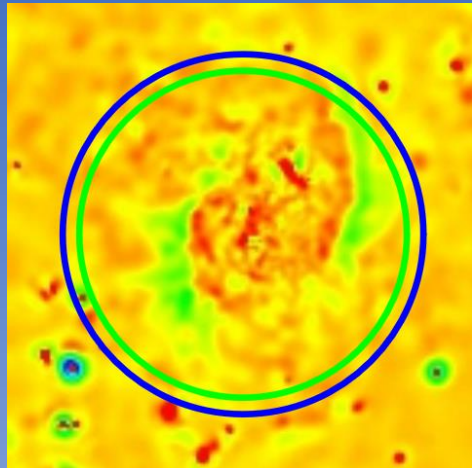
Magneticum



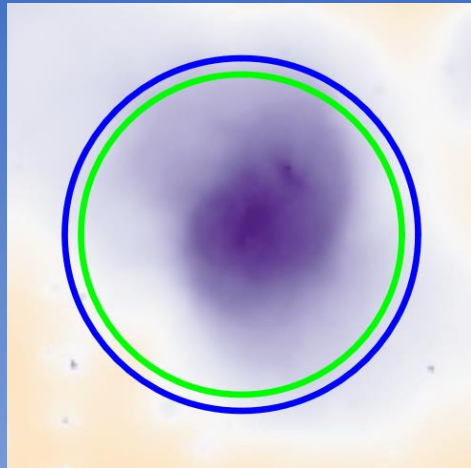
Stars



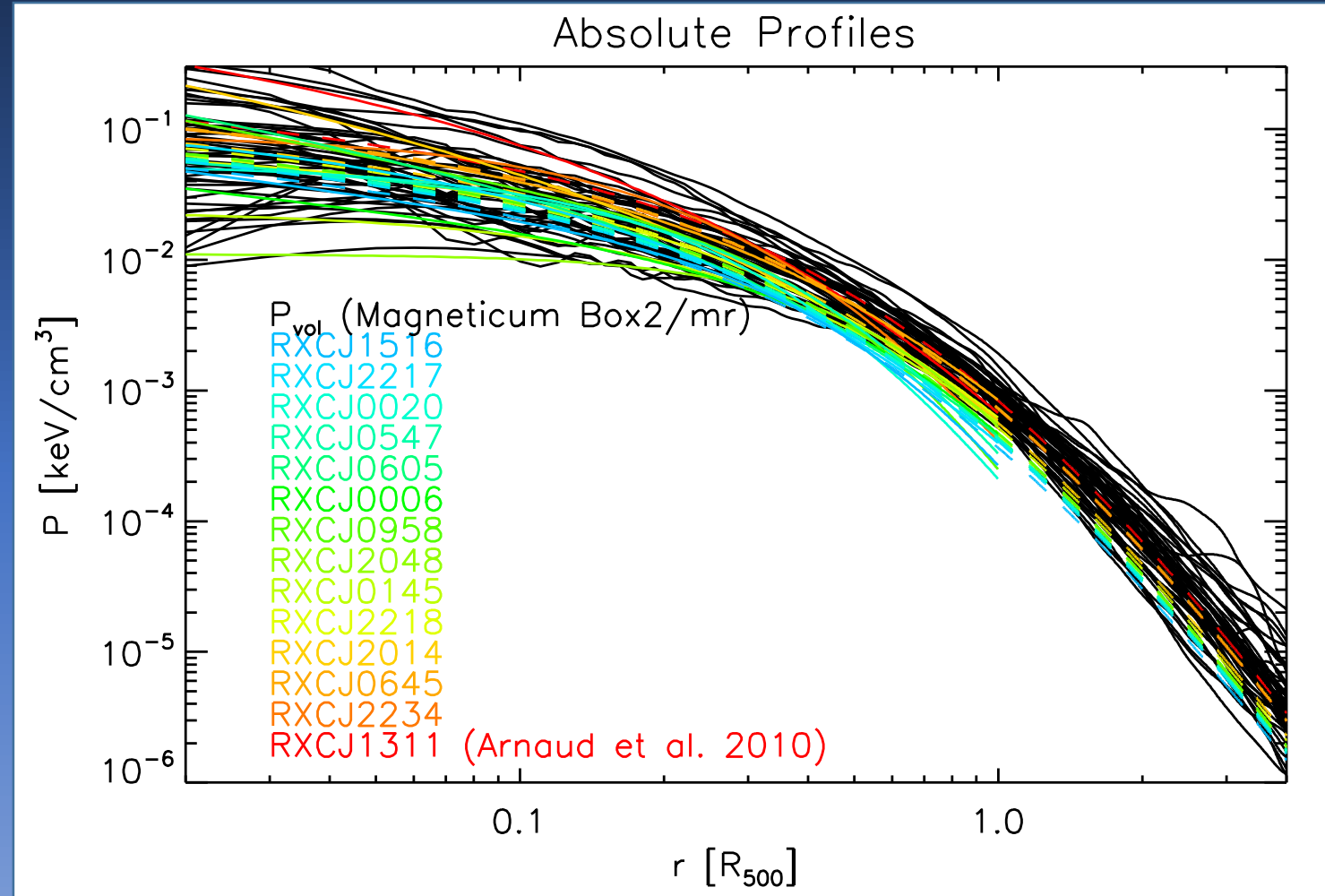
ICM



Shocks



Compton X



Ragagnin et al., submitted for the Magneticum Online Database