most mass subhalo tests

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1). How the most mass sub halo affects the concentration of the host:
I am using the halo catalog to address this question. I find where subhalos, including the most massive sub halo, are located in each host and measure the distances between the center of the host halo and the sub halos. I test if the most massive sub halo is typically located far out from the center so that its existence should not affect r_s of the host.
The figure shows the cumulative profile of subhalos in the MW zoom-in simulations. In each panel, the black line denotes the distribution of all subhalos (above simulation resolution) as a function of radius. The red line denotes the distribution of the most massive sub halo as a function of radius. The left column is just this, but the right column is the distribution weighted by the sub halo mass. I have added all zoom-in simulations I have to make the plot. The first row is for Group1 hosts, which have rapid recent accretion and typically host a high-mass sub halo. The second row is using Group2 host, which do not have rapid recent accretion. The bottom row is for all halos. The radius for the x-axis of the plot is renormalized to rvmax, which is where the rotation curve of the host halo reaches the maximum. For an NFW halo, rvmax = 2.1626r_s. This is how r_s(klypin) is computed. A blue vertical line in each panel marks r = rvmax. The pink band covers a length equal to 2 times of the mean r_s of the most mass sub halos used in each panel. If most of subhalos or most massive subhalos are distributed far out from the blue line (and the pink band), they should not contribute a significant mass within rvmax. Therefore, they should not affect the determination of r_s. This is definitely true for GP2 type hosts (f(<r)<10% no matter how plotted). For GP1 type hosts, about 20% of the most massive subhalos are located within rvmax (50% for the mass-weighted measure). It indicates that the most massive sub in GP1 hosts may weakly affect r_s by being located within r_s.

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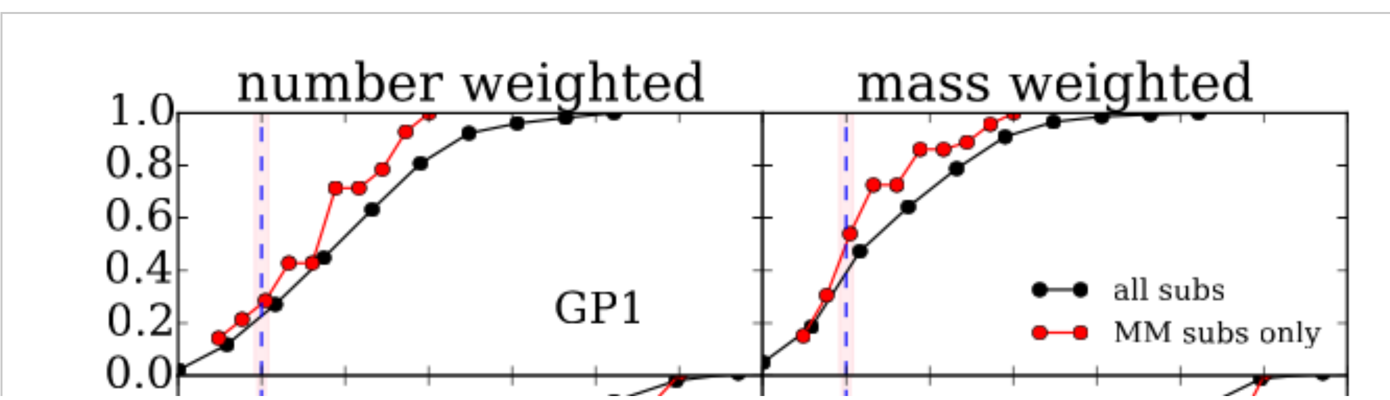

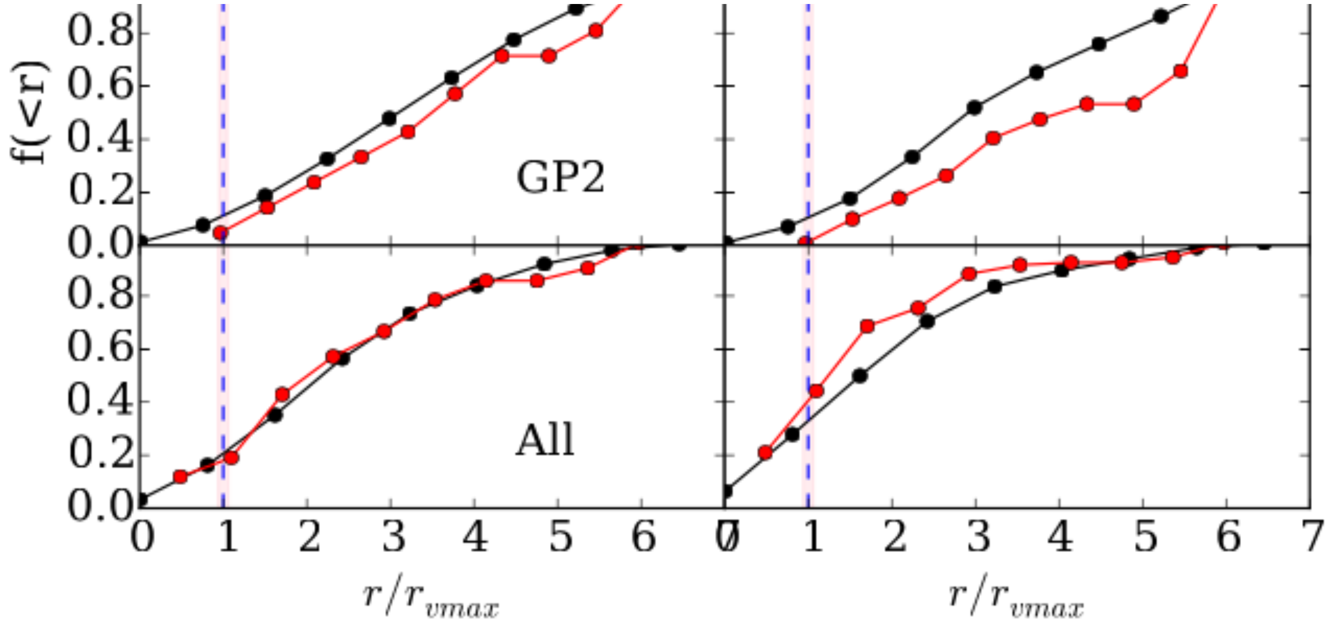

2). How the accretion of the most massive sub halo affects the MAH of the host halo:

I track the merger tree and find the mass of the most massive subhalo at accretion. I subtract its mass (as a constant) from the MAH since it is accreted. The corrected MAH would be the MAH as if the most massive sub halo is never involved.

I show how the most massive subhalo corrected MAH fitting parameters compare to the original MAH fitting parameters in the first row. Ignore the last row for concentration. The y-axises are the corrected MAH parameters, and the x-axises are the originals. Color denotes the mass of the most mass subhalo, with redder corresponding to higher masses. The second row panels show the distribution of halos in the gamma - beta + gamma space changes. The left panel is using the original fitting parameters, but the second panel is using the correct MAH parameters. The bottom panels show the distribution in the beta+gamma - concentration space. In all the panels, circles are the cosmological simulation halos, and stars are the zoom-ins. The result suggests that the accretion of the most massive subhalo does contribute to the fast recent accretion, but it is not the only effect. After removing the mass contributed by the most massive subhalo, the MAH fitting parameters do vary. The effect is stronger for hosts that have more massive subhalos. However, after removing the most massive sub halo, the trend in the correlation we talk about in the paper still exist, but a lot weaker.

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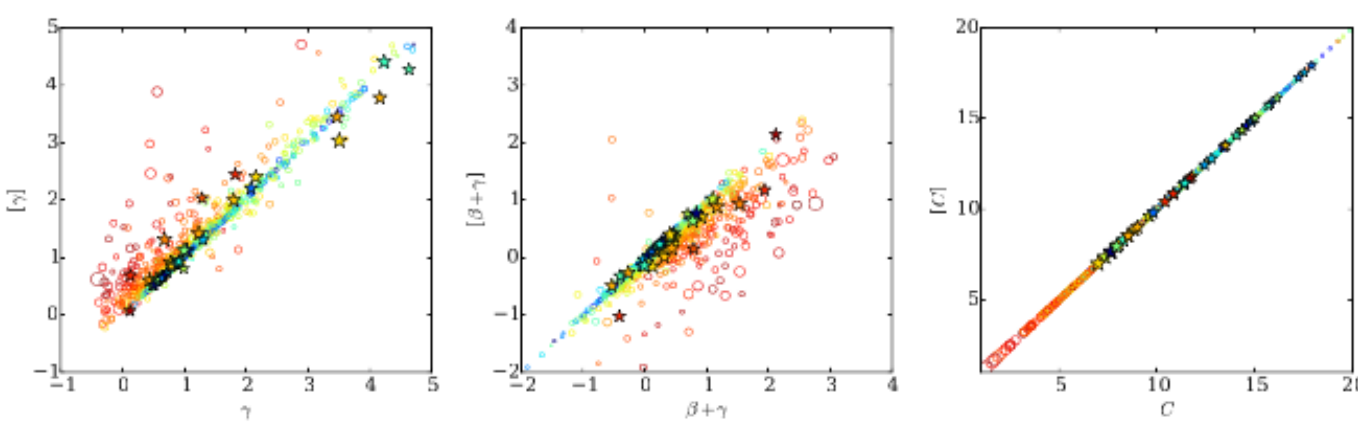

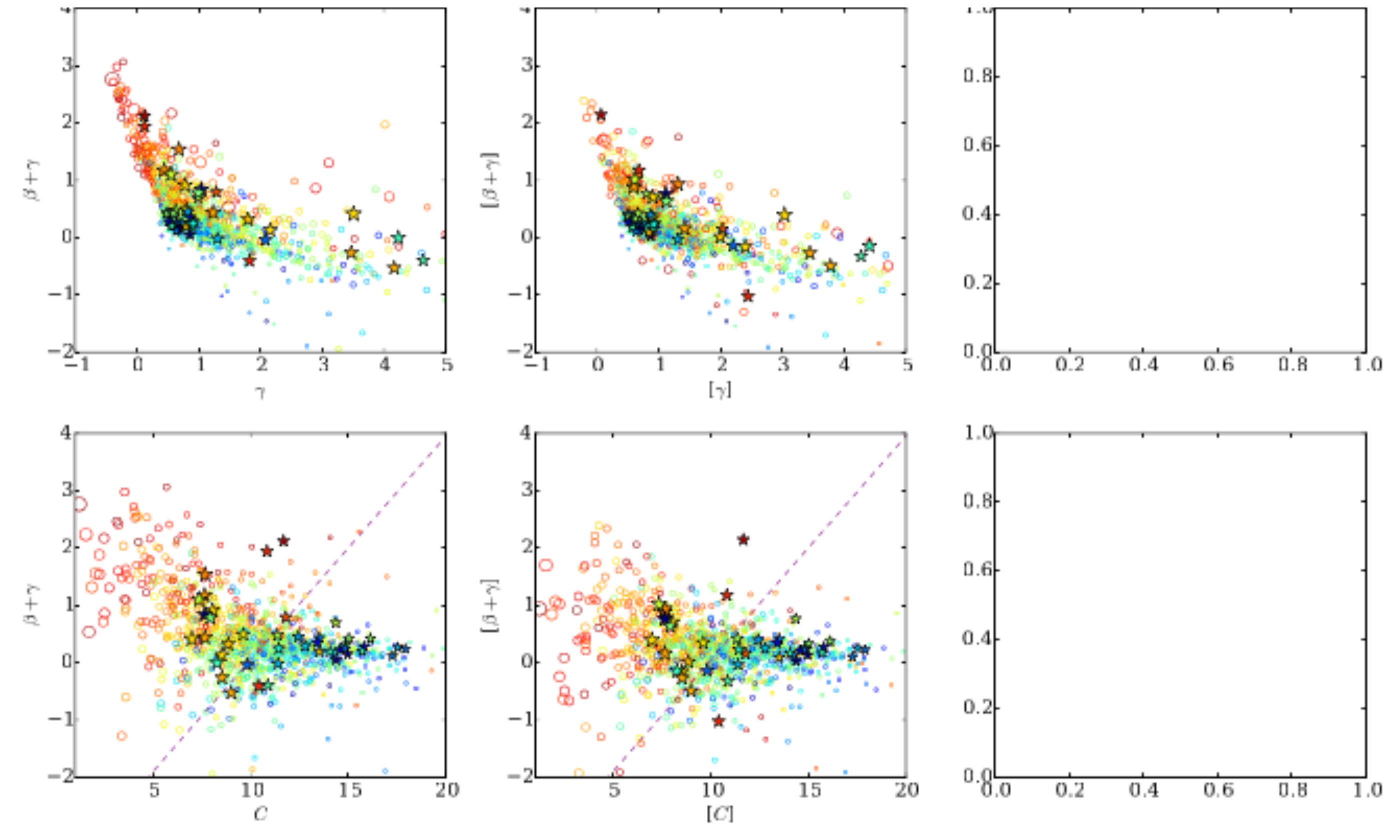

3). Same as the figure in 2), but this time, I subtract the instantaneous sub halo mass from the host MAH. In this case, the mass stripped from the most massive sub halo is added into the host mass. The effect is weaker than subtracting the sub halo mass at accretion, because Msub becomes smaller as a function of time due to stripping.

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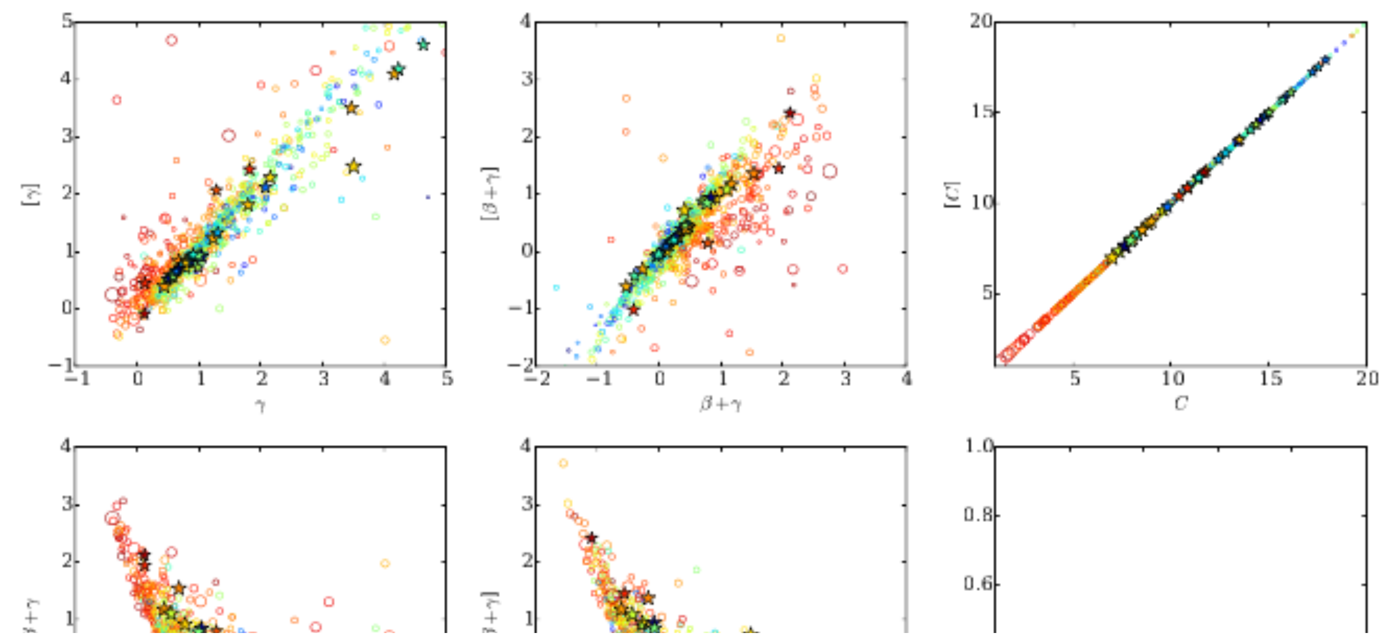

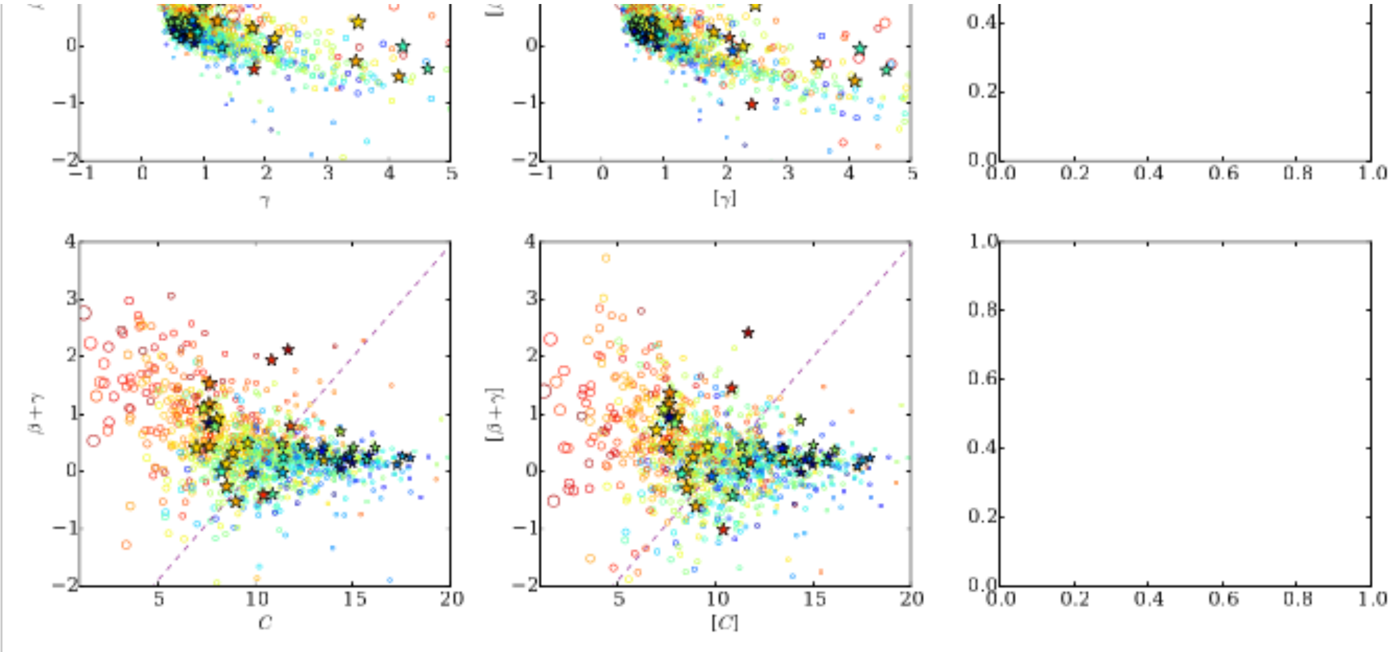

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