RE: MNRAS: MN-15-2470-L.R3

Author's Comments:

The authors would like to thank the referee for their report and we welcome the chance to respond their comments here. We have highlighted any changes made in blue in the revised paper, which include clarifying our use of the terms quenching, quenched; the addition of an extra figure showing the AGN-HOST locations on a colour-magnitude and stellar mass-SFR diagram (Fig 3) and including uncertainties on the distributions presented originally in Figs 3 & 4 (now Figs 4 & 5). We provide more detailed comments below.

We hope that these changes satisfy the referee's concerns and that the paper is now acceptable for publication.

The authors didn't correctly address the point raised by the first referee. Indeed, their simulation show that they do not recover the colors of the blue and green galaxies. They recover correctly only the red peak. I have a fundamental difficulty with their general approach. The authors fit "quenched star formation histories" as explained in the methodology section. They extensively discuss the quenching parameters (for instance "quenching at early times is also observed for inactive population"). But their sample is not selected to be quenched galaxies. Because of the GALEX selection, they are mostly dominated by normal star-forming galaxies. Therefore, I don't undertsand how the authors can discuss the quenching parameters of a population which has not quenched. I would agree with the method if the authors were fitting/discussing red galaxies or galaxies in transition.

We have added an extra diagram to the paper, now Figure 3, showing the locations of both the AGN-HOST and INACTIVE samples on an optical colour-magnitude diagram and on the M_*-SFR diagram (stellar masses and SFRs are obtained from the MPA-JHU catalog, which fully accounts for the presence of an AGN when calculating the SFR and corrects for aperture effects caused by the fibre spectra of SDSS). This figure shows that despite the fact that the majority of these AGN-HOST galaxies would be classified as "blue" galaxies (73% blue, 21% green and 7% red), lying below the green valley in the colour magnitude diagram, 51% of them in fact lie more than 1σ below the star forming "main sequence" (with 74% lying below the relation itself) and are indeed undergoing quenching, transitioning to the quiescent population.

Despite the NUV detection from GALEX, these galaxies are therefore clearly not normal star forming galaxies. In Section 2.2 we have added a reference to Ko et al. (2013), who find that in a sample of quiescent red-sequence galaxies without Hα emission, 26% show NUV excess emission and that the fraction with recent star formation is 39%. These findings therefore show that a detection in NUV does not necessarily infer that the galaxy is a normal star forming galaxy but can also be currently undergoing quenching or indeed quiescent. We therefore believe that fitting these galaxies with the quenching history models presented here, which can encompass galaxies which are either quiescent, quenching or beginning to quench, is the correct approach.

We have addressed the referee's concern in the text in Section 2.2 along with including the new Figure 3, in order to clarify these issues for the reader. We have reworded the misleading term "quenched star formation histories" to " quenching star formation histories" and have clarified our use of the terms “quenching” and “quenched”/ “quiescent”. We think the paper is clearer as a result of this clarification and thank the referee for raising this issue.

I have major comments on figures 3 and 4. All the individual SFHs are combined to create one average SFH (for a given mass bin). But the reader can't apprehend the intrinsic dispersion between the individual SFHs. Having a shaded area including 68% of the individual SFHs could already alleviate this problem. Such area could indicate if the discussed trends are significative. Moreover, we can not have any feeling on the uncertainties affecting the average SFH measurement in Fig. 3 and 4. For instance, I would suspect that a long tau value and an early tQ is degenerated with a short tau and a late tQ. It could explain the bimodality in the middle left panel. It could explain the several peaks visible in the various SFHs, which are suspicious. It seems really difficult to discussed in detail the average SFHs of Fig.3 and 4 without having an idea of what are the robust trends.

We are happy to show the uncertainties on the distributions presented and have included these regions on Figures 4 & 5 (originally Figs 3 & 4). The method we use to present these distributions is cumulative across the populations presented, so we have calculated the uncertainties using a bootstrap method. In each bin we take the minimum and maximum values achieved by 1000 bootstrap iterations which each sample a different random 90% of the given population. These shaded regions help to encompass the uncertainties in the results much better than the previous uncertainties quoted in Table 1. We note that with these uncertainties shown by the shaded regions, that the results still hold.

The referee is correct in highlighting that degeneracies do exist across these results - we refer the referee to Figure 4 of Smethurst et al. (2015) where this was discussed. A long tau value and an early tq, is degenerate with a short tau and a late tq as highlighted by the referee but the use of both the u-r and NUV-u colours helps combat this issue. The strongest peak at late quenching times (~12 Gyr) and rapid quenching rates (~0.1 Gyr) derived for the AGN-HOST galaxies are only degenerate with the secondary peak at early times (~4 Gyr) with slow quenching rates (~3 Gyr) at a redshift z = 0.250. The maximum redshift of the AGN-HOST sample is z = 0.219±0.002, with a mean redshift <z> = 0.0839 ± 0.0005. By the observed redshift of this sample, the two peaks are therefore not degenerate in model colour space. If this were the case, this would not just affect the results of the AGN-HOST sample but also the INACTIVE sample to the same degree, along with both disc and smooth vote fraction weighted populations. Since we see clear differences between the two different samples and between the morphologies within a given population, the conclusions drawn do not arise due to the degeneracies of the model.

Finally, the authors do not include correction for dust attenuation. Is it not possible to use the SDSS spectra to correct the colors for dust attenuation ?

We unfortunately cannot use the SDSS spectra to correct for dust attenuation as this only provides spectral information inside the fibre, i.e. the central regions of the galaxy. Since we are using global SED colours, an estimate of just the central Balmer decrement would not be sufficient in correcting for the dust attenuation. Masters et al. (2010) showed that the Balmer decrement ratio within the fibre is much higher than expected due to this issue and so does not provide an accurate representation of the dust attenuation in a galaxy.

It is possible to estimate average dust corrections as a function of inclination, as in Masters et al. (2010). We discuss this in Section 2.2 of the paper. It is particularly an issue for highly inclined discs, of which 23% of our sample have p_disc > 0.5 and log(a/b) > 0.7. We find no correlation between the inclination, log(a/b) and either the stellar mass, SFR (calculated from Hα flux) or NUV-u colour. There is a slight correlation between the inclination and the optical u-r colour, with a Δu-r ~ 0.2 from the least to the most inclined - this is in agreement with Masters et al. (2010).

We have therefore investigated how this affects our results by reproducing similar plots as in Figures 4 & 5 with the AGN-HOST sample split by edge on, log(a/b) > 0.7 and face on galaxies, log(a/b) < 0.7 and provided them for the referee's interest in the uploaded PDF (no split by stellar mass is made in this case). We note that the distributions for edge-on and face-on galaxies are almost indistinguishable for the elliptical weighted population densities (as expected, since this problem of dust mainly affects disc galaxies). There are some slight differences between the edge on and face on disc weighted distributions, however the same conclusions are drawn in either case. We are therefore confident in our assertion in Section 2.2 that the main conclusions drawn in the paper could not be produced by the effects of dust and are comfortable with not performing a dust attenuation correction.

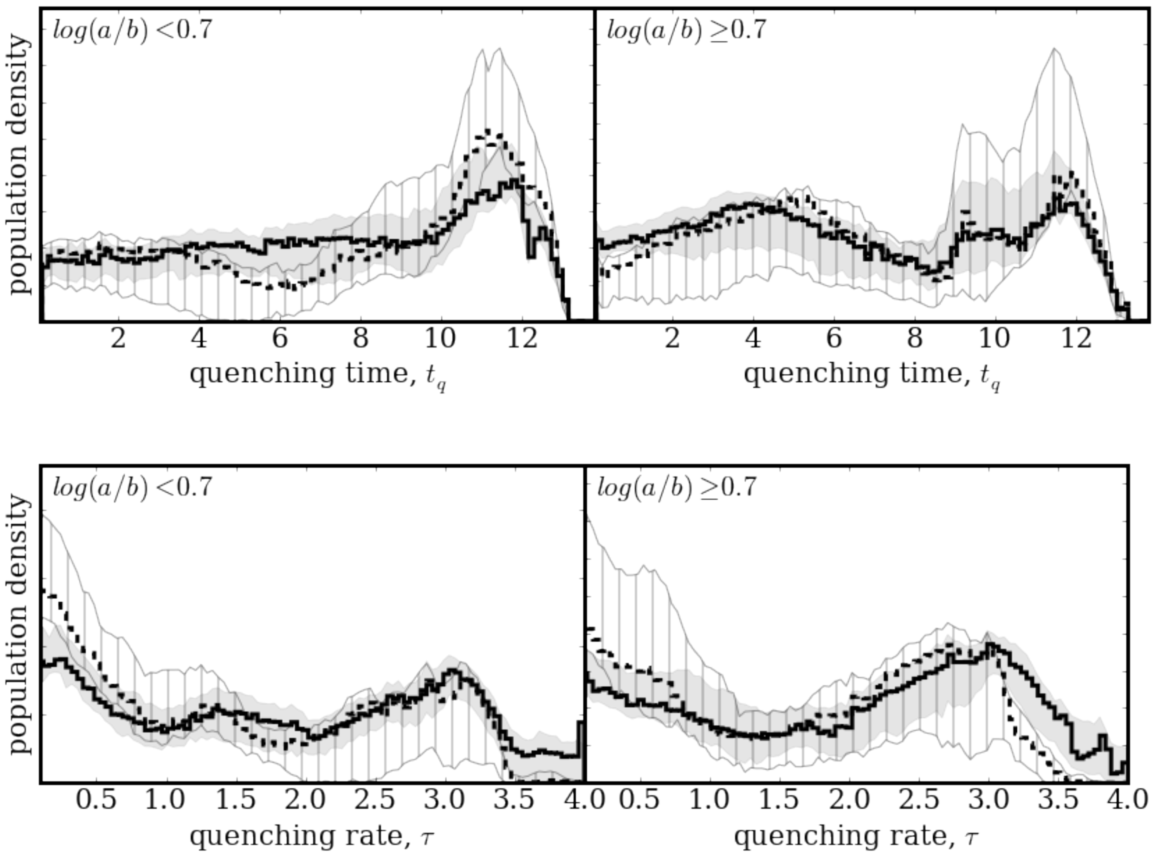

Figure 1: Population density distributions for the quenching time t_q (top) and quenching rate $\boldsymbol{\tau}$ (bottom) normalised so that the areas under the curves are equal. Face-on (log(a/b) < 0.7; left) and edge-on (log(a/b) ≥ 0.7 ; right) galaxies are weighted by both smooth

(dashed) and disc (solid) vote fractions. Uncertainties from bootstrapping are shown by the shaded regions for the smooth (grey striped) and disc (grey solid) population densities. A low (high) value of t_q corresponds to the early (recent) Universe.