Combine figures 3 and 4

~~thank James Binney~~

first submit to astoph and then monthly notices

then send copy to scott saying its been sumbitted (improved the treatment) CC ostriker and philip

~~I also have one question. When you make your plots of the heating, you integrated over time. What is the starting time in this integral? Is it the age of the universe? I imagine that probably the answer is not very sensitive to the time interval / start time you use, but just mention which equations you integrate over what time interval in the paper to create the figures.  I am just asking because the FDM fluctuations show up at around the collapse-time / free-fall time of the halo, i.e. when you have multiple shell crossing, before that the DM distribution is smooth.~~

Section 4.3

~~\* If heating is dominant in driving the evolution of σD then, since they predict the heating rate depends ...    what are you referring to by "they" over here?~~

~~Latex / typesetting:~~

~~\* fix m\_{acc} to m\_{\rm acc} in some places because I see both styles in the paper~~

~~\* Equation 30. lhs is missing ")"~~

~~\* in the text, be consistent with "figure N" vs "Figure N"~~

Although highly successful on cosmological scales, Cold Dark Matter (CDM) models predict unobserved over-dense <i>cusps</i> in dwarf galaxies and overestimate their formation rate. We consider an ultra-light axion-like scalar boson which promises to reduce these observational discrepancies at galactic scales. The model, known as Fuzzy Dark Matter (FDM), avoids cusps, suppresses small-scale power, and delays galaxy formation via macroscopic quantum pressure. We compare the substructure of galactic dark matter halos comprised of ultra-light axions to conventional CDM results. Besides self-gravitating subhalos, FDM includes additional substructure in the form of non-virialized over-dense wavelets formed by quantum interference patterns which provide a more efficient source of heating to galactic discs than do subhalos. We find that, in the solar neighborhood, wavelet heating is sufficient to give the oldest disc stars a velocity dispersion in excess of 30 km s<sup>-1</sup> within a Hubble time if energy is not lost from the disc. Furthermore, we calculate the radius-dependent velocity dispersion and corresponding scale height caused by the heating of dynamical substructure in both CDM and FDM with the determination that these effects will produce a flaring that terminates the Milky Way disc at 15 - 20 kpc. Although the source of thickened discs is not known, the heating due to perturbations caused by dark substructure cannot exceed the total disc velocity dispersion. Therefore, this work provides a lower bound on the FDM particle mass of m<sub>a</sub> > 0.63 × 10<sup>-22</sup> eV. Furthermore, FDM wavelets with particle mass m<sub>a</sub> ∼ 0.7 × 10<sup>-22</sup> eV. should be considered a viable mechanism for producing the observed disc thickening with time.

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Furthermore, we calculate the radius-dependent velocity dispersion and corresponding scale height caused by the heating of dynamical substructure in both CDM and FDM with the determination that these effects will produce a flaring that terminates the Milky Way disc at \SIrange{15}{20}{\kilo \parsec}. Although the source of thickened discs is not known, the heating due to perturbations caused by dark substructure cannot exceed the total disc velocity dispersion. Therefore, this work provides a lower bound on the FDM particle mass of $m\_a > \SI{0.63 e-22}{\electronvolt}$. Furthermore, FDM wavelets with particle mass $m\_a \sim \SI{0.7e-22}{\electronvolt}$ should be considered a viable mechanism for producing the observed disc thickening with time.