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A possible scheme to alleviate the small-scale tension encountered by fuzzy dark matter

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Fuzzy dark matter (FDM) with mass around 10^{-22} eV is believed to be a more hopeful DM candidate compared to cold dark matter (CDM). Because FDM can solve the small-scale problems for CDM, thanks to its wave nature due to the very light mass. These problems arise from the incorrect prediction for the structure growth. For example, CDM predicts a cusp at the center of DM halo, while recent observations show a preference for core in DM halo profile. While FDM, which can be realized by axion-like-particles, has successfully explain these problems, by suppressing the structure growth at small scale. This is achieved by its wave nature (or we call "quantum pressure") countering the collapse of DM halos. More recently, however, small-scale observations at high redshifts, such as Lyman-alpha, begin to challenge FDM in return. That is, the FDM which can solve the CDM crisis, predicts too much suppression at small scale, and so appears a closing window of its parameter space. In this talk, I will show our result on alleviating or even solving such tension in a new theory. We focus on the redshift difference between these observations, and propose a scheme of DM scalar field with differently-evolving sound speed. Under the frame of DBI theory, we have showed that it is possible to change the behavior of the quantum pressure term, therefore change the process of structure growth. I will present some examples in this talk, while more possibilities remain to be explored.

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