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**Lyman-$\alpha$ Forest Constraints on Decaying Dark Matter and Implications for Galactic Substructure Properties** MEI-YU WANG, Indiana Univ - Bloomington, RUPERT CROFT, Carnegie Mellon University, ANNIKA PETER, The Ohio State University, ANDREW ZENTNER, University of Pittsburgh, CHRIS PURCELL, West Virginia University — I present an analysis of high-resolution N-body simulations of decaying dark matter (DDM) cosmologies which focuses on the statistical properties of the transmitted Lyman-$\alpha$ (Ly$\alpha$) flux in the high-redshift intergalactic medium (IGM). In this type of model, a dark matter particle decays into a slightly less massive stable dark matter particle and a massless particle. The small mass splitting will provide a non-relativistic kick velocity $V_k$ to the daughter particle and result in free-streaming effect. I especially focus on late decay scenario with decay lifetime around the order of the age of the Universe. I present new limits on unstable dark matter models using current Ly$\alpha$ forest data sets combined with the WMAP7 data. I also use zoom-in numerical simulations to explore the ability of DDM models to solve the small scale problem in galactic halos. I have found that these particular DDM models may provide a solution to both the Galactic subhalo abundance and core/cusp problems, and also that they are consistent with current Ly$\alpha$ limits.

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