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Measuring the Timeline of Cosmic Reionization with Galaxies[1]
LILY WHITLER, Arizona State University, CHARLOTTE MASON, Center for Astrophysics | Harvard & Smithsonian — Reionization of hydrogen is driven by the first structures in the universe, so understanding the timeline of reionization promises to shed light on the nature of these early objects. In particular, transmission of Lyman alpha (Lya) from galaxies through the intergalactic medium (IGM) is sensitive to neutral hydrogen in the IGM, so can be used to probe reionization. In this work, we implement an improved model of the galaxy UV luminosity–dark matter halo mass relation to infer the fraction of neutral hydrogen in the IGM from Lya observations. Many models assume that UV-bright galaxies reside in massive dark matter halos in overdense regions of the IGM, and thus in relatively large ionized regions. However, observations and N-body simulations indicate that scatter in the UV luminosity–halo mass relation is expected. We model the relation with scatter to assess the impact on Lya visibility during reionization. We show that scatter in the UV luminosity–halo mass relation tends to reduce Lya visibility compared to models without scatter, and that this is most significant for UV-bright galaxies. We infer the neutral fraction at $z \sim 7$, updating the inference without scatter, and place our results in the context of other constraints on the reionization timeline.

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