Hints of dark matter-neutrino interactions in Lyman-α data

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Based on

Hooper & Lucca 2021 [2110.04024]

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The Lyman-α flux power spectrum

- ▶ Photons from quasars
  1) travel through H clouds,
  2) get absorbed and
  3) re-emitted in other direction

- ▶ Since clouds are at lower redshifts than the source, features are shifted towards lower wavelengths
  $\rightarrow$ Lyα forest

- ▶ Calculate normalized transmission, Fourier transform, ensemble average, get 1D flux PS and its variance $\Delta_F^2(k)$ (see e.g. Garzilli et al. 2019 for a great, recent, pedagogical introduction)
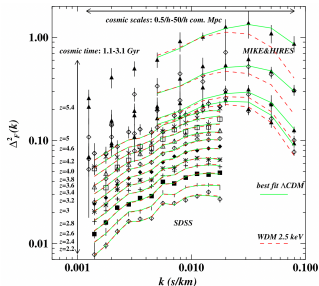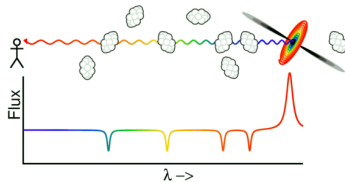
Figures adapted from www.astro.ucla.edu (top) and Viel et al. 2013 (bottom)

New tension emerging from the (Lyα) forest

▶ At large scales: $2 - 3\sigma$ tension in the determination of the tilt of the MPS at Lyα scales between early-time inference and SDSS data

▶ At small scales: similar (qualitative) conclusion in the context of MIKE/HIRES data
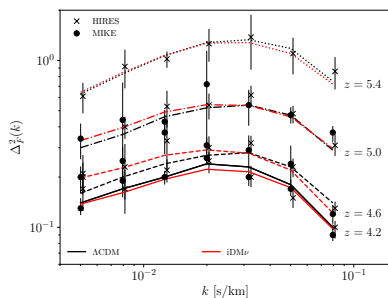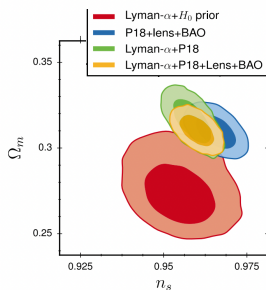
Figures adapted from Palanque-Delabrouille et al. 2019 (left) and Hooper & Lucca 2021 (right)

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Potential for discovery of new physics

▶ Many DM models predict a suppression of the matter/flux PS at Lyα scales, but only few can correctly adjust its tilt

▶ DM-ν interactions are one such example, leading to a preference for an interaction strength 3σ away from zero

▶ Future work fundamental to test the validity of method and results