

Using HI Observations to Test Ultra-Light Axion Dark Matter

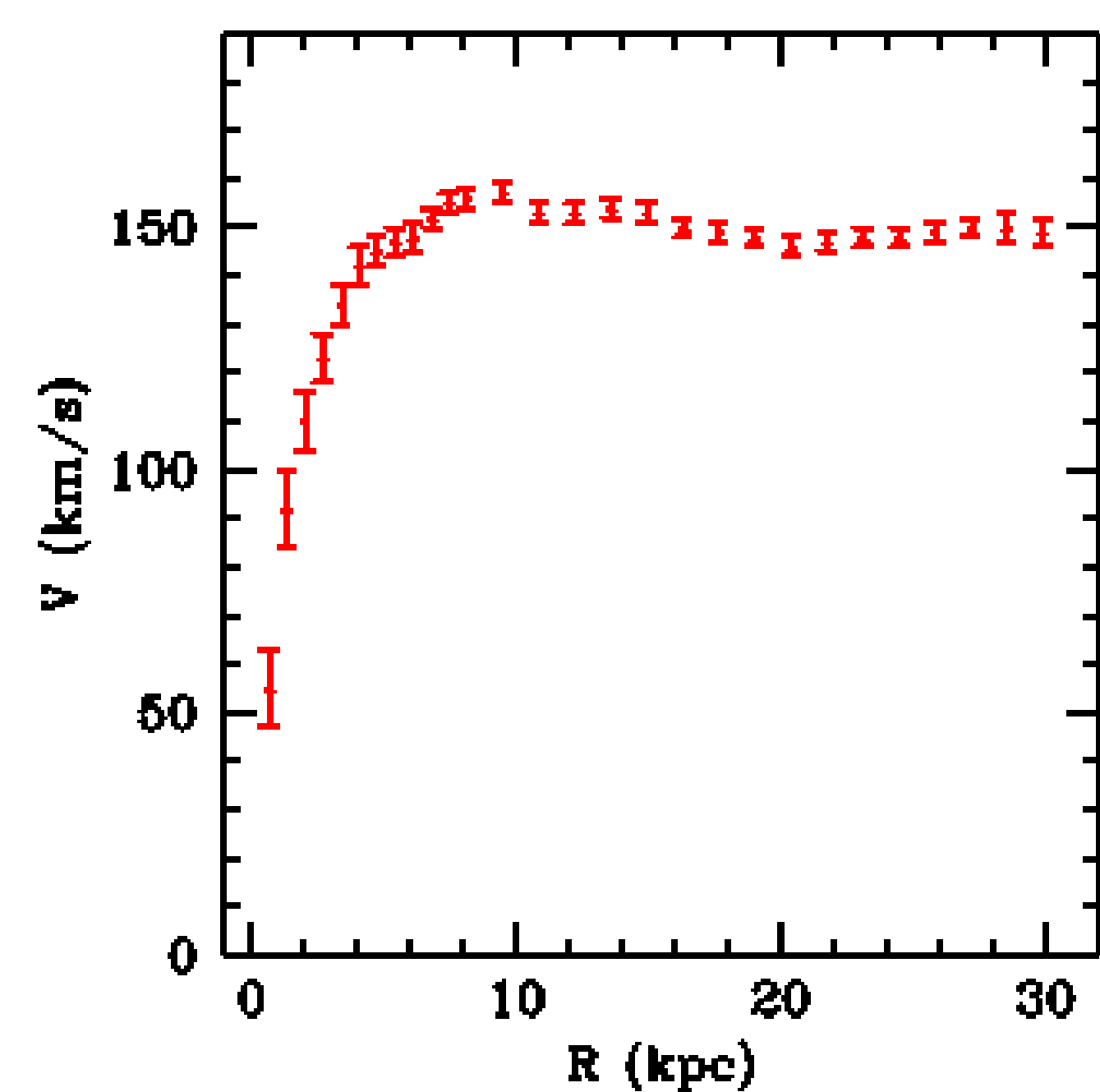
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Dark Matter

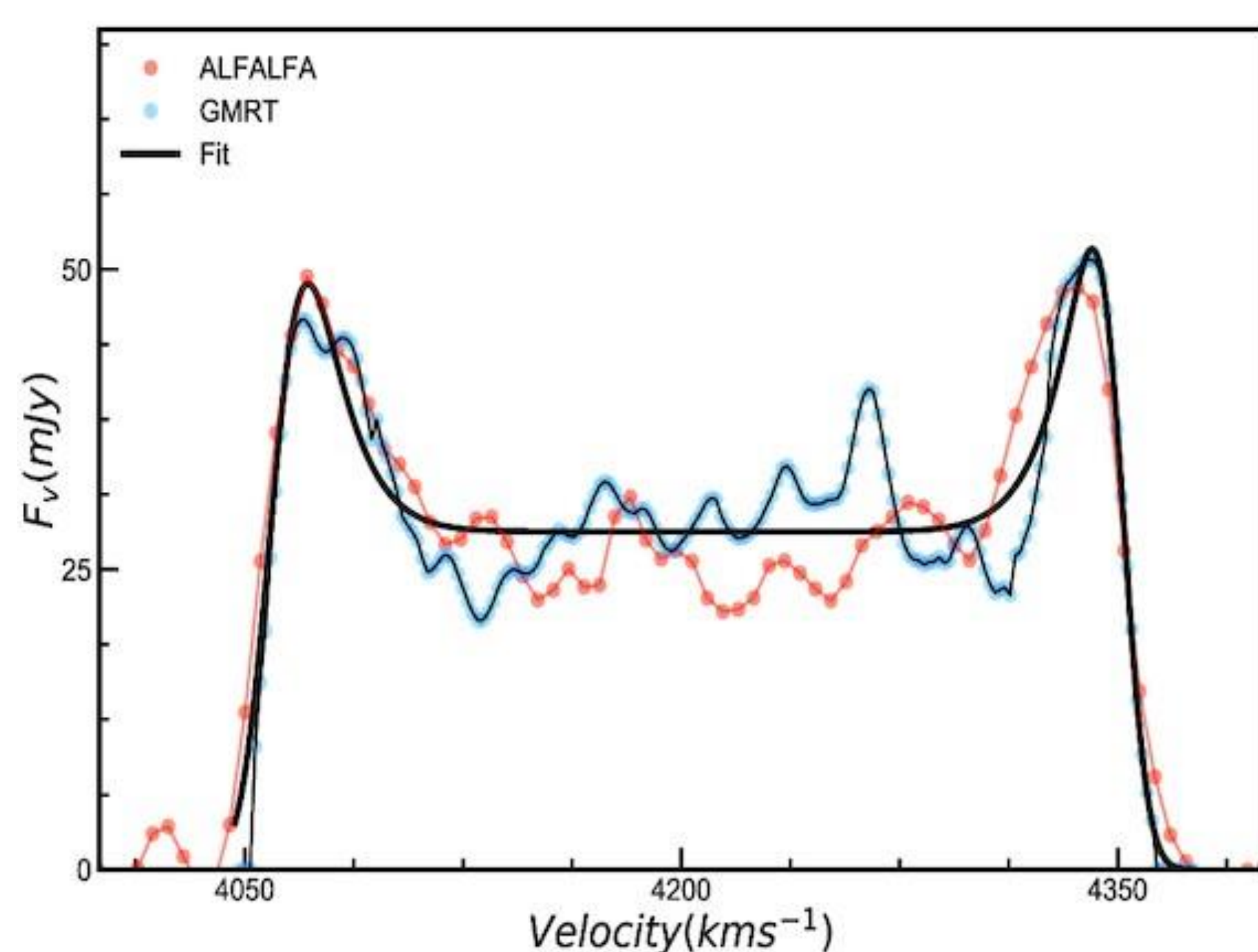
- ❑ The edge of galaxies rotate faster than Newton's Laws predict
- ❑ Result of mysterious "dark matter"



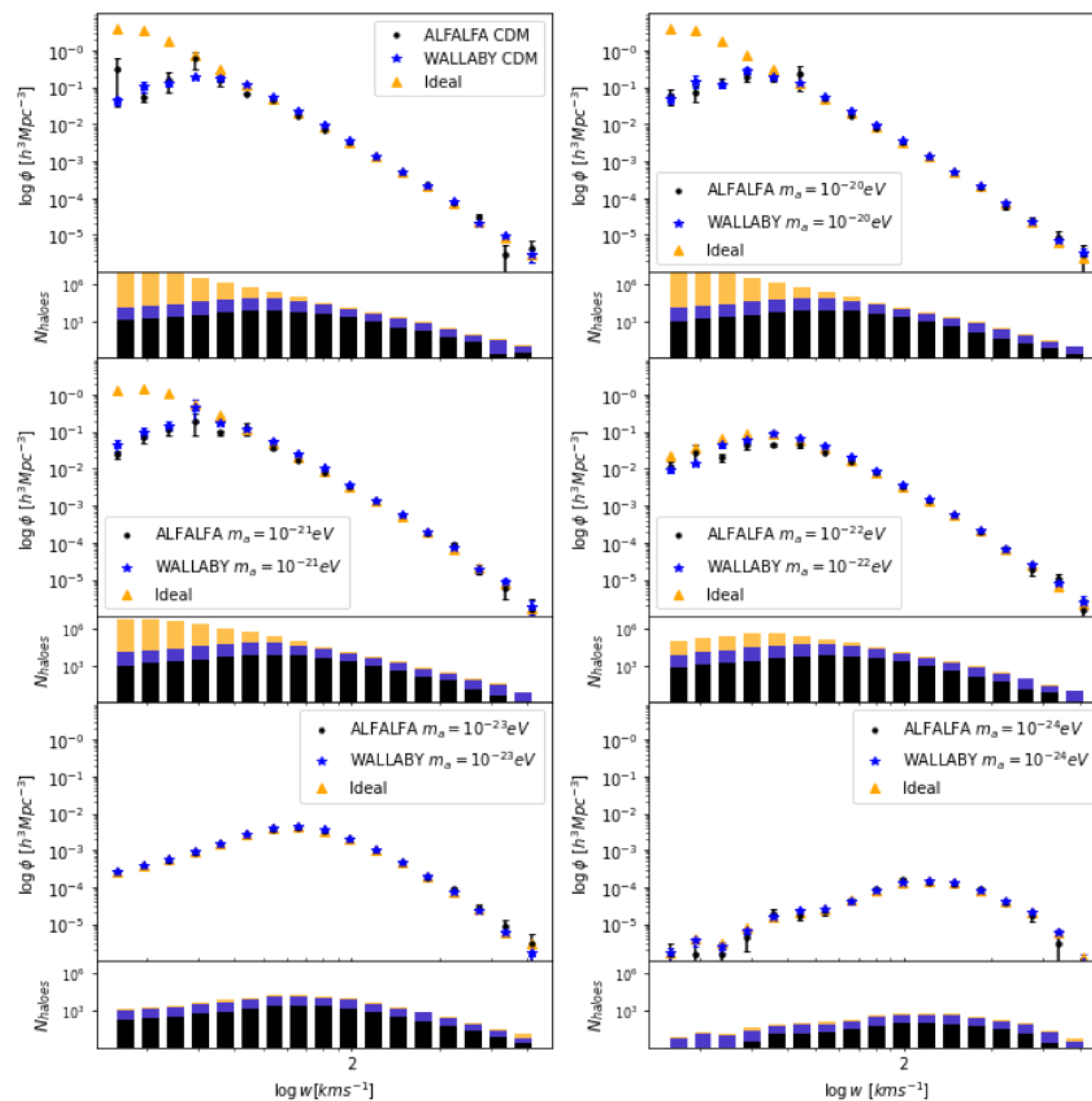
- ❑ Cold dark matter (CDM) models overpredict the number of small-scale structures

What is HI

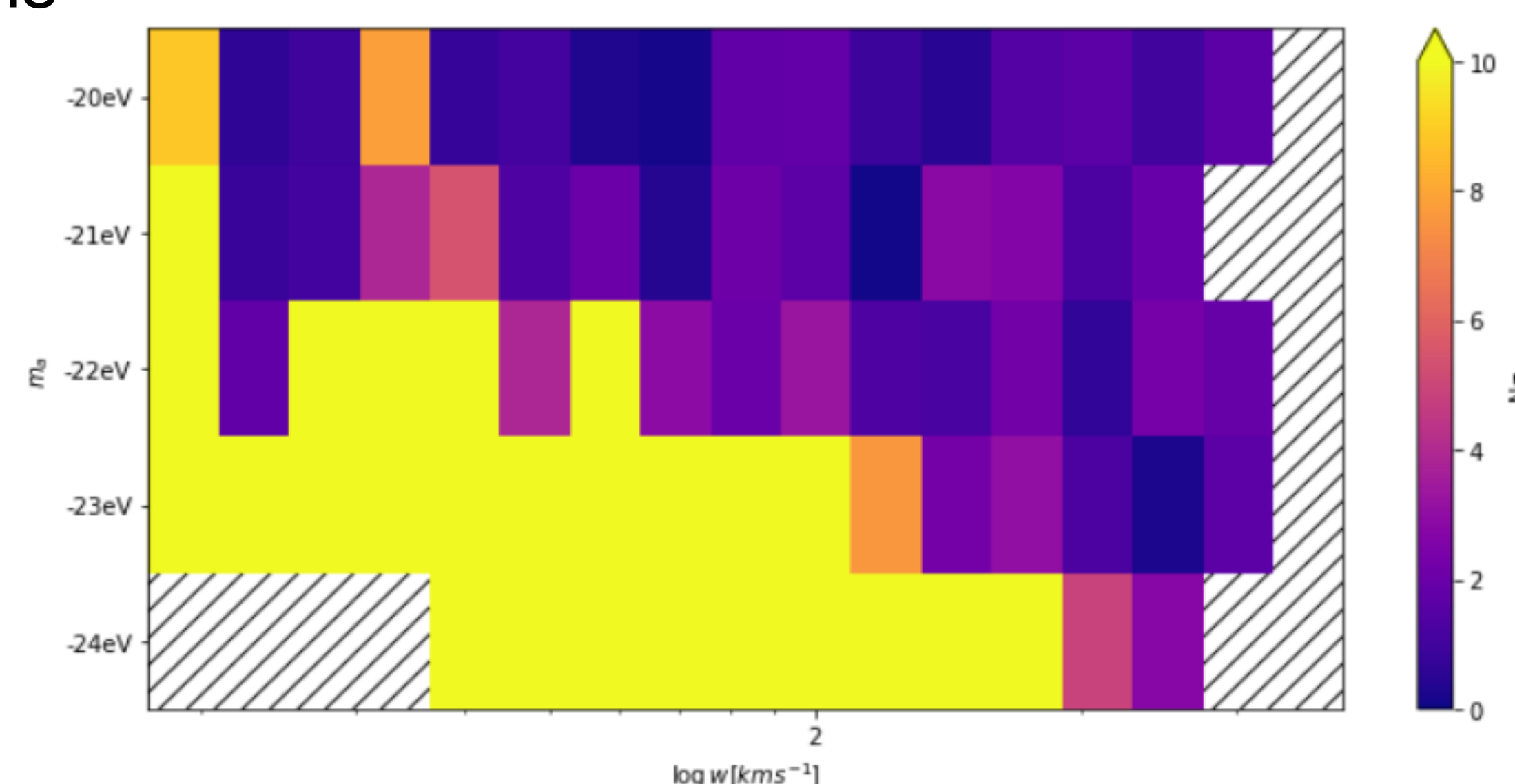
- ❑ Neutral atomic hydrogen (HI) emits light at specific wavelength (21cm) and galaxies have a lot of it
- ❑ Galactic dynamics can be inferred by observing Doppler broadened 21cm line



Results



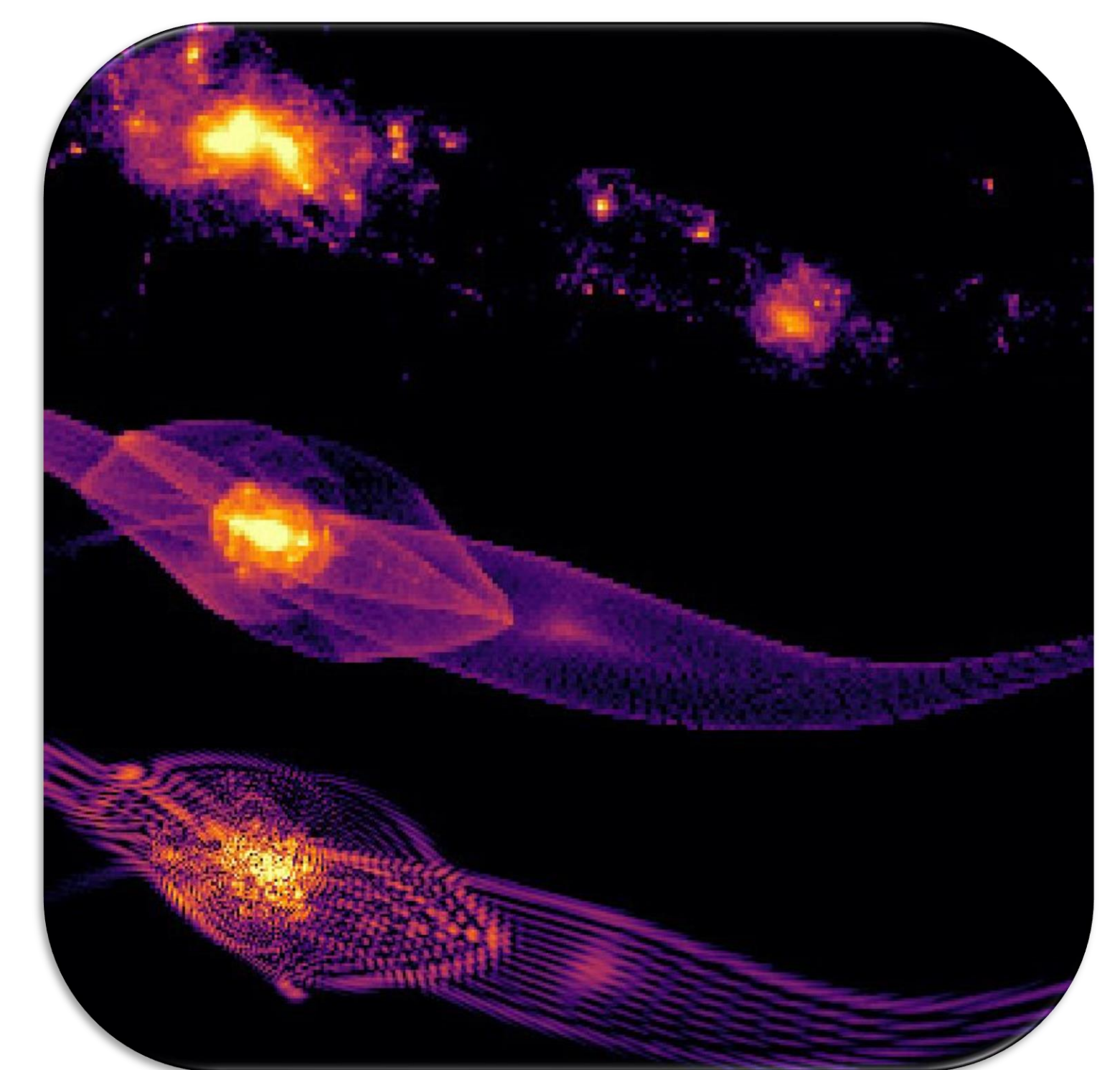
- ❑ Find that survey sensitivity limits prevented mock observations from including low width galaxies that were either not face on or extremely bright
- ❑ Led to an underweighting in volume number density for low widths



- ❑ Axion masses less than -22eV deviate considerably from CDM therefore are unlikely to be feasible candidates

Ultra-Light Axion

- ❑ Ultra-Light Axion (ULA) hypothesized particle of dark matter
- ❑ Solves overprediction by smearing out small scale structures



Simulations

- ❑ Six mock universes: one cold dark matter, five ULA dark matter, varying by axion mass
- ❑ Performed mock observations in each universe according to existing HI survey limits (ALFALFA & WALLABY)
- ❑ Constructed HI Width Functions (HIWF) that show volume number density of halos as a function of HI width