Title: Finding Halos in the Lyman-alpha forest

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Abstract: The circumgalactic medium (CGM) is the bridge between galaxies and the intergalactic medium, typically defined as the region that starts from the galactic disc and extends up to the virial radius. These regions are some of the most active in the Universe, but studying it is a challenge, particularly at the key epoch prior to Cosmic Noon ($z > 2$), where galaxy samples remain small. However, there is an abundance of Lyman-alpha forest data that contain a wealth of information about the conditions present in this medium.

Typically, studying the CGM in the Lyman-alpha forest is done through higher hydrogen column density systems, such as Damped Lyman-alpha (DLA, $N_{HI} > 10^{20}$ cm^{-2}) or Lyman Limit Systems (LLS, $N_{HI} > 10^{17}$ cm^{-2}), but these systems are rare. Furthermore, recent simulations have shown that these only represent a small part of the CGM. By analysing blends of smaller absorbers, recent studies have shown that a new class of CGM absorption should be studied: Strong Blended Lyman-alpha (SBLA) absorbers.

Using the TNG50 simulation, we explore which halo masses are revealed by SBLAs in these studies, and generalise the procedure in order to find halos with a wide range of masses. We further refine the SBLA selection by building a hierarchy where larger SBLAs consume the smaller ones. We show that we are able to transform the Lyman-alpha forest into a powerful halo finding machine, where we find approximately half of the halos between 10^9 and 10^13 solar masses. This will allows us to decompose the wealth of Lyman-alpha forest data from current (e.g DESI, PFS, WEAVE-QSO, 4MOST) and next-generation surveys (e.g DESI-II, MOSAIC, WST) into lists of halos.