Popcorn Cosmic Voids

The identification of cosmic voids was conducted using the Popcorn void finder code. [https://gitlab.com/dante.paz/popcorn_void_finder] Underdense regions, known as popcorn voids, are defined as free-form objects made of the union of spheres with maximum volume, subject to a specified joint integrated underdensity contrast. This method draws inspiration from excursion-set theory, eliminating the need for rescaling processing. The algorithm inherently removes overlapping voids and objects with sizes below the shot noise threshold (see https://ui.adsabs.harvard.edu/abs/2023MNRAS.522.2553P/abstract for details about the void finder).

For void identification, we use subhalos with $M\_tot > 3e11 M_{\odot}$. A maximum superposition of up to $4/3 \pi R_{shot}^3$ was allowed for popcorn voids. In addition to the catalog of free-form voids, a catalog of spherical voids is also included (see paper for details.).

The files are in ASCII format, and the popcorn voids file is structured as follows: The first line indicates the number of identified voids.

 Subsequently, a data block for each void is listed. Each data block has a first line containing a header[1], then a list of the sphere members [2] (one sphere per line) and finally the list of ids [3] (one per line) of the tracers used to compute the integrated density.

The iterative recording of data for each identified void follows. The data at each level includes:

[1] Void ID, number of members, void volume, number of subhalos, internal flag.
[2] x, y, z coordinates of sphere center, sphere radius, internal flag, level in the spanning sphere tree of the popcorn.

[3] ID of each subhalo (consecutive index of the subhalo list after the aforementioned mass cut).

The file of spherical voids contains:

x,y,z coordinates, sphere radius.

These catalogs are utilized in Rodriguez-Medrano et al. (2023). A detailed description of the identification process and algorithm specifics can be found in Paz et al. (2023). The use of these catalogs should credit both papers.