TAO Data Characteristics

Each simulation and galaxy model will potentially contain a vast array of properties of interest to astronomers. *TAO* groups its data for each halo–galaxy pair into the following categories:

- Baryonic masses, such as stellar mass, cold gas mass, and hot halo gas. Metals for each baryonic component are included in this category.
- Other galaxy properties, such as the star formation rate, disk scale radius, and cooling and AGN heating rates.
- Halo properties, such as virial mass, radius and velocity, the halo spin vector, and velocity dispersion.
- Co-moving positions and physical (peculiar) velocities common to both halos and galaxies. These are always given in the Cartesian coordinate system of the simulation box.
- Additional simulation properties, including the temporal snapshot number and any galaxy and halo IDs.

For those considering importing their data into *TAO*, in here we provide a summary of the minimum property requirements that *TAO* needs to operate, broken down by science module.

Light-Cone Module Requirements:

To build a mock light-cone the data must contain Cartesian coordinates for each halo–galaxy pair from the original simulation box; these are then converted to angular coordinates and redshifts. Furthermore, conversion to redshift space requires Cartesian velocities (i.e. proper motion of the galaxies).

SED Module Requirements:

TAO must be able to walk each halo merger tree from any point in its history. Hence, for each object we require pointers that identify both the previous time-step progenitor and that link the sequence of subhalos in a FoF halo at a given time-step in order of decreasing mass. We currently adopt the SUBFIND system of pointers, assuming they are stored in depth-first order for each merger tree, as illustrated by Figure 11 of the Supplemental Material in Springel et al. (2005). Furthermore, to calculate magnitudes the SED module must be able to extract star formation and metallicity histories for each galaxy. Also, the initial mass function (IMF) assumed when calibrating the model is required (e.g., this typically constrains the recycling fraction of mass returned to the interstellar medium from stellar winds).

Mock Image Module Requirements:

The image module requires some measure of morphology to correctly construct the right shape for each galaxy before rendering. This may take the form of seperate disk and bulge stellar masses, for example.