Galaxy formation with L-GALAXIES: Catalogue Description

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In this supplementary material, we describe the full catalogues of galaxy merger trees that are produced by the Ayromlou et al. 2021 version of the L-Galaxies semi-analytical model. A full description of the galaxy formation model used to produce these catalogues can be found here. In addition, the main paper describing this model is given here. Please address your questions about this model/catalogue to Reza Ayromlou (ayromlou@mpa-garching.mpg.de)

Table 1: Main Properties of Galaxies

Quantity [unit]	Shape	Description
Type	N	Indicates whether the galaxy is a "central" (at the center of its FOF group, type=0), a "satellite" (within its own subhalo but not at the center of its FOF group, type=1), or an "orphan" (a satellite that has lost its subhalo, type=2)
HaloIndex	N	The unique identifier of the subhalo
SnapNum	N	The snapshot number where this galaxy was identified
LookBackTimeToSnap [year]	N	The look back time (in years) from $z = 0$ to the redshift of the galaxy
Central_M_Crit200 [$10^{10}\mathrm{M}_\odot$/h]	N	The virial mass ($M_{200,\mathrm{crit}}$) of the FOF group the galaxy resides in
Central_R_Crit200 [Mpc/h]	N	The virial radius ($R_{200,\mathrm{crit}}$) of the FOF group the galaxy resides in
Pos [cMpc/h]	N,3	The galaxy's position in comoving coordinates
Vel [km/s]	N,3	The galaxy's velocity
SuhaloLen	N	Number of particles associated with the subhalo hosting this galaxy
M_Crit200 [$10^{10}\mathrm{M}_\odot$/h]	N	Virial mass ($M_{200,\mathrm{crit}}$) of the subhalo this galaxy was in when it was last a type 0 galaxy. I.e. current virial mass for type 0 galaxies, "infall virial mass" for type 1,2 galaxies
R_Crit200 [Mpc/h]	N	Virial radius ($R_{200,\mathrm{crit}}$) of the subhalo this galaxy was in when it was last a type 0 galaxy. I.e. current virial radius for type 0 galaxies, "infall virial radius" for type 1,2 galaxies
Vvir [km/s]	N	Virial velocity of the subhalo this galaxy was in when it was last a type 0 galaxy. I.e. current virial velocity for type 0 galaxies, "infall virial velocity" for type 1,2 galaxies
Vmax [km/s]	N	Maximum rotational velocity of the subhalo of this galaxy. This property continues to be updated even after the galaxy becomes a type 1
HaloSpin [(Mpc/h)(km/s)]	N,3	the spin of the cold gas disk

InfallVmax [km/s]	N	Maximum rotational velocity of the subhalo of this galaxy. This property continues to be updated even after the galaxy becomes a type 1
InfallVmaxPeak [km/s]	N	Maximum past rotational velocity of the subhalo of this galaxy
InfallSnap	N	Most recent (largest) snapnum at which this galaxy's type changed from 0 to 1 or 2
InfallHotGasMass [$10^{10}M_{\odot}/h$]	N	Mass in hot gas at the time of infall (same as hotGas for type 0 galaxies)
HotGasRadius [Mpc/h]	N	Radius out to which hot gas extends: Rvir for type 0; 0 for type 2; maximum radius out to which hot gas is not stripped for type 1.
OriMergTime [year]	N	Estimated dynamical friction time (in years) when the merger clock was set. Only calculated for type 2 galaxies.
MergTime [year]	N	Estimated remaining merging time (in years). OriMergeTime - time since the merger clock is set. Only calculated for type 2 galaxies
ColdGasMass [$10^{10}M_{\odot}/h$]	N	Mass in the cold gas disk
H2fraction	N	Fraction of cold gas mass that is in H2
StellarMass [$10^{10}M_{\odot}/h$]	N	Total mass in stars in the disk and the bulge together
StellarDiskMass [$10^{10}M_{\odot}/h$]	N	Mass of stars in the disk
StellarBulgeMass [$10^{10}M_{\odot}/h$]	N	Mass of stars in the bulge
HotGasMass [$10^{10}M_{\odot}/h$]	N	Mass in hot gas
EjectedMass [$10^{10}M_{\odot}/h$]	N	Mass in the ejected gas component
BlackHoleMass [$10^{10}M_{\odot}/h$]	N	Mass of the central black hole
HaloStellarMass [$10^{10}M_{\odot}/h$]	N	Mass in intra-cluster stars
PrimordialAccretionRate [$M_{\odot}/yr$]	N	Accretion rate of primordial gas
CoolingRadius [Mpc/h]	N	The radius within which the cooling time scale is shorter than the dynamical timescale
CoolingRate [$M_{\odot}/yr$]	N	Cooling rate
CoolingRate_beforeAGN [$M_{\odot}/yr$]	N	Cooling rate if there was no AGN feedback
QuasarAccretionRate [$M_{\odot}/yr$]	N	Rate at which cold gas is accreted into the central black hole in the quasar mode.
RadioAccretionRate [$M_{\odot}/yr$]	N	Rate at which hot gas is accreted into the central black hole in the radio mode
StarFormationRate [$M_{\odot}/yr$]	N	Star formation rate
StarFormationRateBulge [$M_{\odot}/yr$]	N	Star formation rate in bulge
XrayLum [$\log_{10}$(erg/sec)]	N	Log10 of X-Ray luminosity in erg/sec
BulgeSize [Mpc/h]	N	Half mass radius of bulge

StellarDiskRadius [Mpc/h]	N	Size of the stellar disk, 3x the scale length
GasDiskRadius [Mpc/h]	N	Size of the cold gas disk
StellarHalfMassRadius [Mpc/h]	N	Half-mass radius of the stellar disk
StellarHalfLightRadius [Mpc/h]	N	Stellar half light radius
CosInclination [deg]	N	Inclination of the galaxy. Derived from the angle between the total and z-axis stellar spins of the galaxy
DisruptOn	N	0: galaxy merged onto merger center; 1: galaxy was disrupted before merging onto its descendant, matter went into ICM of merger center
MergeOn	N	0: merger clock not set yet; 1: type 1 galaxy with baryon mass ¿ halo mass, separate dynamical friction time calculated; 2: this galaxy is type 2 and will merge into the merger center in the next snapshot; 3: this galaxy is type 1 and will merge into the central galaxy of the main halo in the next snapshot
MagDust	N,20	Rest-frame absolute magnitude of the galaxy (dust extinction included). Description of the columns is given below
Mag	N,20	Rest-frame absolute magnitude of the galaxy. Description of the columns is given below
MagBulge	N,20	Rest-frame absolute magnitude of the galaxy's bulge. Description of the columns is given below
MassWeightAge [10^9 yr]	N	The age of this galaxy, weighted by mass of its components
rBandWeightAge [10^9 yr]	N	The age of this galaxy, weighted by it's uncorrected r-band magnitude
rho_LBE_Gas [10^{10}M$_\odot$h^2/Mpc^3]	N	Local background environment density of gas
rho_LBE_Total [10^{10}M$_\odot$h^2/Mpc^3]	N	Local background environment density
Vel_LBE [km/s]	N	Local background environment velocity

Table 2: Additional Properties of Galaxies

Quantity [unit]	Shape	Description
ColdGasMassRings [10^{10}M$_\odot$/h]	N,12	The unique identifier of each ring in a galaxy. Runs from 0 to 11, where ring 0 is the innermost ring
H2fractionRings	N,12	Fraction of cold gas mass in each ring that is in H2
StellarDiskMassRings [10^{10}M$_\odot$/h]	N,12	Mass of stars in each ring of the disk
StellarBulgeMassRings [10^{10}M$_\odot$/h]	N,12	Mass of stars in each ring of the bulge
StellarMassFromInSitu [10^{10}M$_\odot$/h]	N	Stellar mass formed in-situ in the galaxy, rather than accreted or formed in merger-induced starbursts. I.e. total mass of stars formed secularly in progenitors along this galaxy's main progenitor branch.

StellarMassFromMergers [$10^{10}M_\odot/h$]	N	Stellar mass accreted onto the galaxy in mergers, rather than formed in-situ or via merger-induced starbursts. I.e. total mass of stars formed in progenitors not along this galaxy's main progenitor branch
StellarMassFromBursts [$10^{10}M_\odot/h$]	N	Mass formed in merger-induced starbursts in the galaxy, rather than accreted in mergers of formed secularly.
MetalsColdGasMass [$10^{10}M_\odot/h$]	N,3	Mass in metals in the cold gas disk
MetalsColdGasMassRings [$10^{10}M_\odot/h$]	N,12,3	Mass of metals in each ring of the cold gas disk
MetalsStellarMass [$10^{10}M_\odot/h$]	N,3	Mass in metals in stars in the disk and the bulge together
MetalsStellarDiskMass [$10^{10}M_\odot/h$]	N,3	Mass in metals in stars in the disk
MetalsStellarBulgeMass [$10^{10}M_\odot/h$]	N,3	Mass in metals in stars in the bulge
MetalsStellarDiskMassRings [$10^{10}M_\odot/h$]	N,12,3	Mass of metals in each ring of the stellar disk
MetalsStellarBulgeMassRings [$10^{10}M_\odot/h$]	N,12,3	Mass of metals in each ring of the stellar bulge
MetalsHotGasMass [$10^{10}M_\odot/h$]	N,3	Mass in metals in the hot gas
MetalsEjectedMass [$10^{10}M_\odot/h$]	N,3	Mass of metals in the ejected mass component
MetalsHaloStellarMass [$10^{10}M_\odot/h$]	N,3	Mass of metals in halo stars
StarFormationRateRings [$M_\odot/yr$]	N,12	Average star formation rate across the snapshot in each ring
DiskMass_elements [$M_\odot$]	N,11	Mass of elements in the stellar disk
BulgeMass_elements [$M_\odot$]	N,11	Mass of elements in the stellar bulge
DiskMassRings_elements [$M_\odot$]	N,12,11	Mass of elements in each ring of the stellar disk
BulgeMassRings_elements [$M_\odot$]	N,12,11	Mass of elements in each ring of the stellar bulge
ColdGas_elements [$M_\odot$]	N,11	Mass of elements in the cold gas disk
ColdGasRings_elements [$M_\odot$]	N,12,11	Mass of elements in each ring of the cold gas disk
HotGas_elements [$M_\odot$]	N,11	Mass of elements in the hot gas
ICM_elements [$M_\odot$]	N,11	Mass of elements in halo stars
EjectedMass_elements [$M_\odot$]	N,11	Mass of elements in the ejected mass component

* For each **"element"** dataset, eleven elements are included: H, He, C, N, O, Ne, Mg, Si, S, Ca, Fe
* For each **"ring"** dataset, the outer ring radius in kpc is given by the following list:
$[0.029, 0.059, 0.12, 0.24, 0.47, 0.94, 1.9, 3.8, 7.5, 15, 30, 60]$

Table 3: Magnitudes

For each of the three Mag* datasets, all magnitudes are rest-frame, absolute (AB). The twenty entries correspond to (in order):

Entry	Band
0	Rest-frame absolute (AB) magnitude in the Johnson-Bessel U filter ($\lambda = 0.36\mu$m) of the galaxy
1	Rest-frame absolute (AB) magnitude in the Johnson-Bessel B filter ($\lambda = 0.435\mu$m) of the galaxy
2	Rest-frame absolute (AB) magnitude in the Johnson-Bessel V filter ($\lambda = 0.55\mu$m) of the galaxy
3	Rest-frame absolute (AB) magnitude in the Cousins Rc filter ($\lambda = 0.64\mu$m) of the galaxy
4	Rest-frame absolute (AB) magnitude in the Cousins Ic filter ($\lambda = 0.79\mu$m) of the galaxy
5	Rest-frame absolute (AB) magnitude in the VISTA Z filter ($\lambda = 0.88\mu$m) of the galaxy
6	Rest-frame absolute (AB) magnitude in the VISTA Y filter ($\lambda = 1.02\mu$m) of the galaxy
7	Rest-frame absolute (AB) magnitude in the VISTA/2MASS J filter ($\lambda = 1.26\mu$m) of the galaxy
8	Rest-frame absolute (AB) magnitude in the VISTA/2MASS H filter ($\lambda = 1.60\mu$m) of the galaxy
9	Rest-frame absolute (AB) magnitude in the Johnson-Bessel K ($\lambda = 2.22\mu$m) filter of the galaxy
10	Rest-frame absolute (AB) magnitude in the VISTA/2MASS Ks ($\lambda = 2.16\mu$m) filter of the galaxy
11	Rest-frame absolute (AB) magnitude in the IRAC 3.6um filter of the galaxy
12	Rest-frame absolute (AB) magnitude in the IRAC 4.5um filter of the galaxy
13	Rest-frame absolute (AB) magnitude in the IRAC 5.8um filter of the galaxy
14	Rest-frame absolute (AB) magnitude in the IRAC 8.0um filter of the galaxy
15	Rest-frame absolute (AB) magnitude in the SDSS u filter ($\lambda = 0.355\mu$m) of the galaxy
16	Rest-frame absolute (AB) magnitude in the SDSS g filter ($\lambda = 0.469\mu$m) of the galaxy
17	Rest-frame absolute (AB) magnitude in the SDSS r filter ($\lambda = 0.617\mu$m) of the galaxy
18	Rest-frame absolute (AB) magnitude in the SDSS i filter ($\lambda = 0.748\mu$m) of the galaxy
19	Rest-frame absolute (AB) magnitude in the SDSS z filter ($\lambda = 0.893\mu$m) of the galaxy