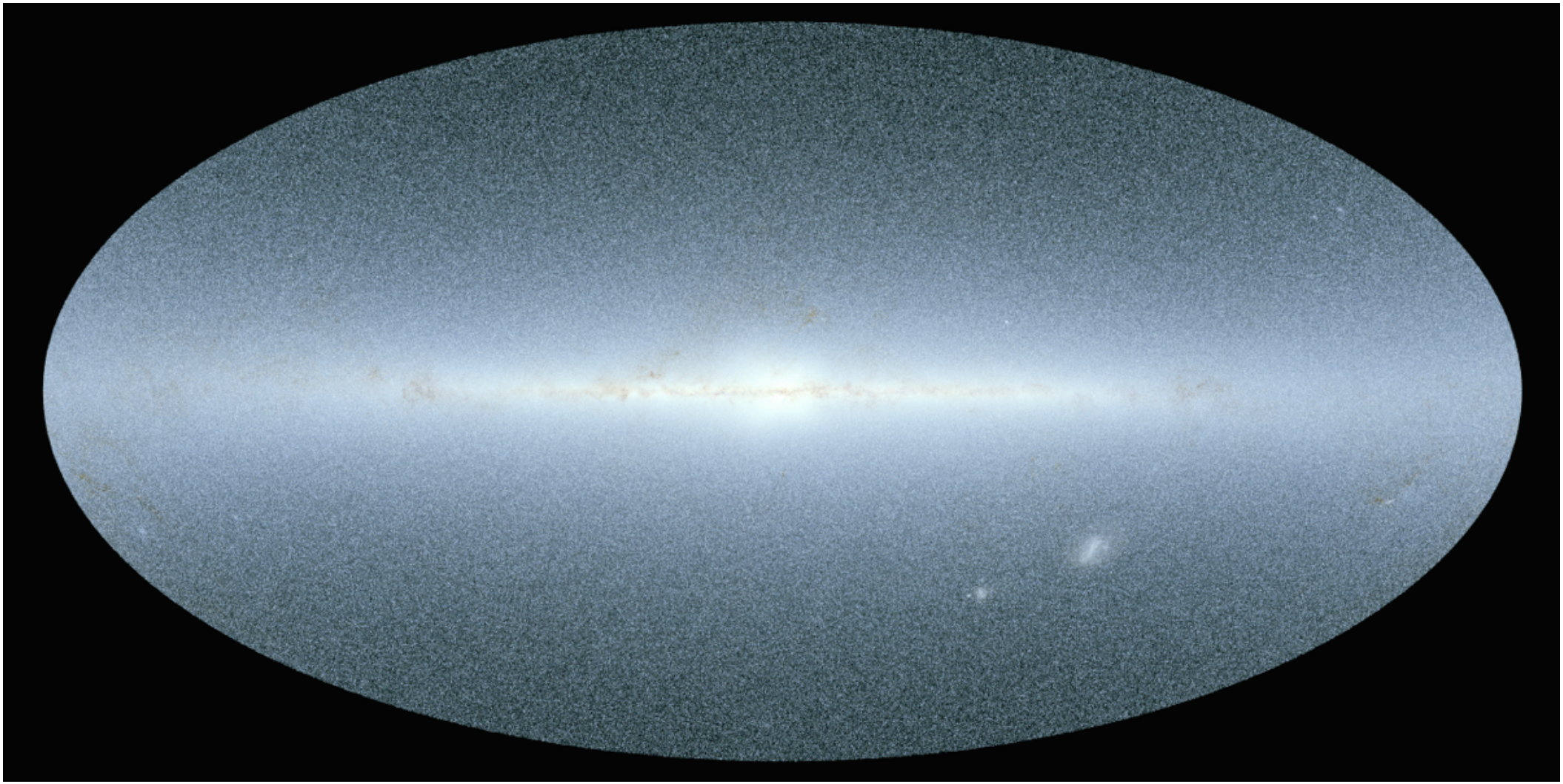
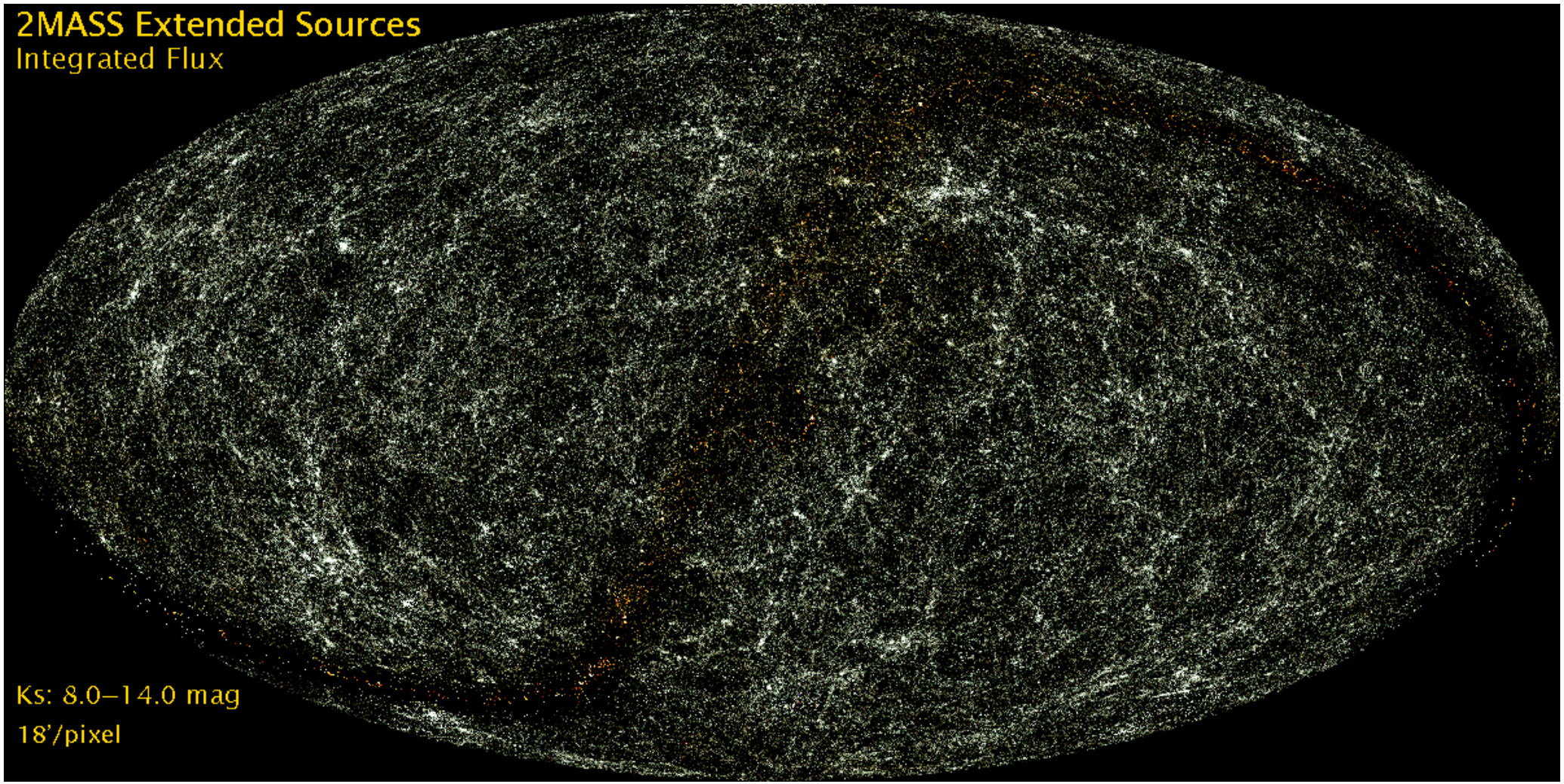
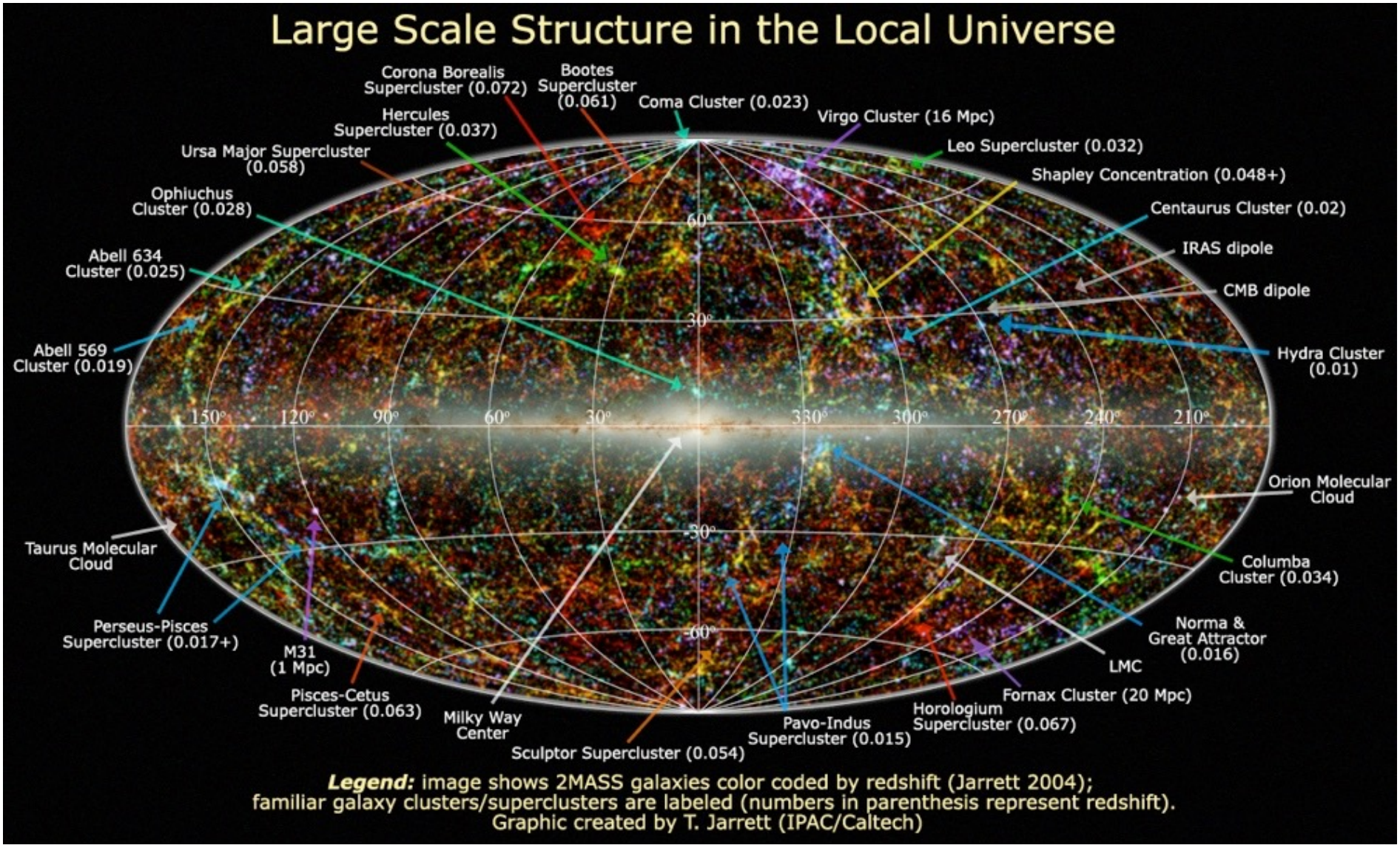
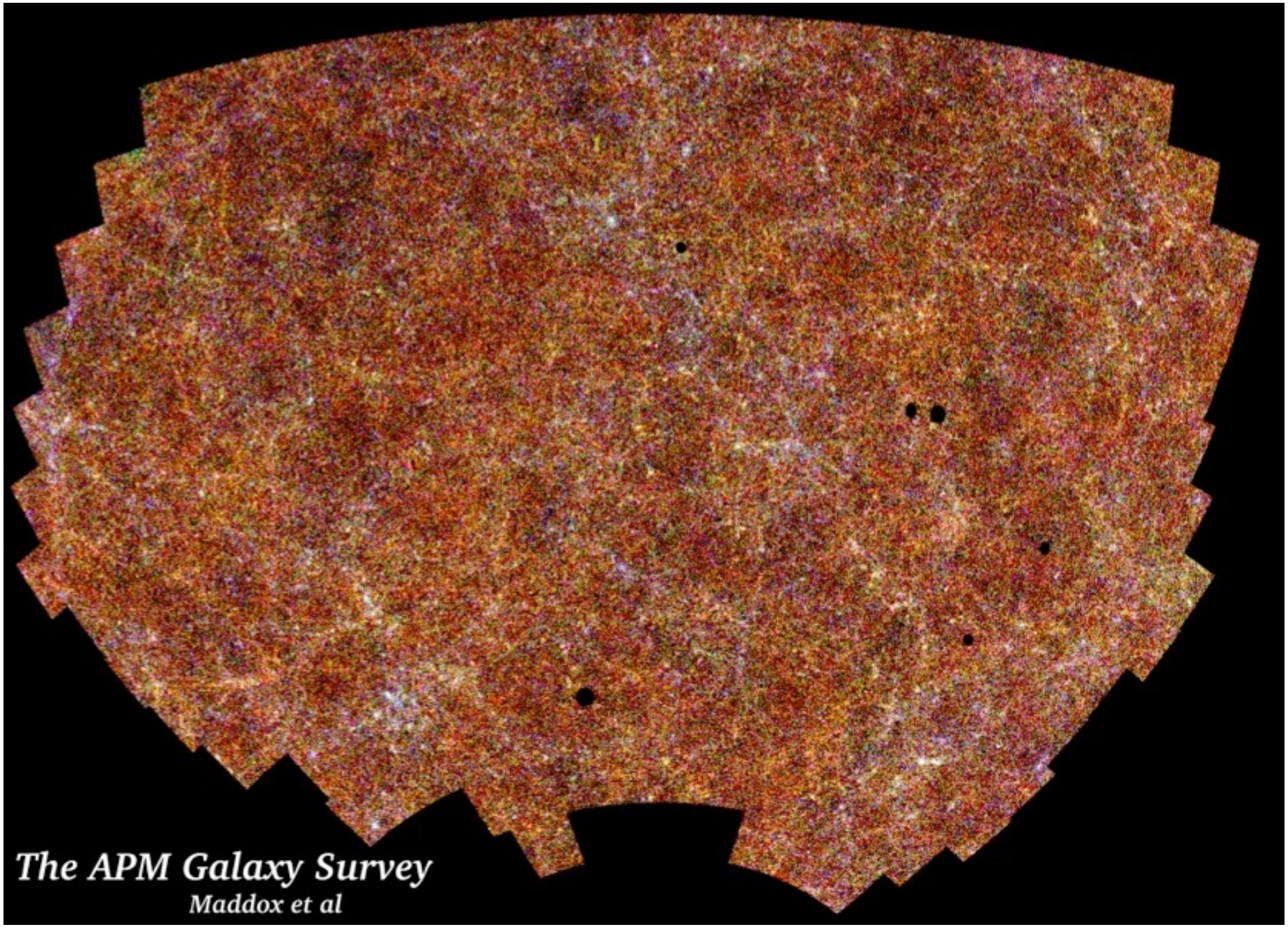
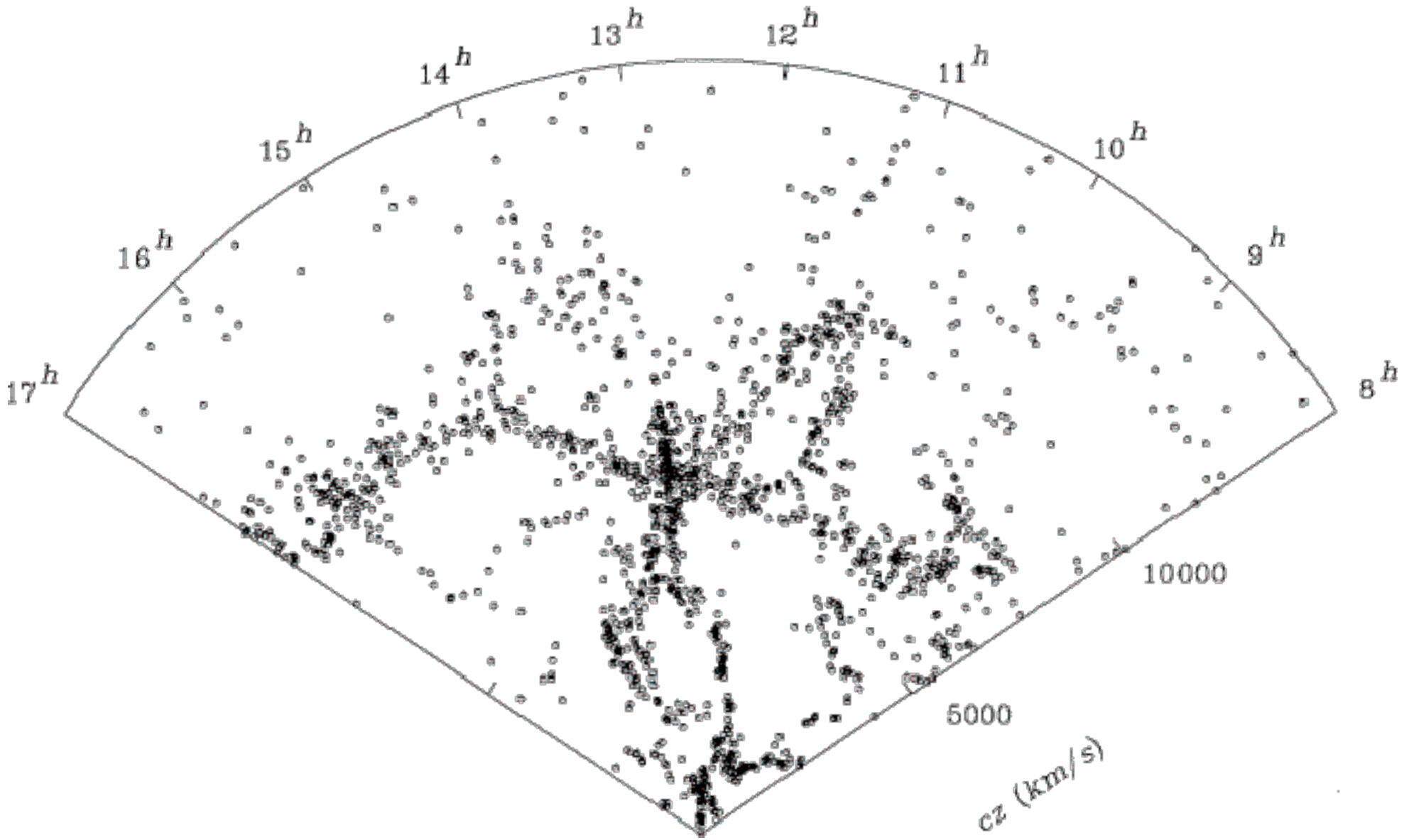
6. Large-scale structure

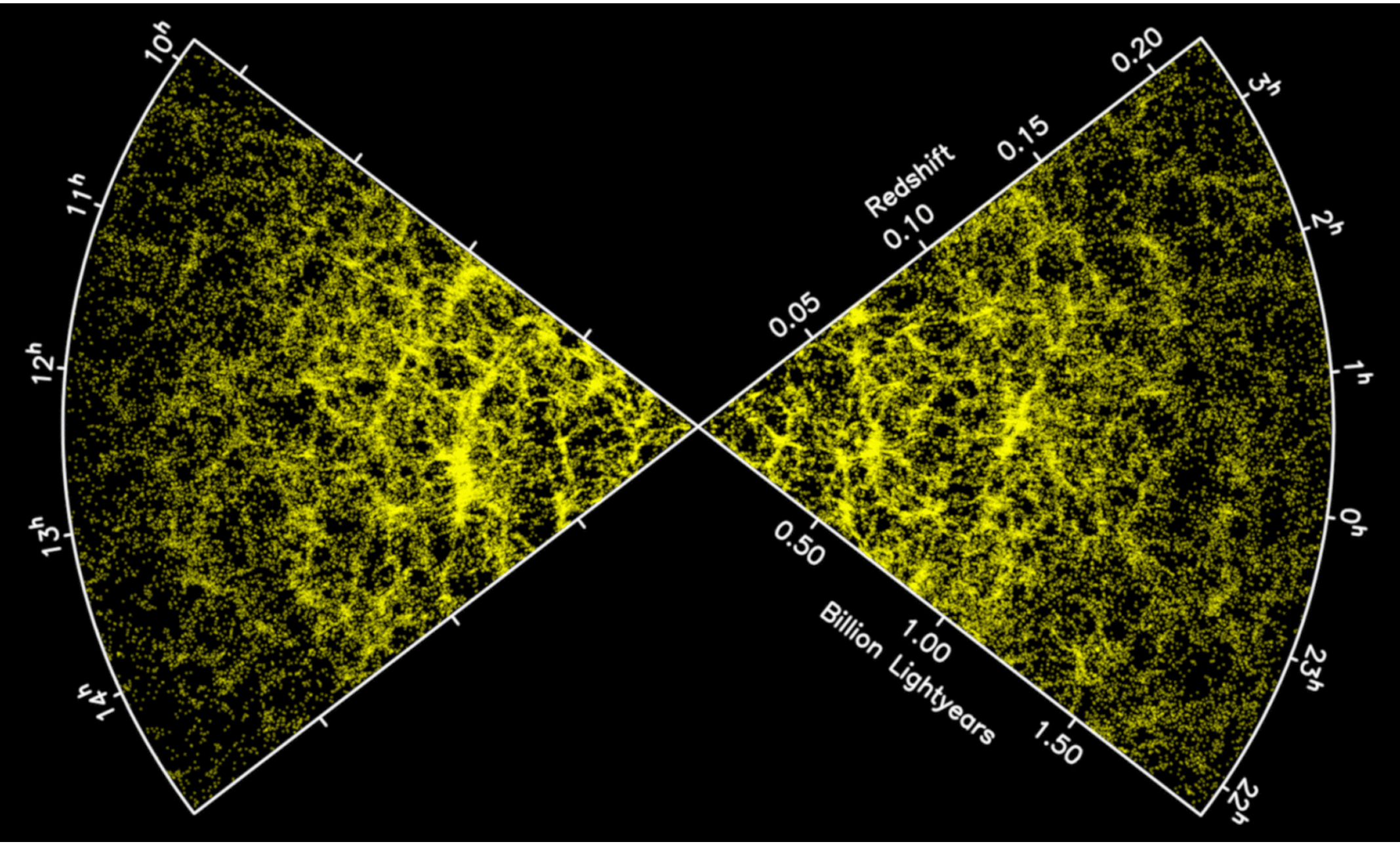


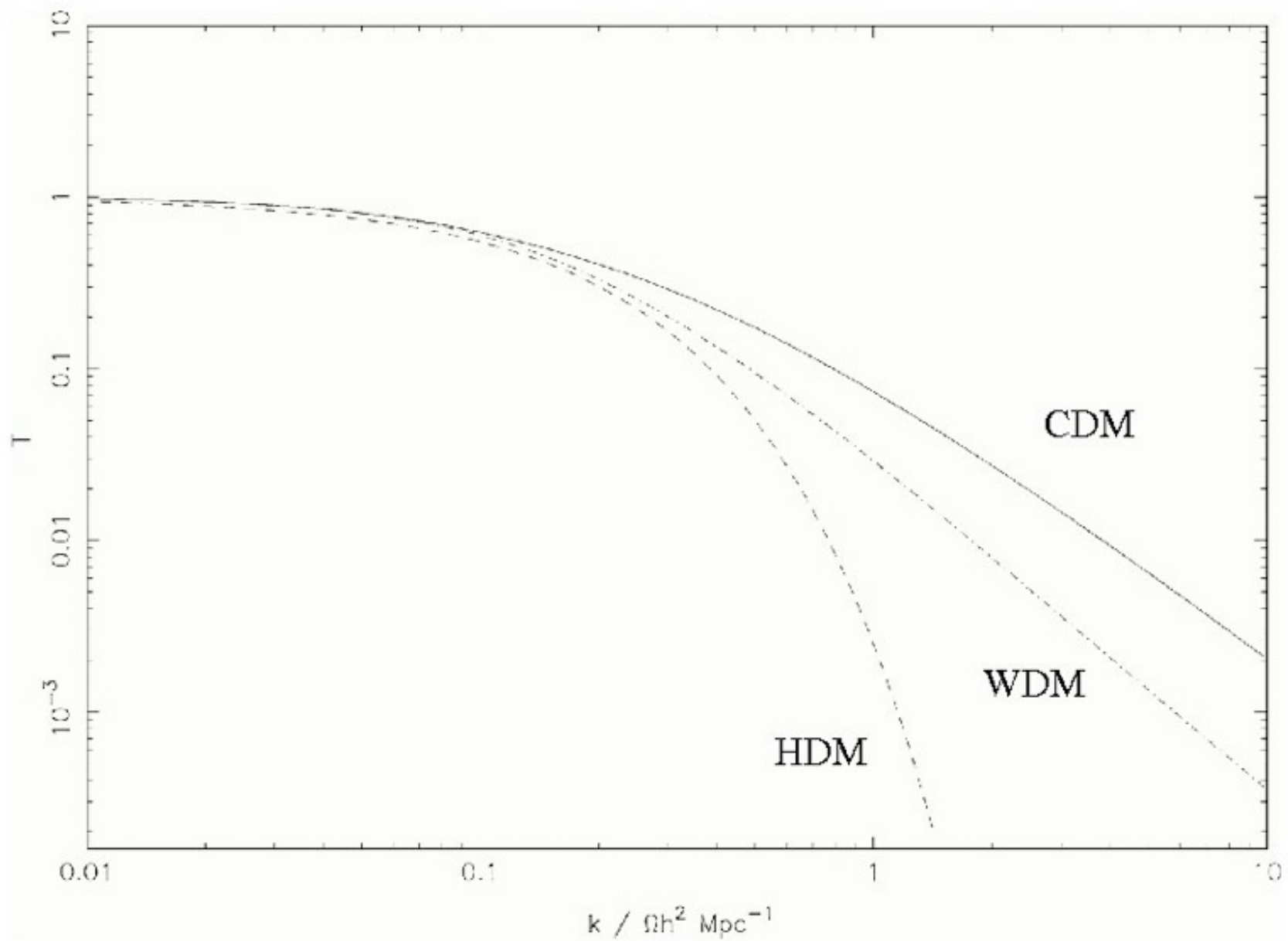

2MASS Extended Sources
Integrated Flux
Ks: 8.0–14.0 mag
18'/pixel

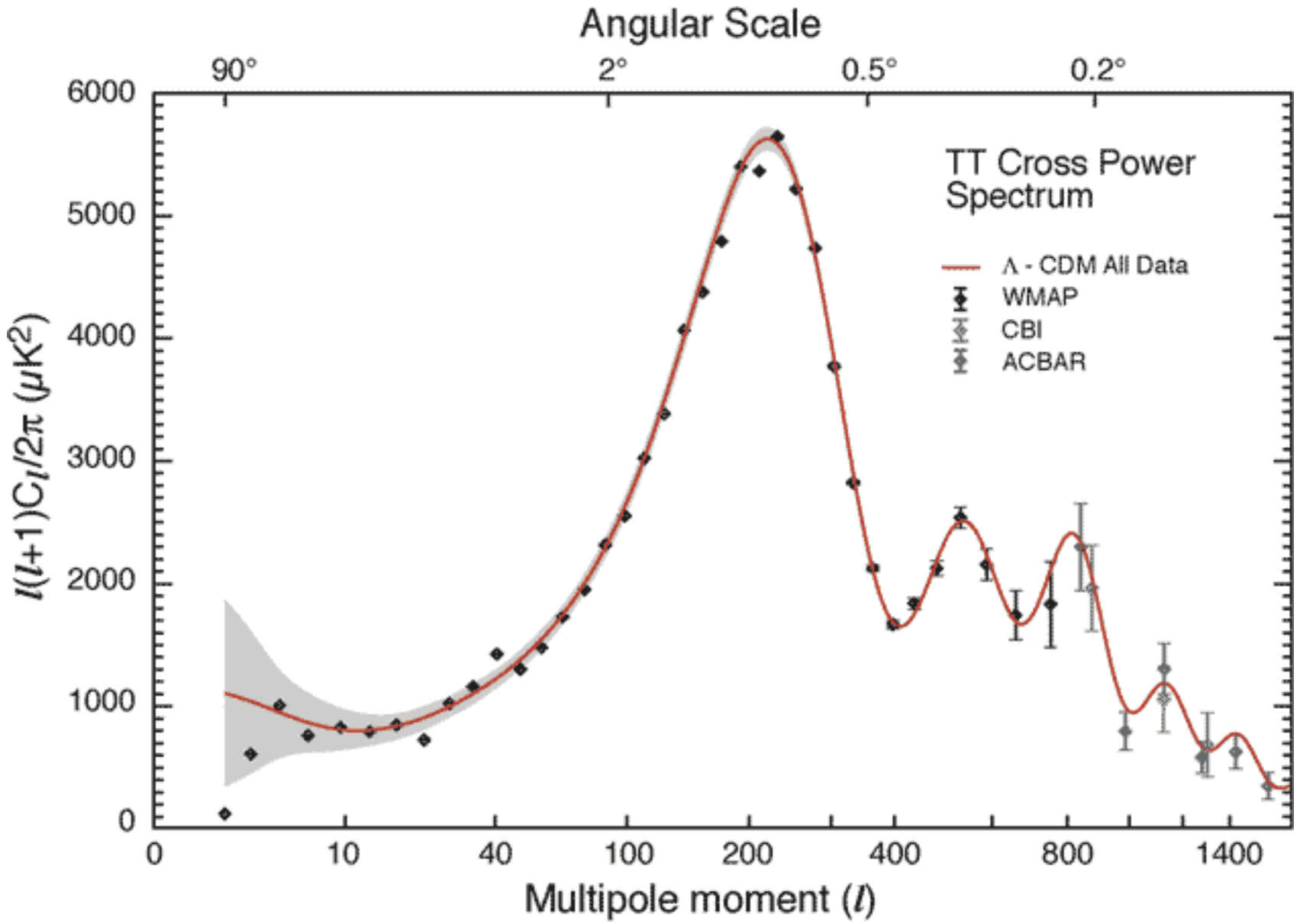

Large Scale Structure in the Local Universe
Corona Borealis Supercluster (0.072)
Bootes Supercluster (0.061)
Coma Cluster (0.023)
Virgo Cluster (16 Mpc)
Hercules Supercluster (0.037)
Ursa Major Supercluster (0.058)
Leo Supercluster (0.032)
Shapley Concentration (0.048+)
Ophiuchus Cluster (0.028)
Centaurus Cluster (0.02)
Abell 634 Cluster (0.025)
IRAS dipole
CMB dipole
Abell 569 Cluster (0.019)
Hydra Cluster (0.01)
60°
30°
150°
120°
90°
60°
30°
330°
300°
270°
240°
210°
-30°
-60°
Orion Molecular Cloud
Taurus Molecular Cloud
Columba Cluster (0.034)
Perseus-Pisces Supercluster (0.017+)
Norma & Great Attractor (0.016)
M31 (1 Mpc)
LMC
Pisces-Cetus Supercluster (0.063)
Fornax Cluster (20 Mpc)
Milky Way Center
Horologium Supercluster (0.067)
Pavo-Indus Supercluster (0.015)
Sculptor Supercluster (0.054)
Legend: image shows 2MASS galaxies color coded by redshift (Jarrett 2004);
familiar galaxy clusters/superclusters are labeled (numbers in parenthesis represent redshift).
Graphic created by T. Jarrett (IPAC/Caltech)

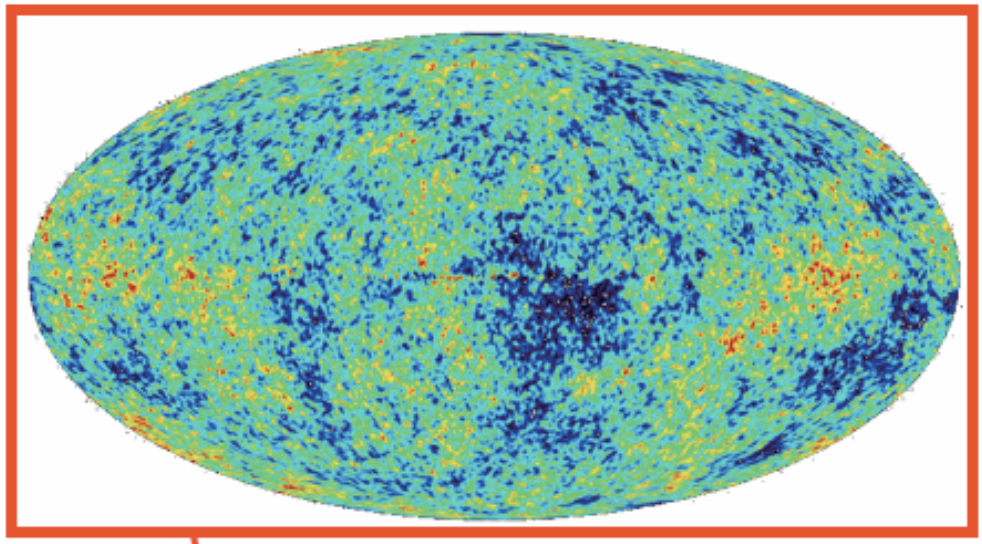

The APM Galaxy Survey
Maddox et al

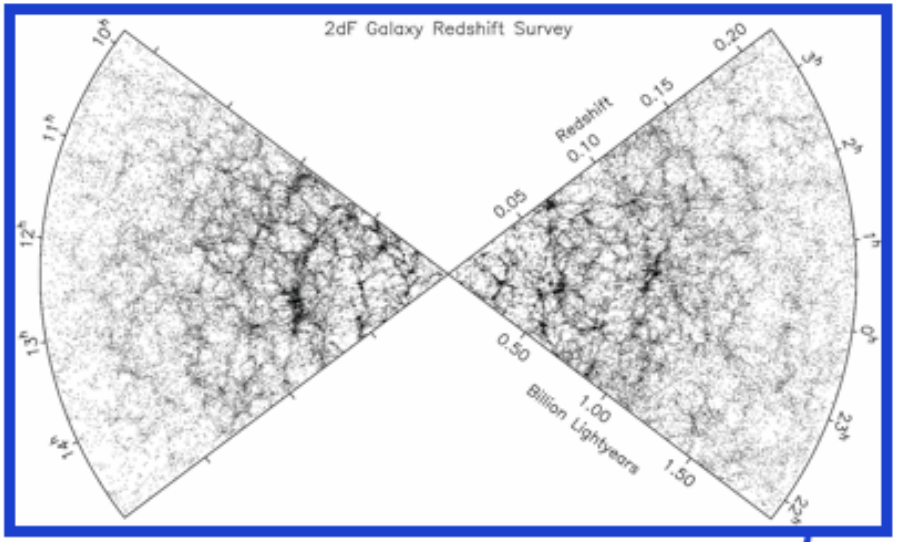

13h
12h
14h
11h
15h
10h
16h
9h
17h
8h
10000
5000
cz (km/s)


10h
11h
12h
13h
14h
Redshift
0.05
0.10
0.15
0.20
3h
2h
1h
0h
23h
22h
0.50
1.00
1.50
Billion Lightyears


10
1
0.1
0.01
10^{-3}
T
CDM
WDM
HDM
0.01
0.1
1
10
k / Ωh^2 Mpc^{-1}


Angular Scale
90°
2°
0.5°
0.2°
6000
5000
4000
3000
2000
1000
0
$l(l+1)C_l/2\pi$ (μK^2)
TT Cross Power Spectrum
Λ - CDM All Data
WMAP
CBI
ACBAR
0
10
40
100
200
400
800
1400
Multipole moment (l)





Roughness $P(k)$

$P(k) \propto k$

Peak

$\lambda \approx 200$ Mly

wiggles

$P(k) \propto 1/k^2$

Long waves

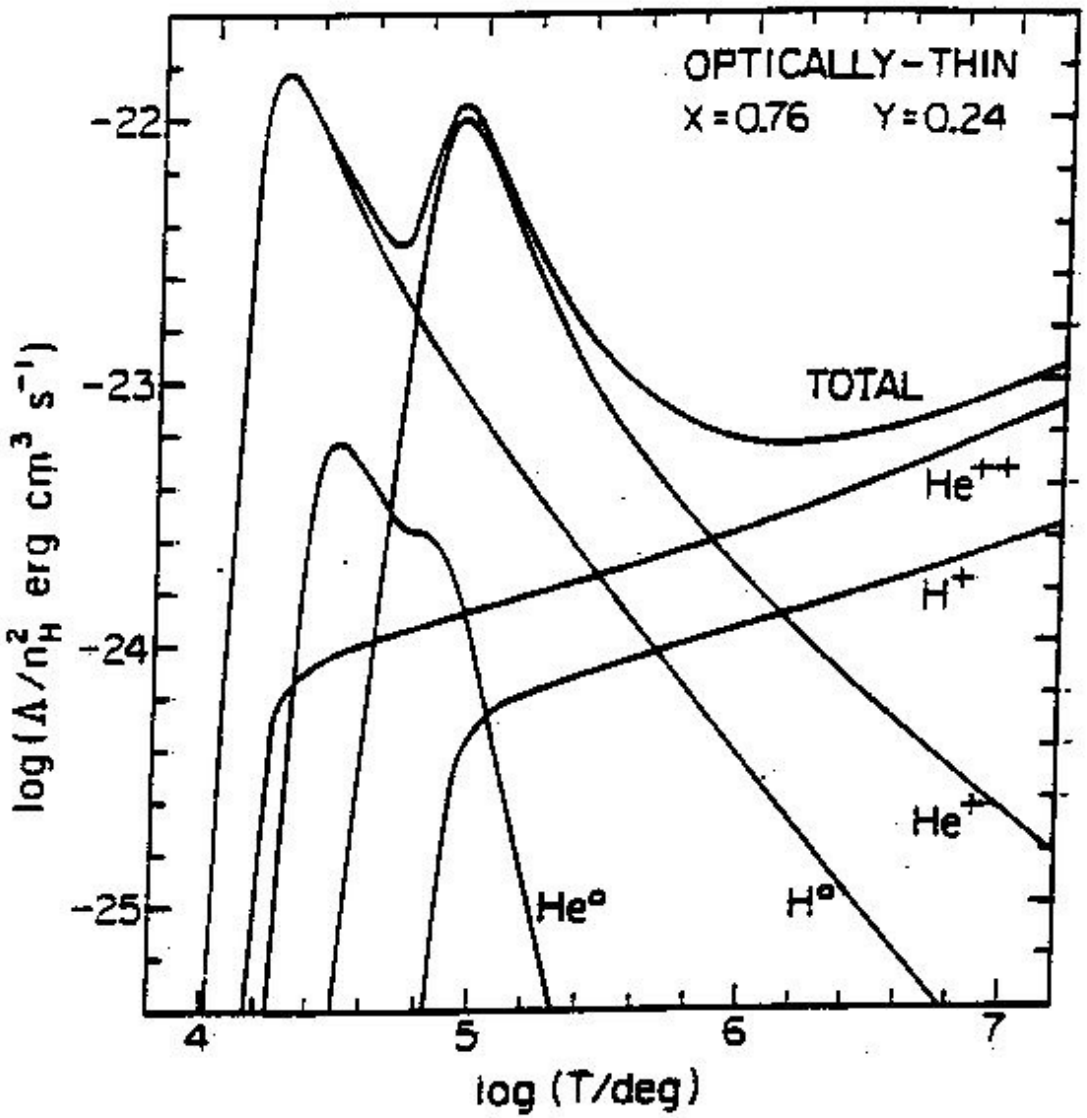
Spatial Frequency: k

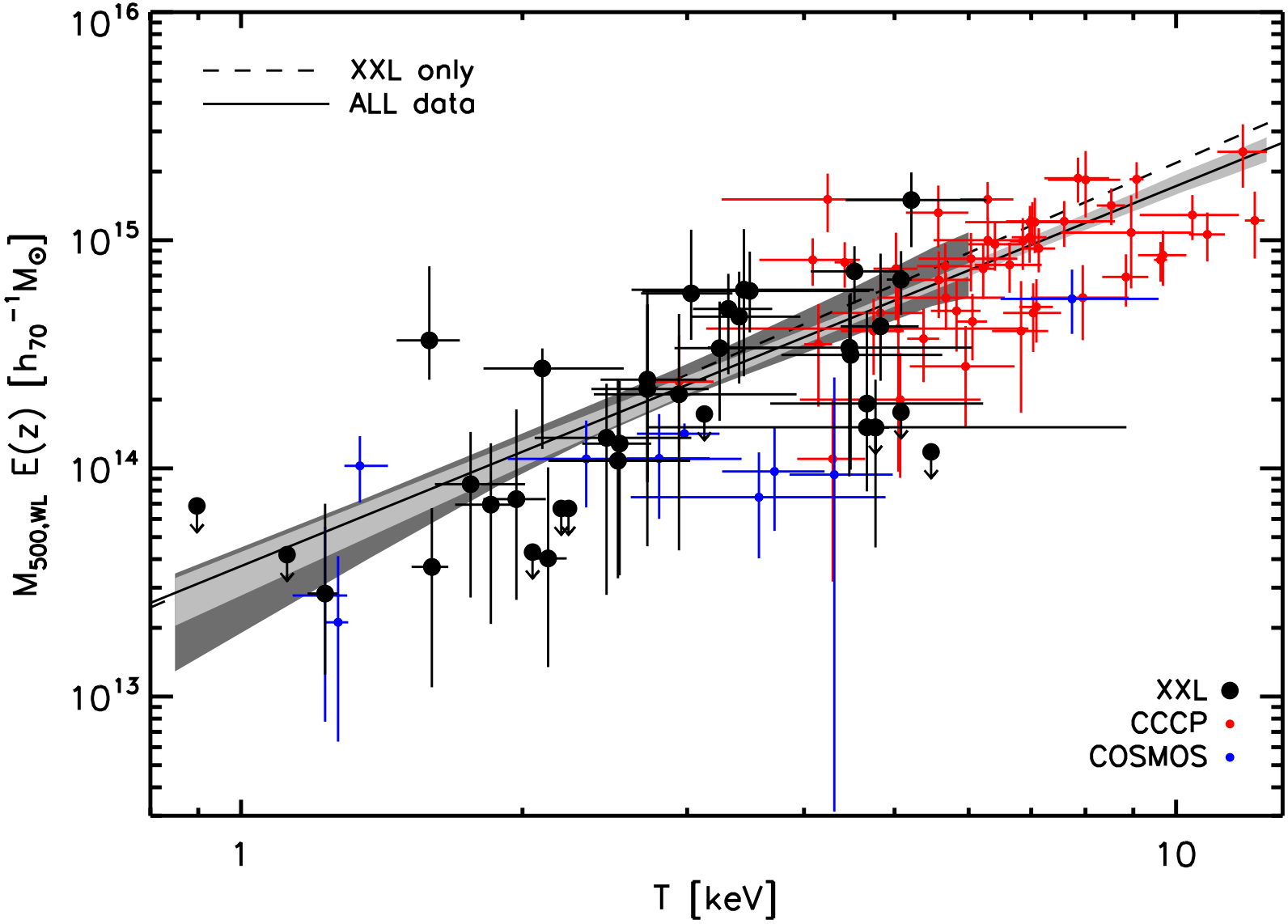
Short waves

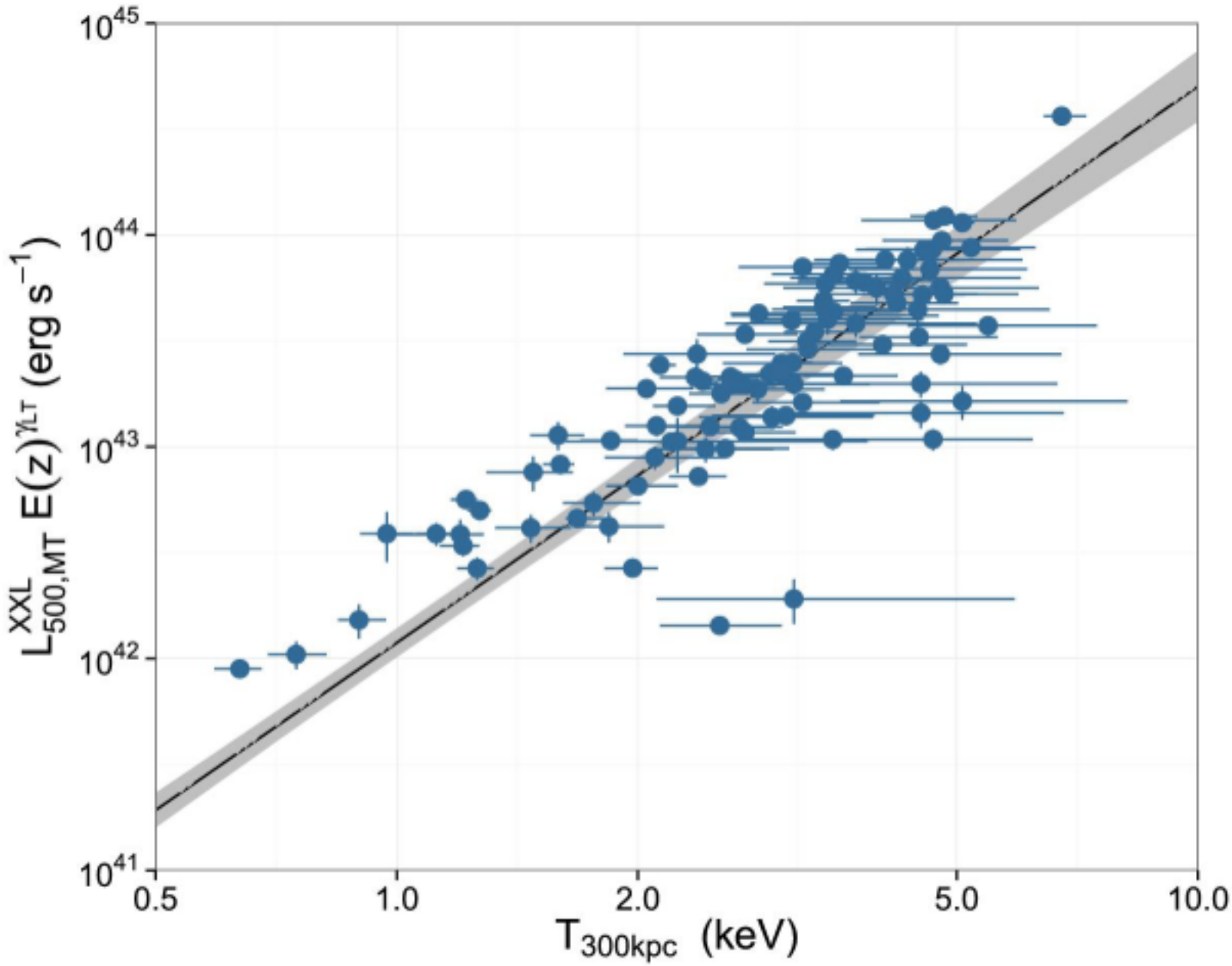

z = 48.4
T = 0.05 Gyr
500 kpc

Table 1: The most important numerical parameters for the six full volume runs. Gravitational softenings for all particle types other than DM are comoving kpc (with value equal to that of the DM) until $z = 1$ after which they are fixed to their $z = 1$ values, such that at $z = 0$ they have half the softening length as the DM. $m_{\rm baryon}$ is the "target gas mass" (i.e. only the mean mass). The number of gas cells equals the $N_{\rm GAS}$ value only in the initial conditions, the number will then drop as stars and black holes form. Moreover, the total number of baryonic particles (gas cells + star particles + wind particles + black holes) is also not conserved since gas cells can be refined/de-refined to keep their mass within a factor of 2 around $m_{\rm baryon}$. In contrast, the total number of tracers and dark matter particles are both conserved for the duration of the simulation.

Run Name	Alt. Name	Volume [Mpc^3]	$L_{\rm box}$ [Mpc/h]	$N_{\rm GAS}$	$N_{\rm TR}$	$N_{\rm DM}$	$\epsilon_{\rm baryon}$ [kpc]	ϵ_{DM} [kpc]	m_{baryon} [M$_\odot$]	m_{DM} [M$_\odot$]
Illustris-1	L75n1820FP	106.5^3	75	1820^3	1820^3	1820^3	0.7	1.4	1.6×10^6	6.3×10^6
Illustris-2	L75n910FP	106.5^3	75	910^3	910^3	910^3	1.4	2.8	1.0×10^7	5.0×10^7
Illustris-3	L75n455FP	106.5^3	75	455^3	455^3	455^3	2.8	5.7	8.0×10^8	4.0×10^8
Illustris-1-Dark	L75n1820DM	106.5^3	75	0	0	1820^3	-	1.4	-	7.6×10^6
Illustris-2-Dark	L75n910DM	106.5^3	75	0	0	910^3	-	2.8	-	6.0×10^7
Illustris-3-Dark	L75n455DM	106.5^3	75	0	0	455^3	-	5.7	-	4.8×10^8


OPTICALLY-THIN
X=0.76 Y=0.24
TOTAL
He++
H+
He+
He°
H°
-22
-23
-24
-25
4
5
6
7
log (Λ/n²H erg cm³ s⁻¹)
log (T/deg)


XXL only
ALL data
XXL
CCCP
COSMOS
$M_{500,WL}$ E(z) [$h_{70}^{-1}M_\odot$]
T [keV]
10^{16}
10^{15}
10^{14}
10^{13}
1
10


10^{45}
10^{44}
10^{43}
10^{42}
10^{41}
$L^{XXL}_{500,MT}\ E(z)^{\gamma_{LT}}$ (erg s^{-1})
0.5
1.0
2.0
5.0
10.0
T_{300kpc} (keV)