



27 April 2014

The New Universe and the Human Future

Nancy Ellen Abrams

&

Joel R. Primack

Hubble Space Telescope Ultra Deep Field - ACS



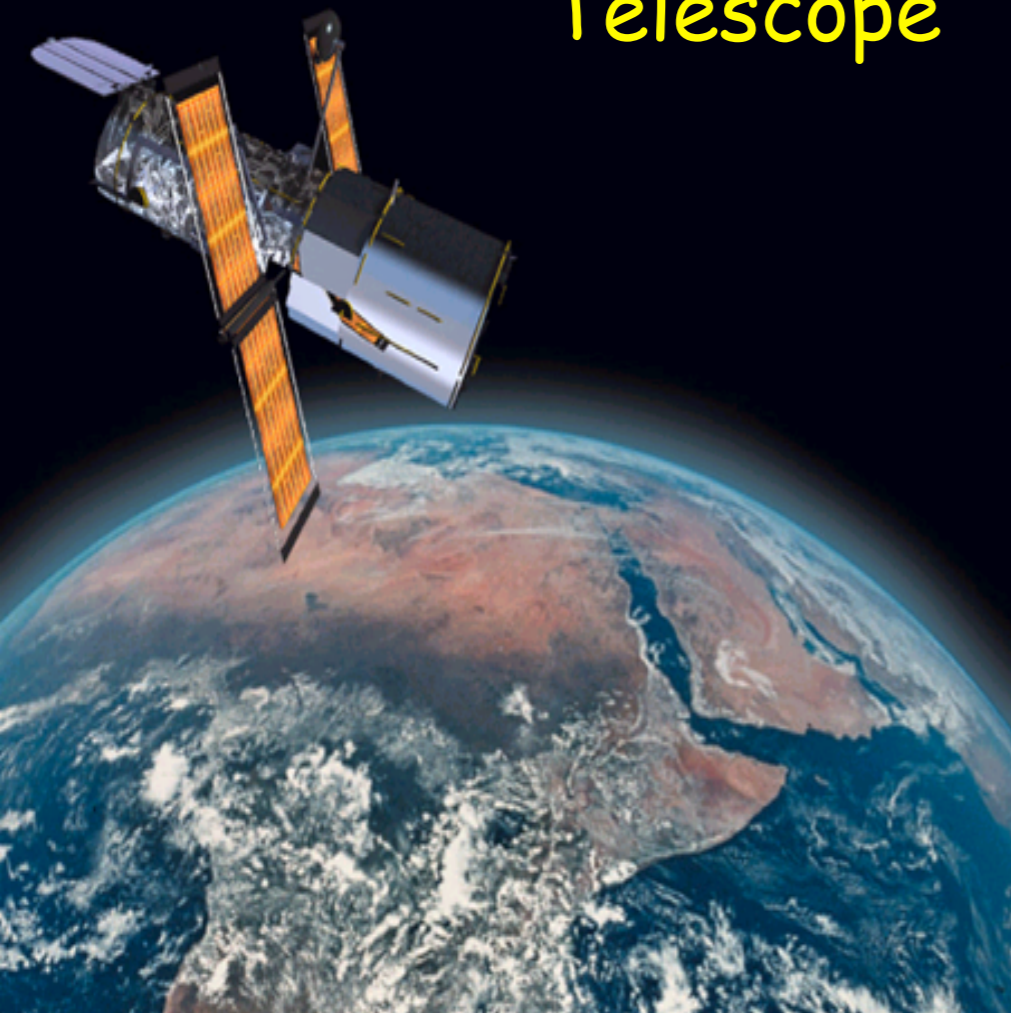
2.5 meter SDSS
Telescope



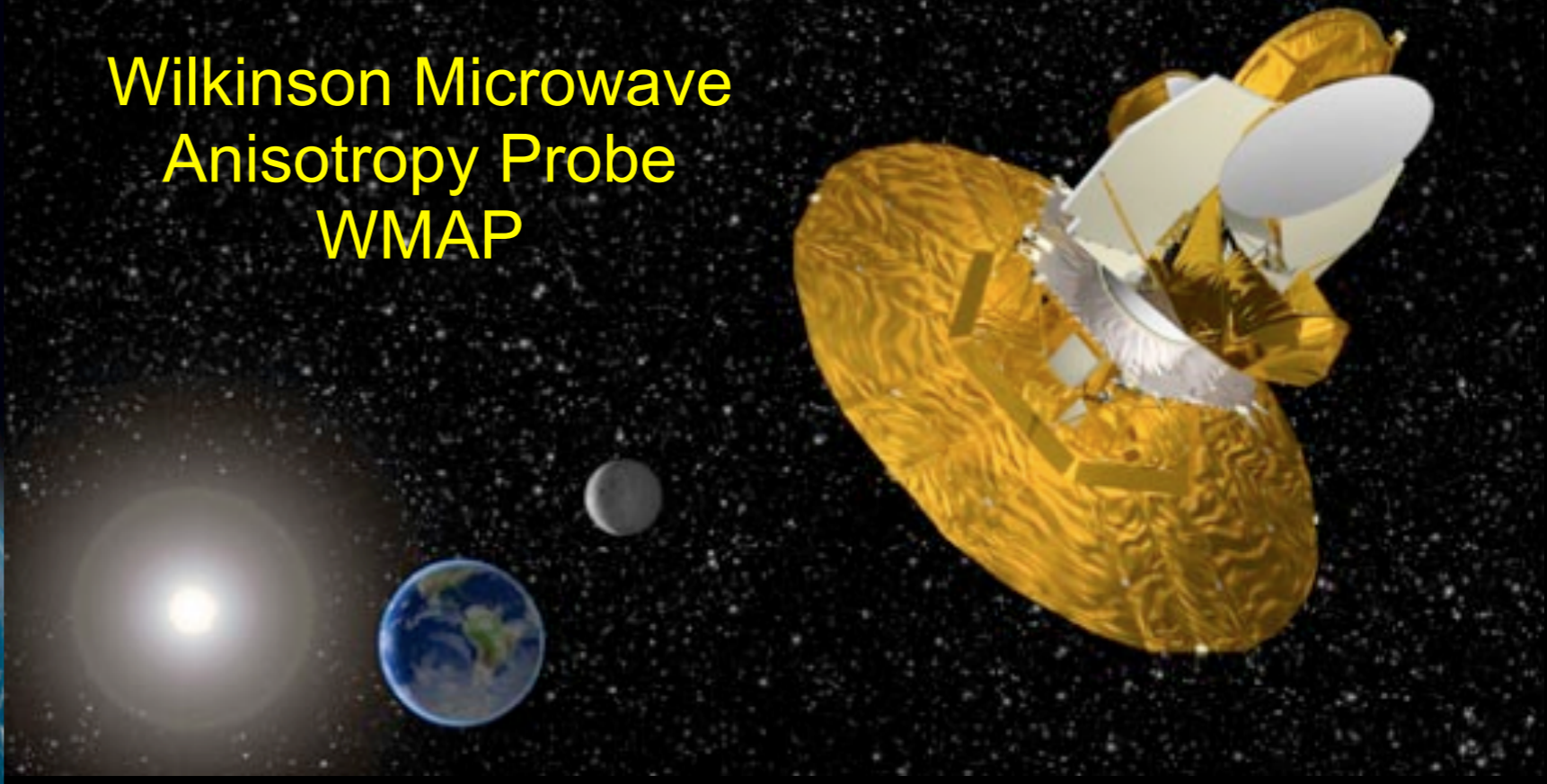
10 meter Keck Telescopes



Hubble Space
Telescope



Wilkinson Microwave
Anisotropy Probe
WMAP



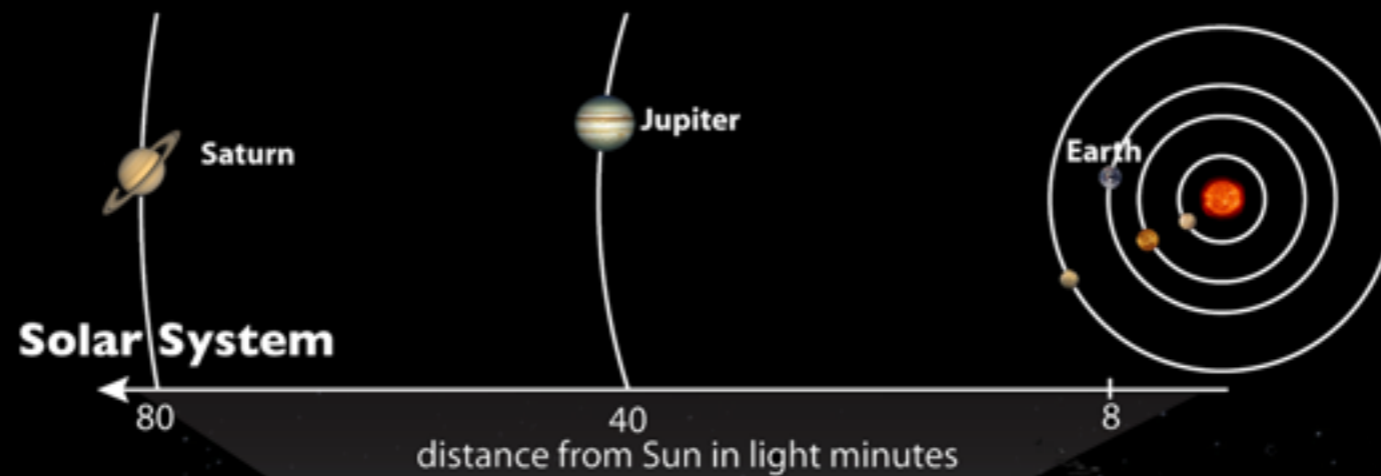


Cosmology is going through a scientific revolution that is creating humanity's ***first picture of the universe that might actually be true.***

End

In the new scientific picture, ***we are cosmically central, and we live at a pivotal time.***

The Modern Scientific Cosmos



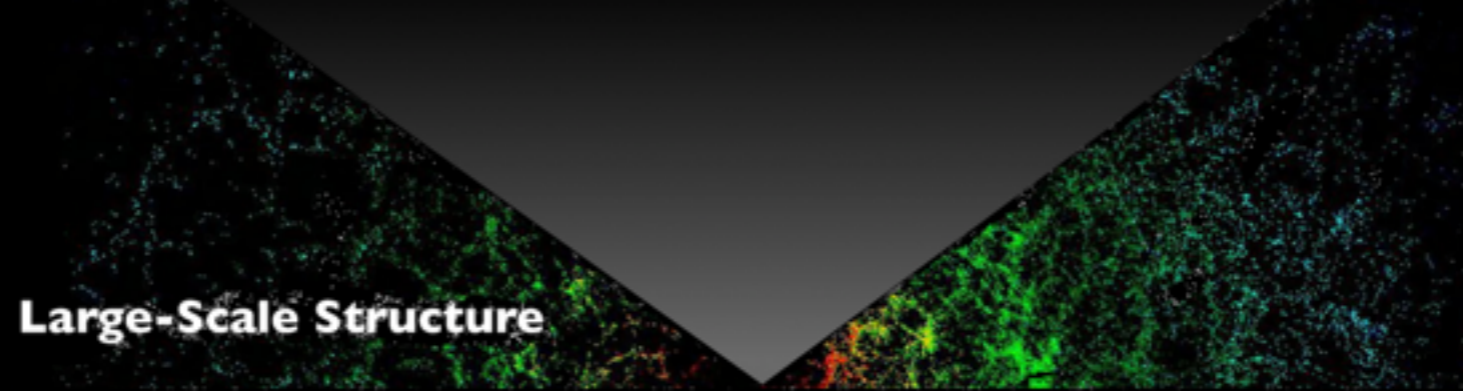
Our Cosmic Address



100,000 light-years



each dot is a big galaxy



Sloan Digital Sky Survey

0 1 billion light-years to cosmic horizon

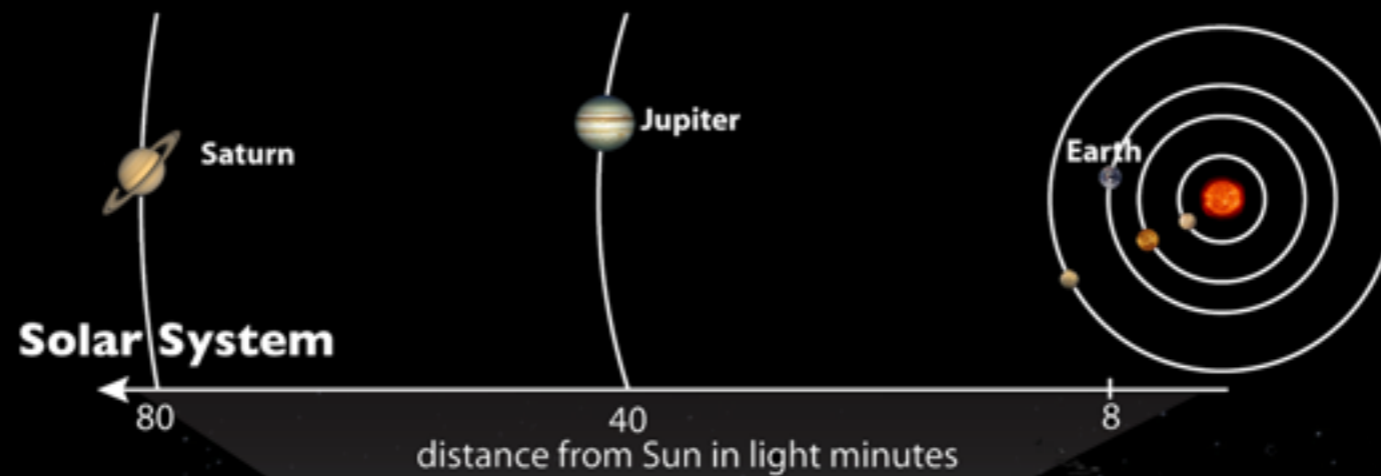
VOYAGE TO THE VIRGO CLUSTER



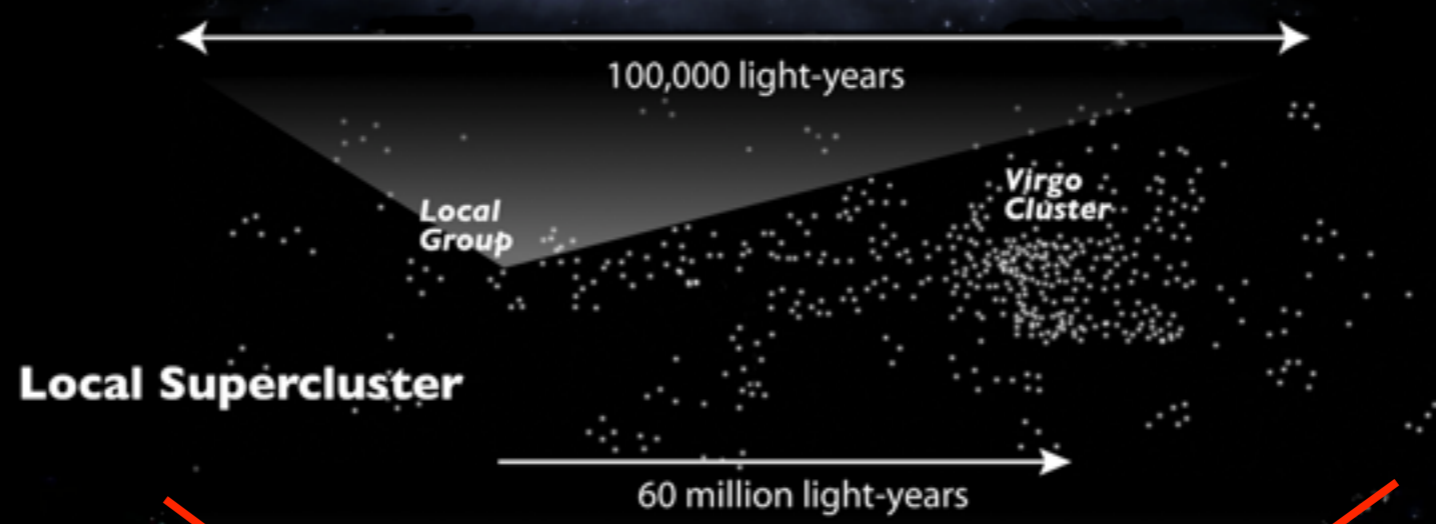
VOYAGE TO THE VIRGO CLUSTER



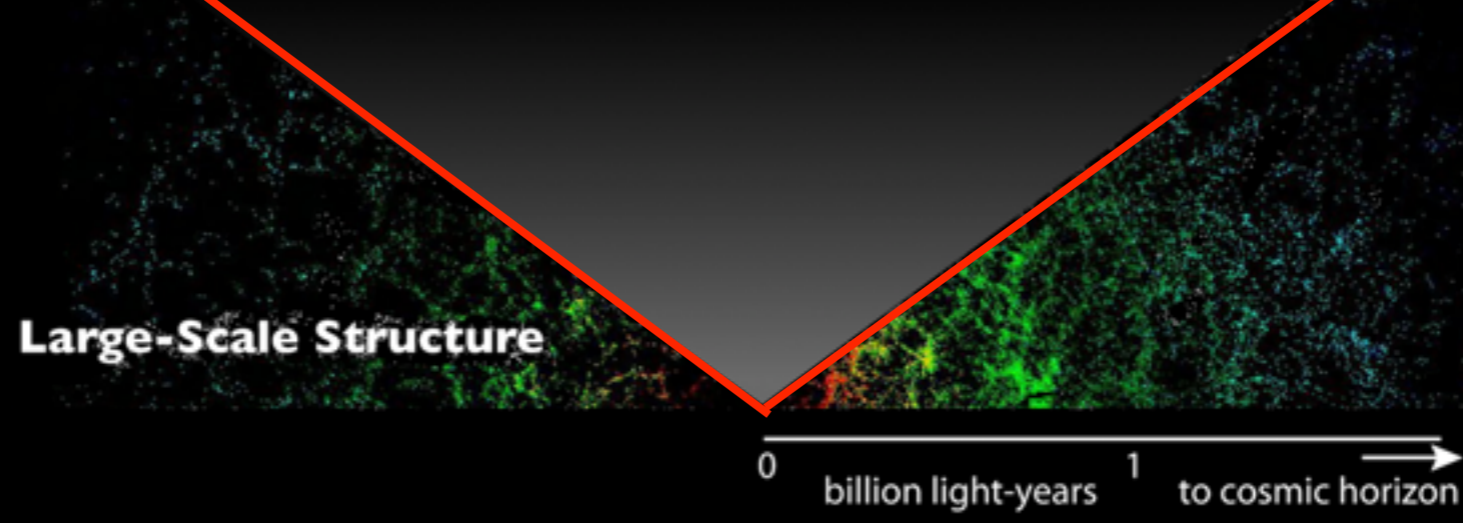
The Modern Scientific Cosmos



Our Cosmic Address



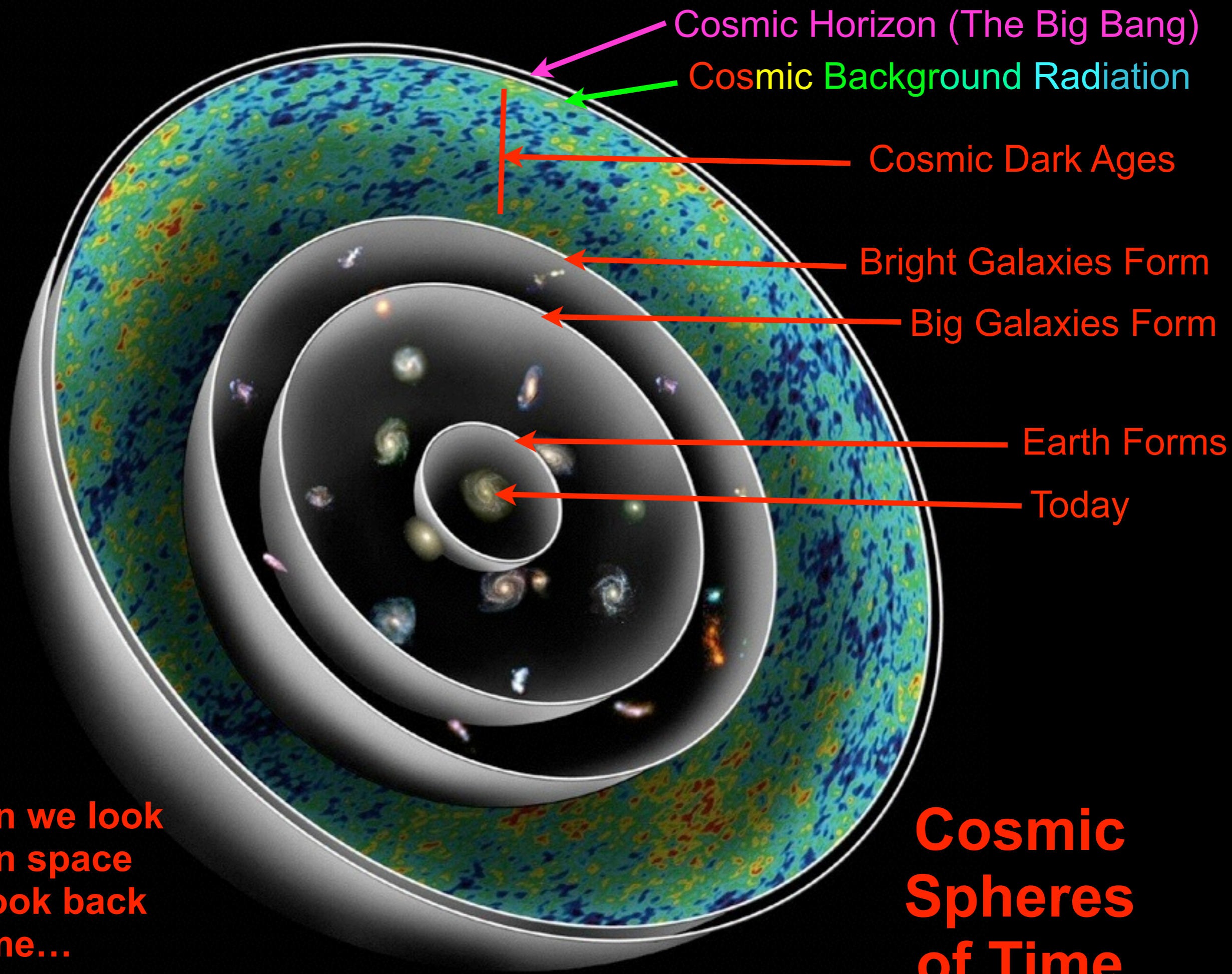
each dot is a big galaxy



Sloan Digital Sky Survey

GALAXIES MAPPED BY THE SLOAN SURVEY





Cosmic Horizon (The Big Bang)

Cosmic Background Radiation

Cosmic Dark Ages

Bright Galaxies Form

Big Galaxies Form

Earth Forms

Today

When we look out in space we look back in time...

Cosmic Spheres of Time

This picture is beautiful but misleading, since it only shows about 0.5% of the cosmic density.

The other 99.5% of the universe is invisible.

Periodic Table

Li	Be	B	C	N	O	F	Ne										
Na	Mg	Al	Si	P	S	Cl	Ar										
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	--	--	--	--	--	--	--	--	--
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu				
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr				

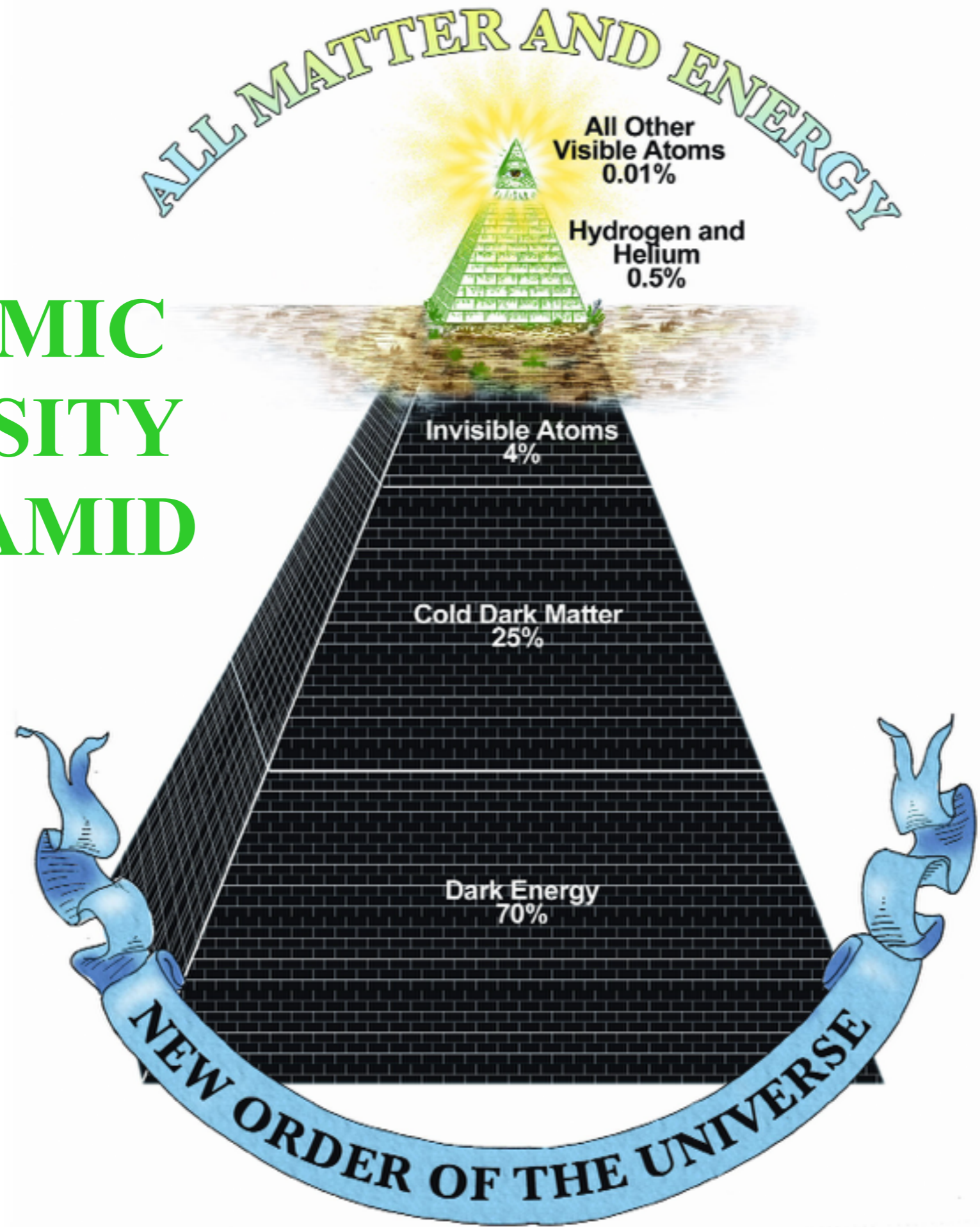
White - Big Bang Pink - Cosmic Rays
Yellow - Small Stars Green - Large Stars
Blue - Supernovae



stardust

stars

COSMIC DENSITY PYRAMID

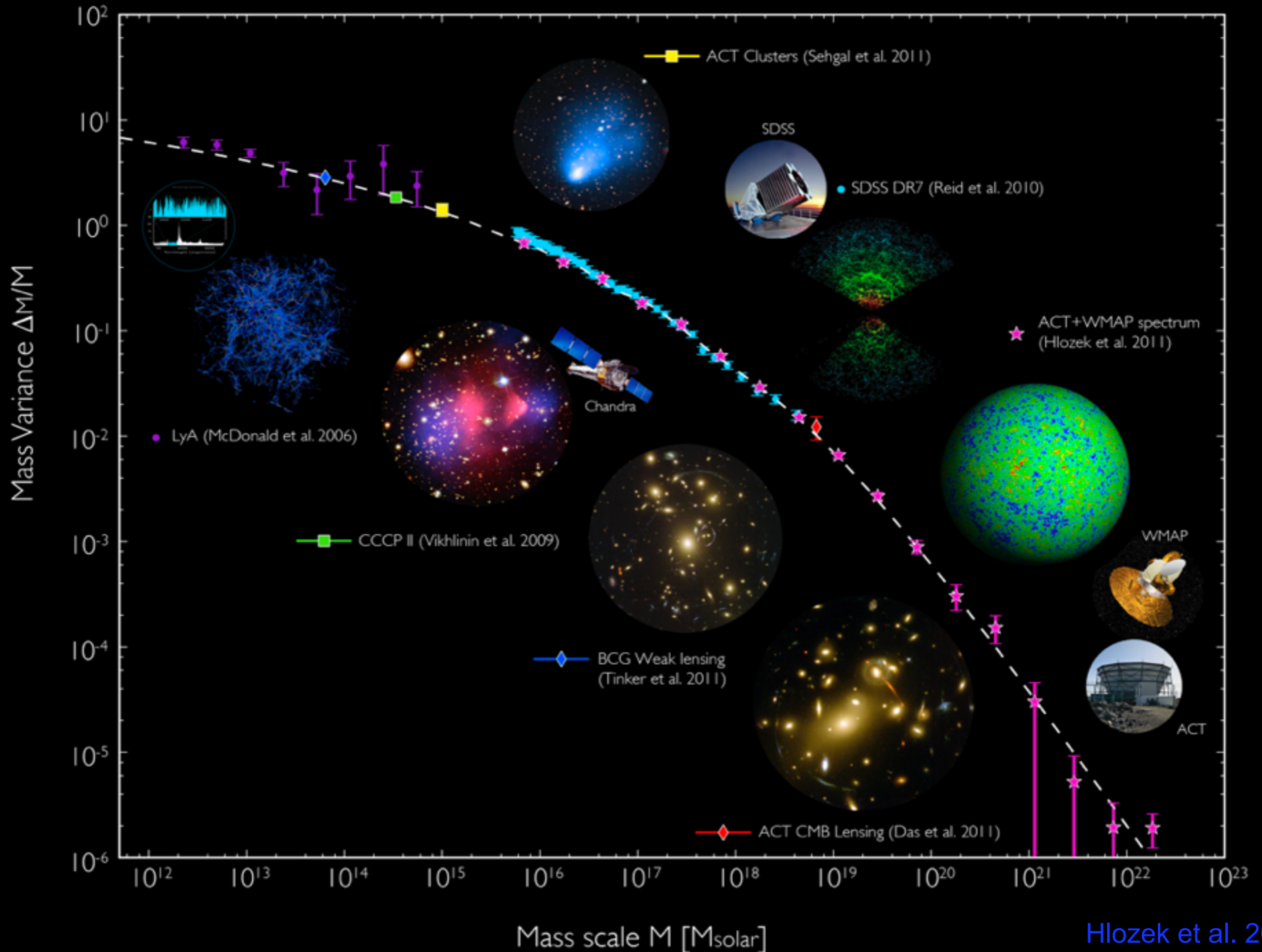


**DARK MATTER
+ DARK ENERGY =
DOUBLE DARK
THEORY**

Technical Name:

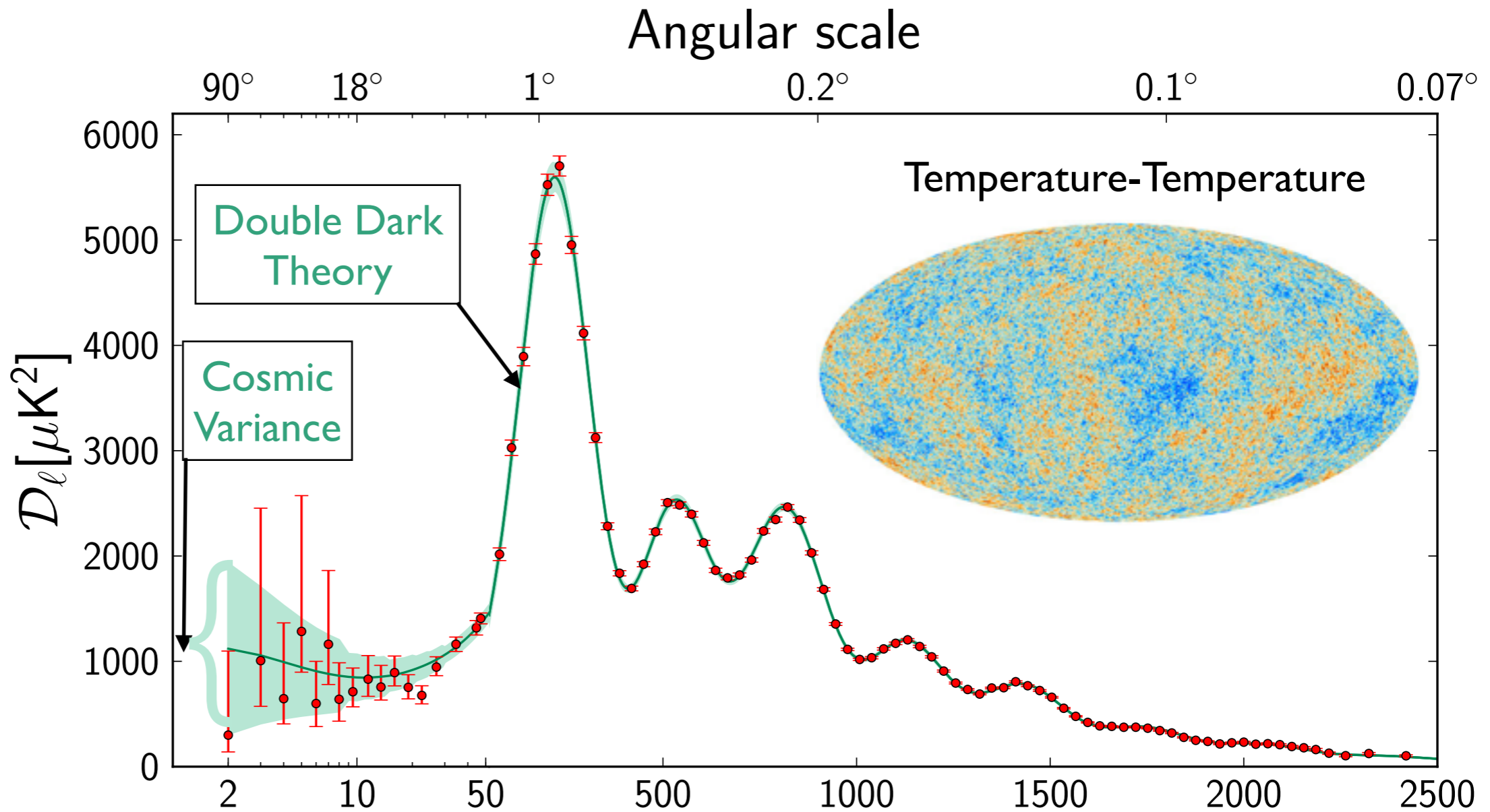
Lambda Cold Dark Matter (Λ CDM)

Matter Distribution Agrees with Double Dark Theory!

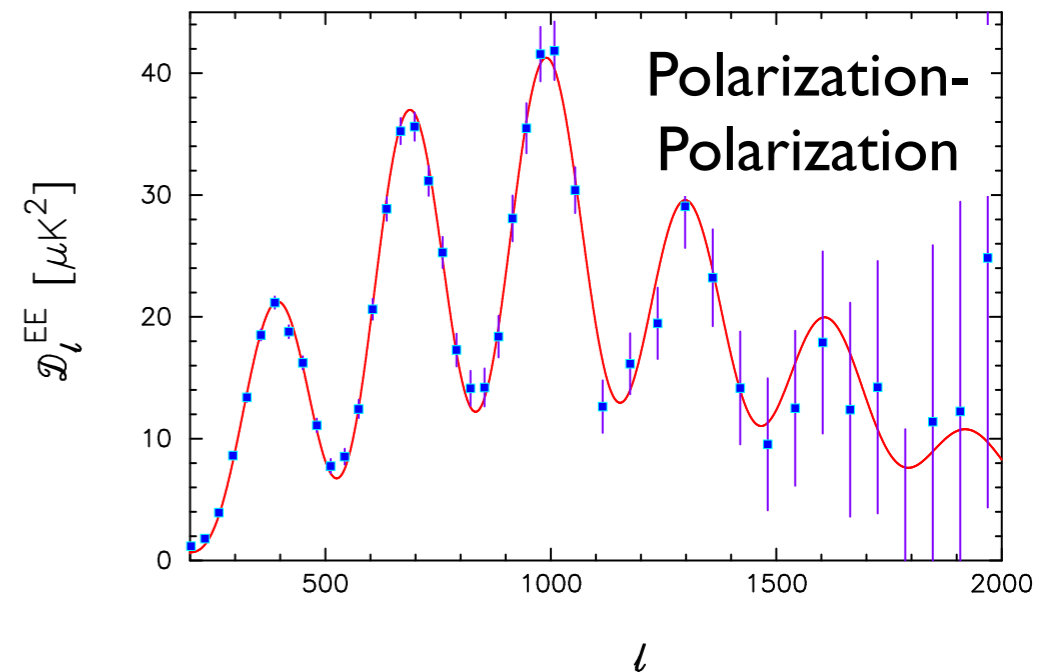
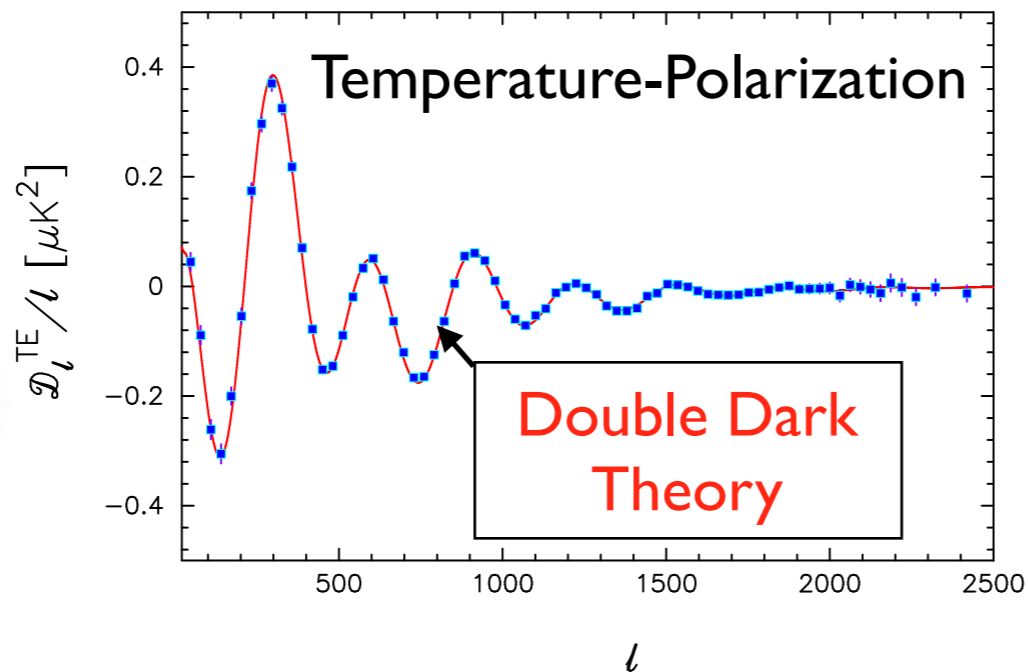


European
Space
Agency
PLANCK
Satellite
Data

Released
March 21,
2013



Agrees with Double Dark Theory! Multipole moment, ℓ



All Other Atoms 0.01%
H and He 0.5%

} Visible Matter 0.5%

Invisible Atoms 4%

Cold Dark Matter 25%

Dark Energy 70%

Imagine that the entire universe is an ocean of dark energy. On that ocean sail billions of ghostly ships made of dark matter...

Matter and Energy Content of the Universe

Λ CDM

Double Dark Theory

Dark Matter Ships

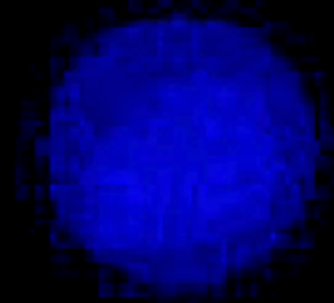
on a

Dark Energy Ocean



"QUARKS. NEUTRINOS. MESONS. ALL THOSE DAMN PARTICLES YOU CAN'T SEE. THAT'S WHAT DROVE ME TO DRINK. BUT NOW I CAN SEE THEM!"

$z=49.000$

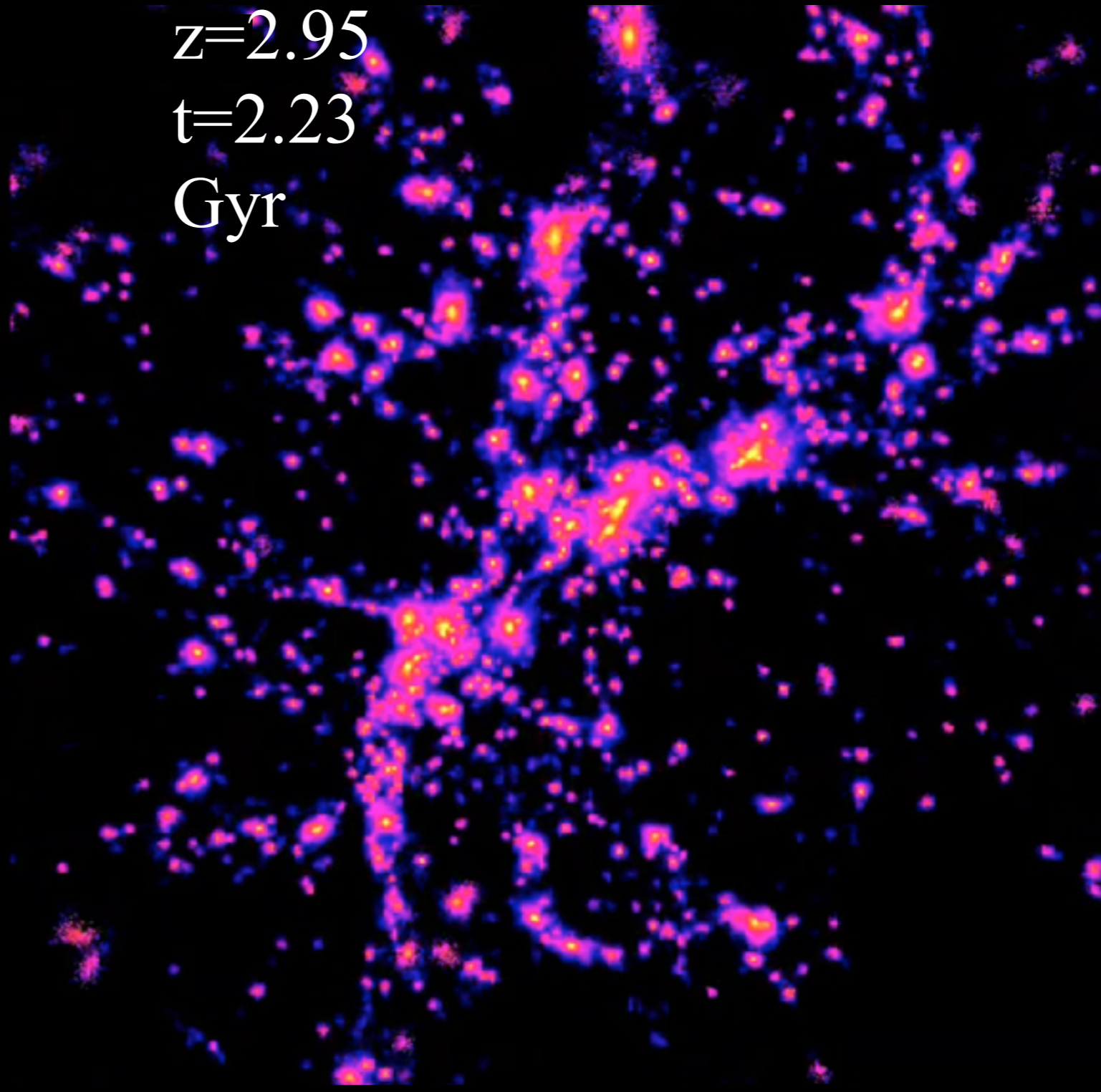
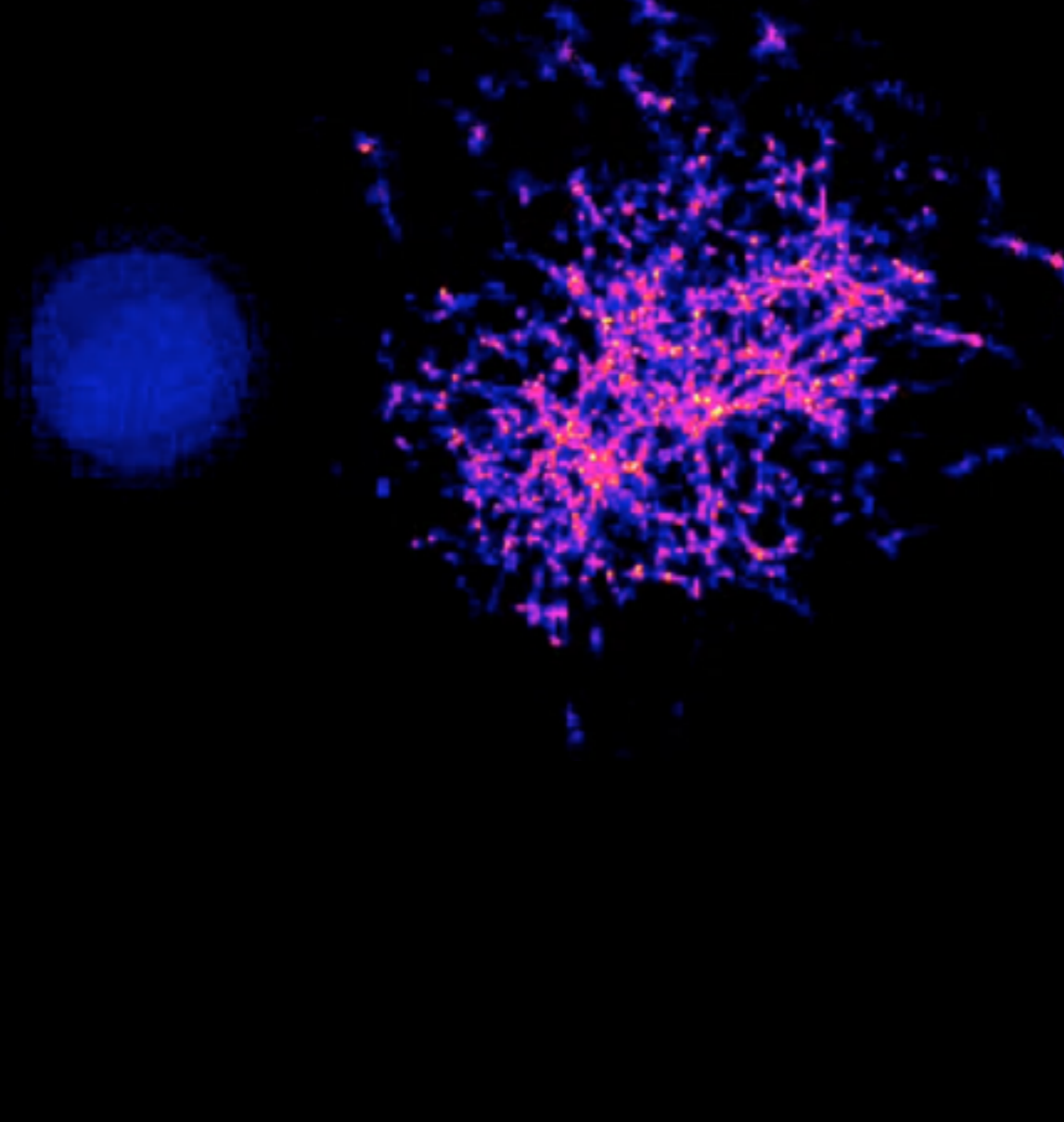


Expansion....

$z=49.00$
 $t=49$
Myr

$z=12.01$
 $t=374\text{M}$
yr

$z=2.95$
 $t=2.23$
Gyr



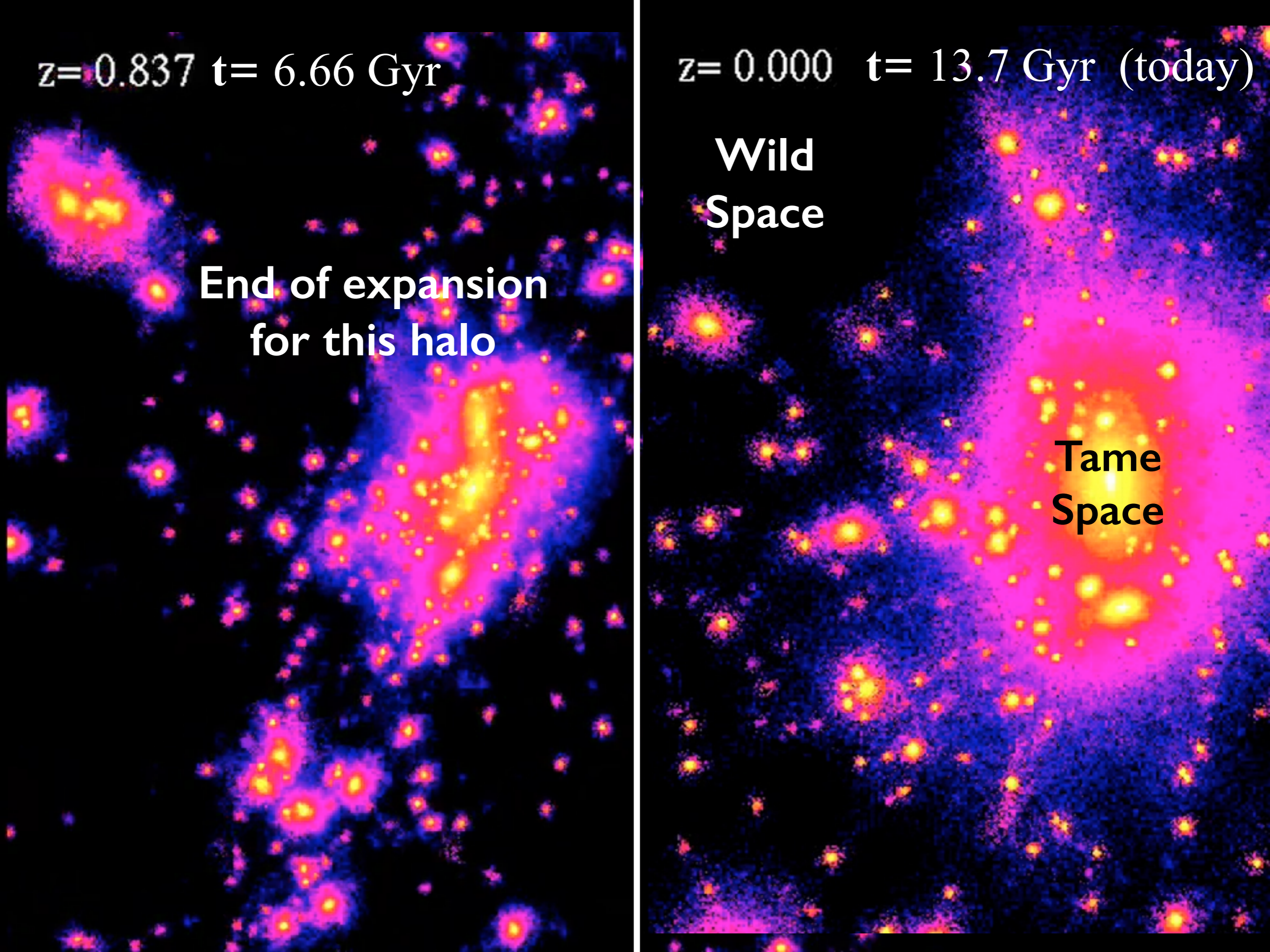
$z=0.837$ $t=6.66$ Gyr

End of expansion
for this halo

$z=0.000$ $t=13.7$ Gyr (today)

Wild
Space

Tame
Space



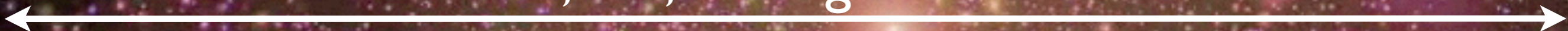
Aquarius Simulation

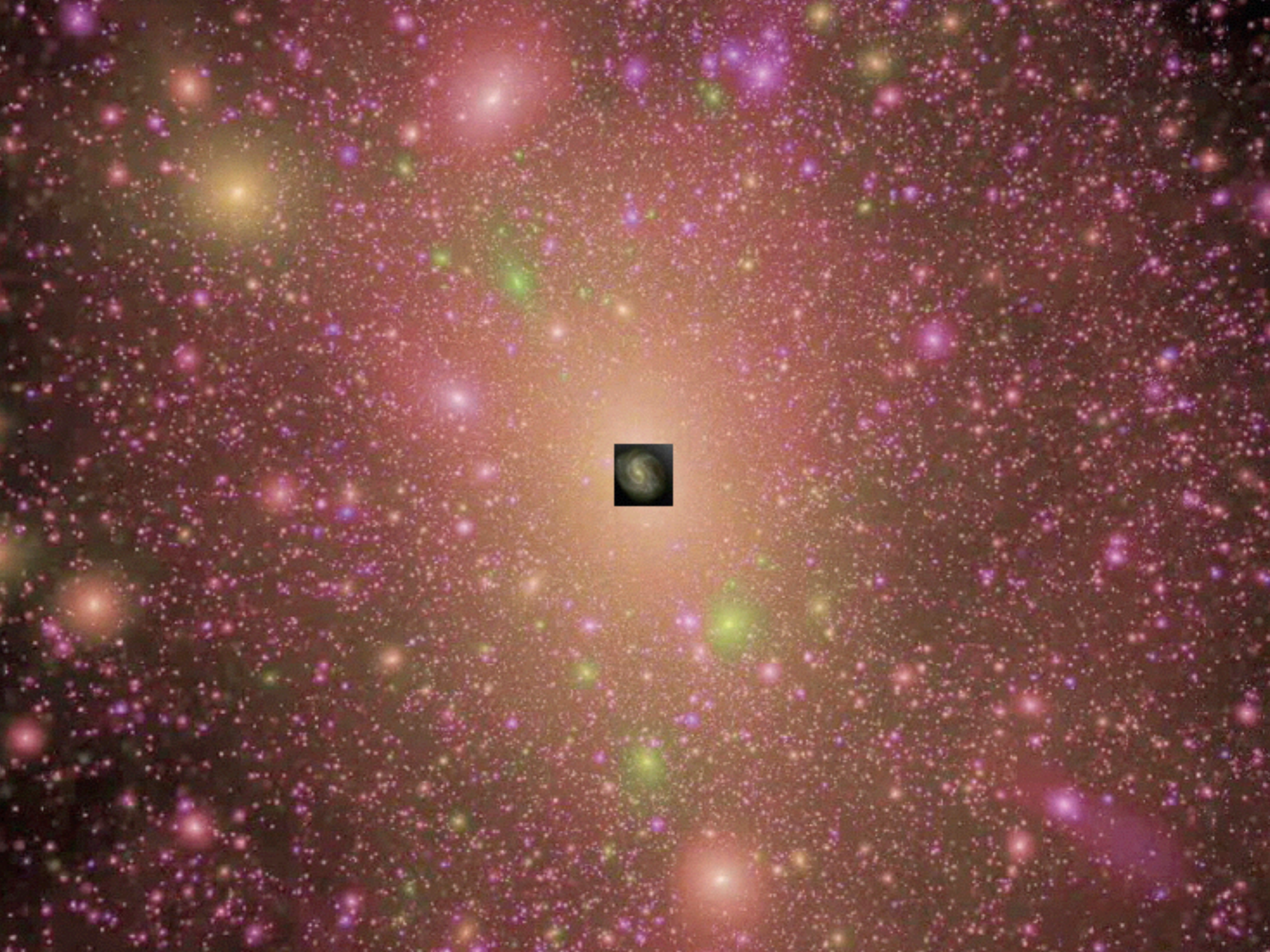
Volker Springel

Milky Way
100,000 Light Years

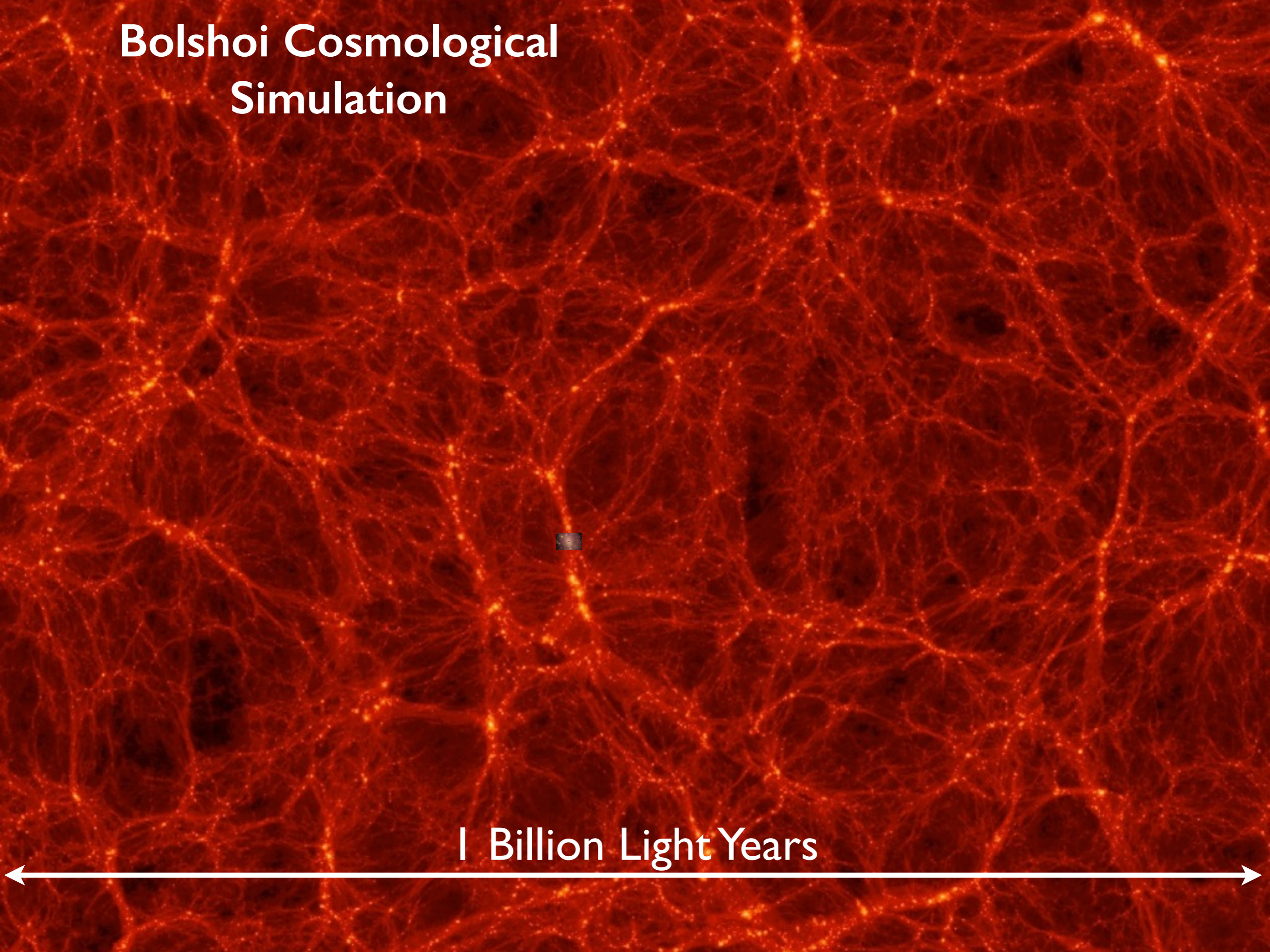


Milky Way Dark Matter Halo
1,500,000 Light Years





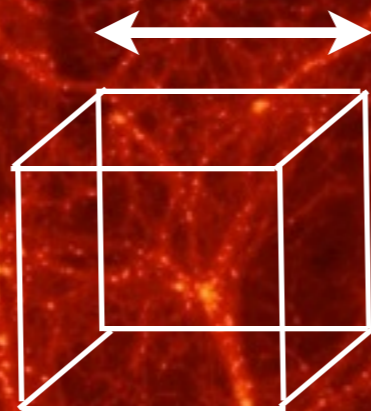
Bolshoi Cosmological Simulation



1 Billion Light Years

Bolshoi Cosmological Simulation

100 Million Light Years



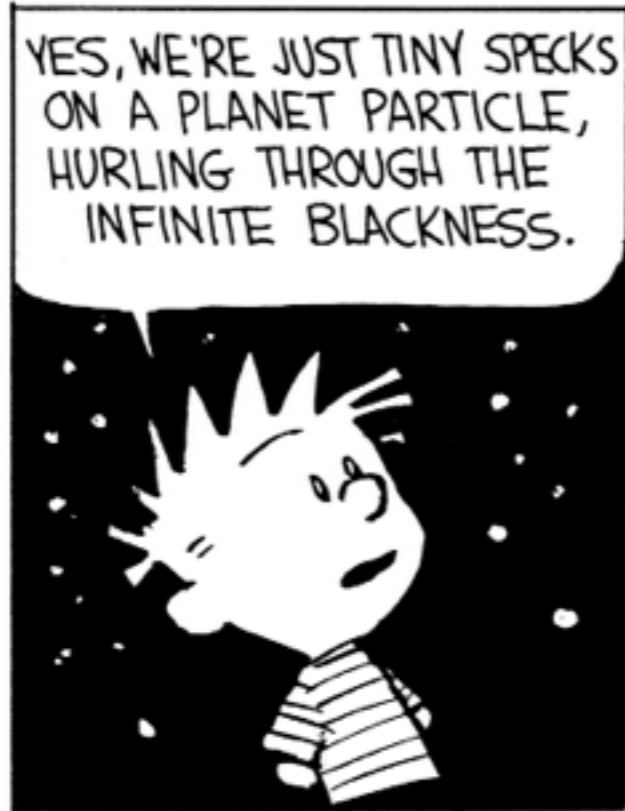
1 Billion Light Years

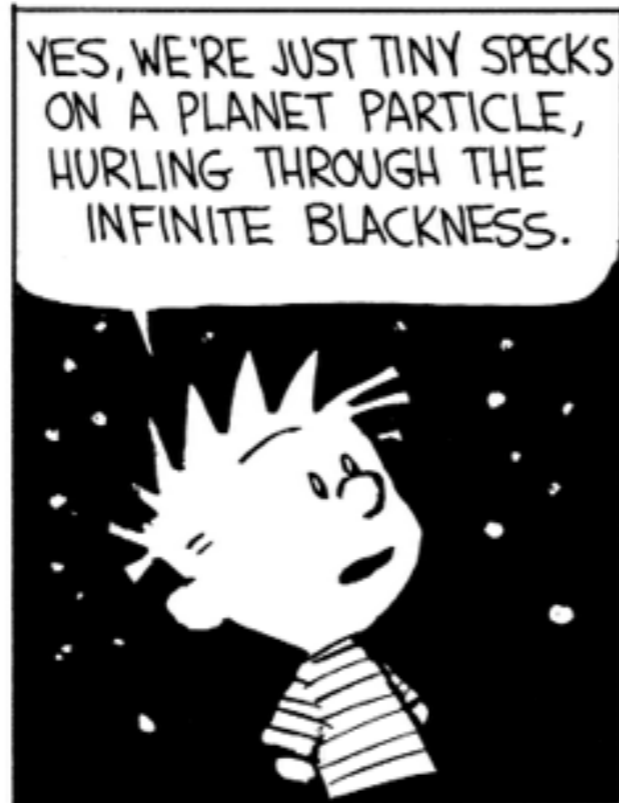


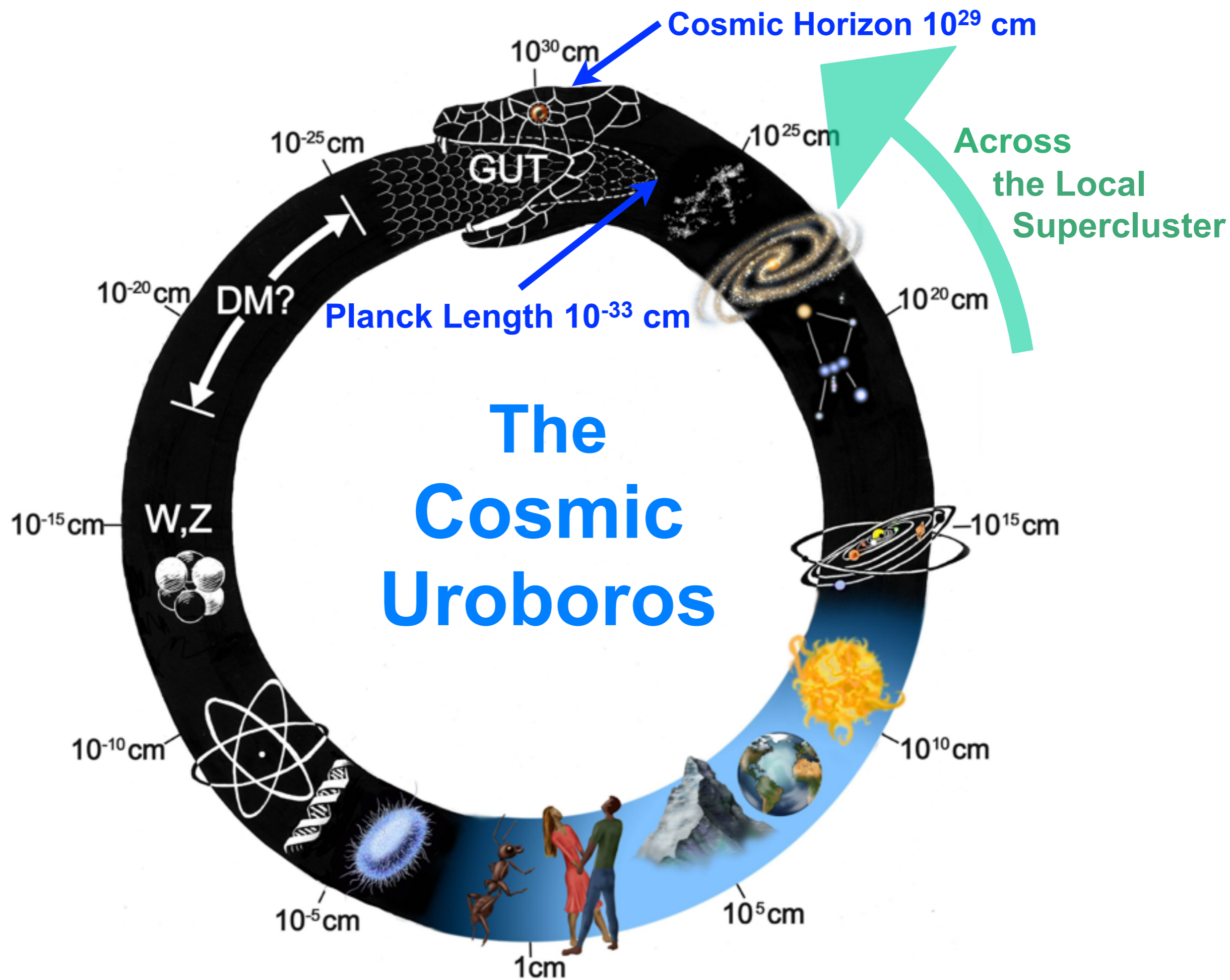
Bolshoi Cosmological Simulation

100 Million Light Years









Superstrings?

10^{30} cm

10^{25} cm

GUT

10^{-25} cm

Dark Matter?

10^{-20} cm

DM?

10^{20} cm

Different Forces Are Important on Different Size Scales

10^{-15} cm

W,Z

Weak & Strong

10^{15} cm

10^{-10} cm

Electromagnetic

10^{10} cm

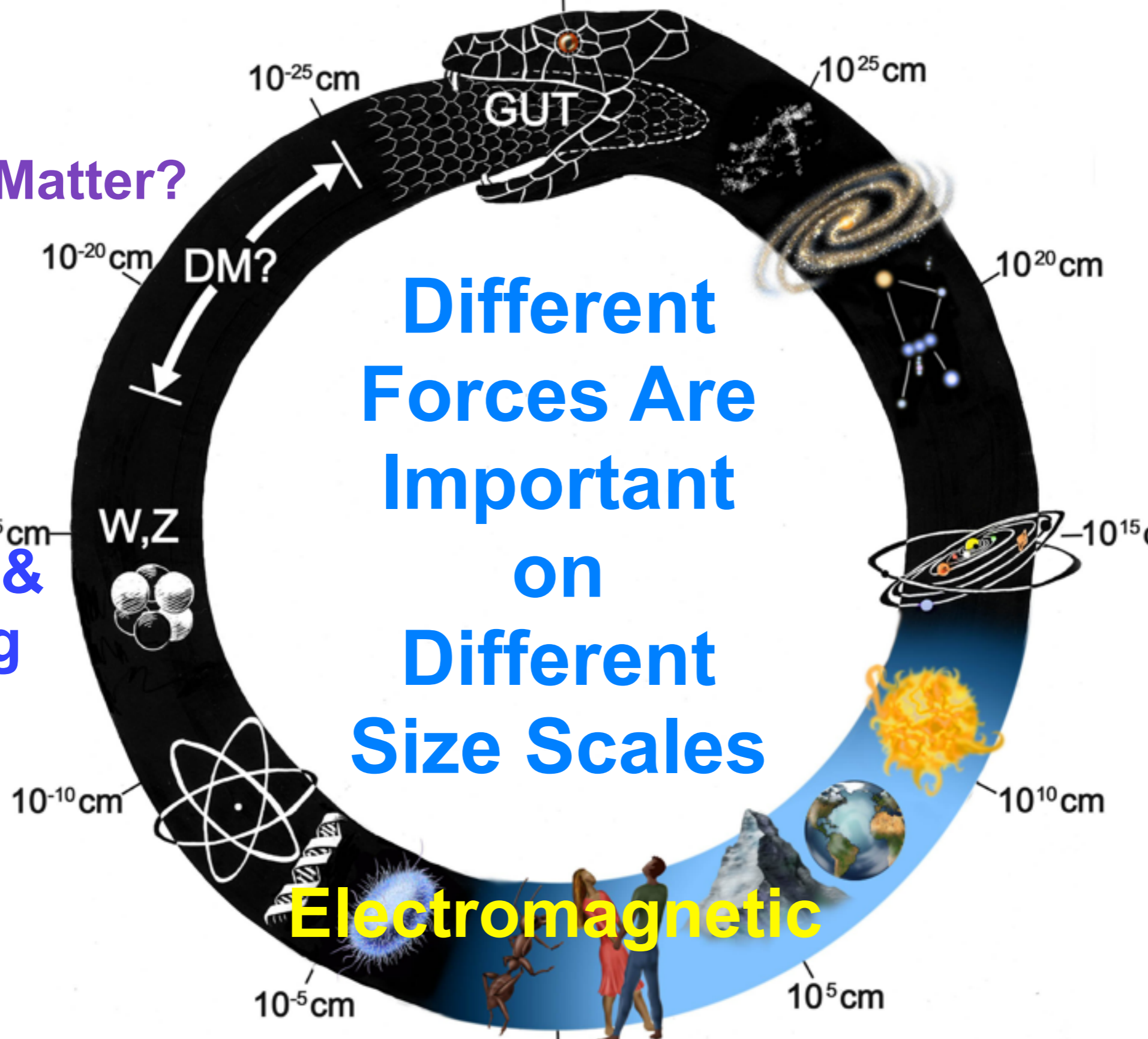
10^{-5} cm

1 cm

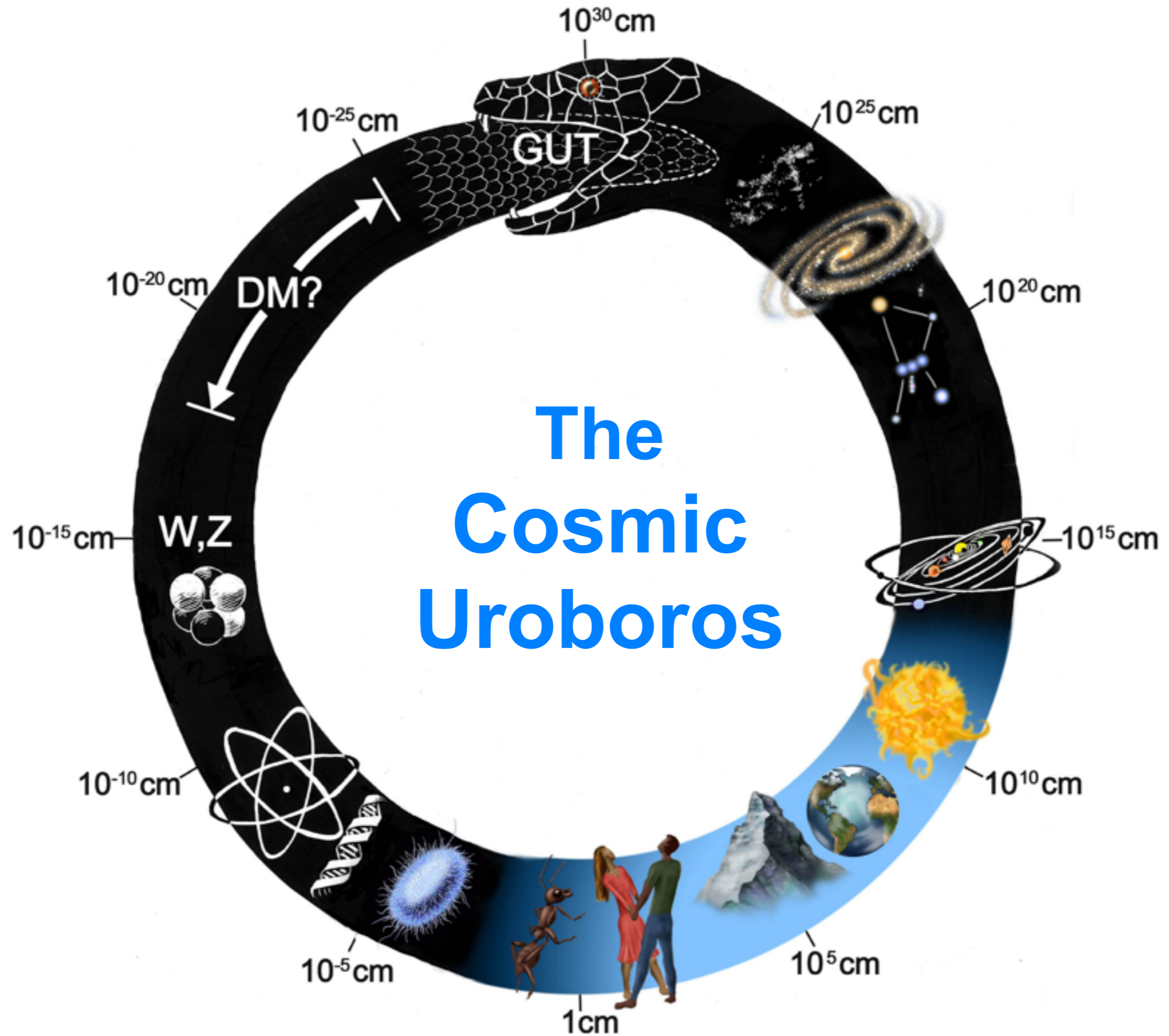
10^5 cm

Gravitation

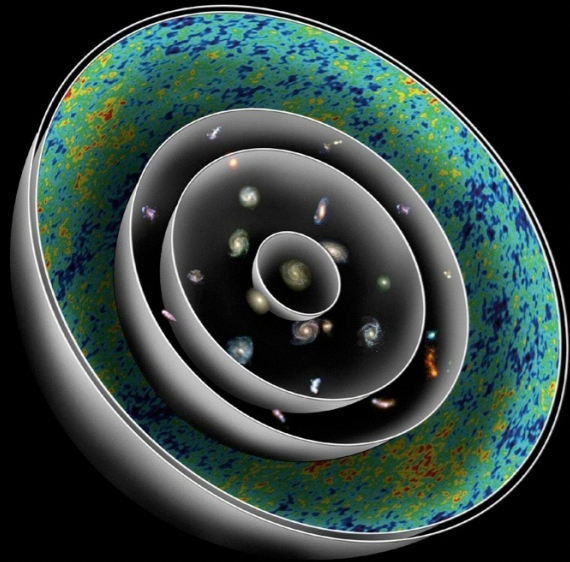
SIZE MATTERS!



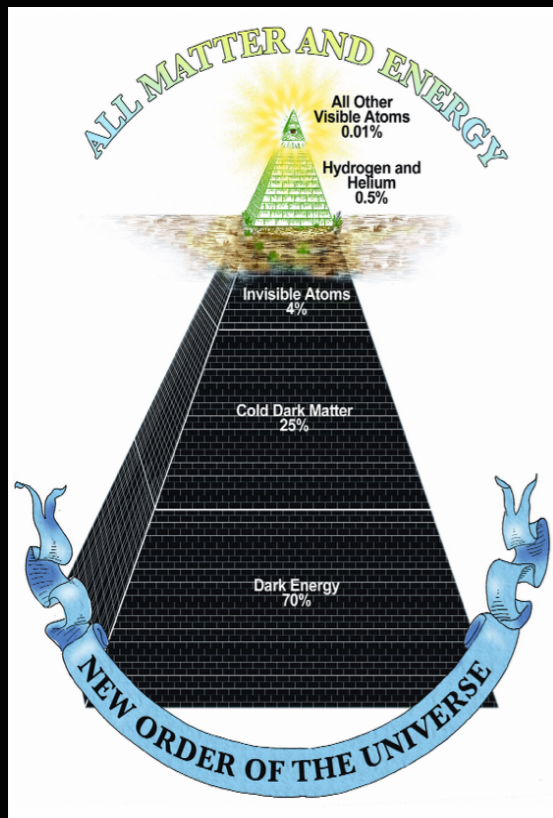




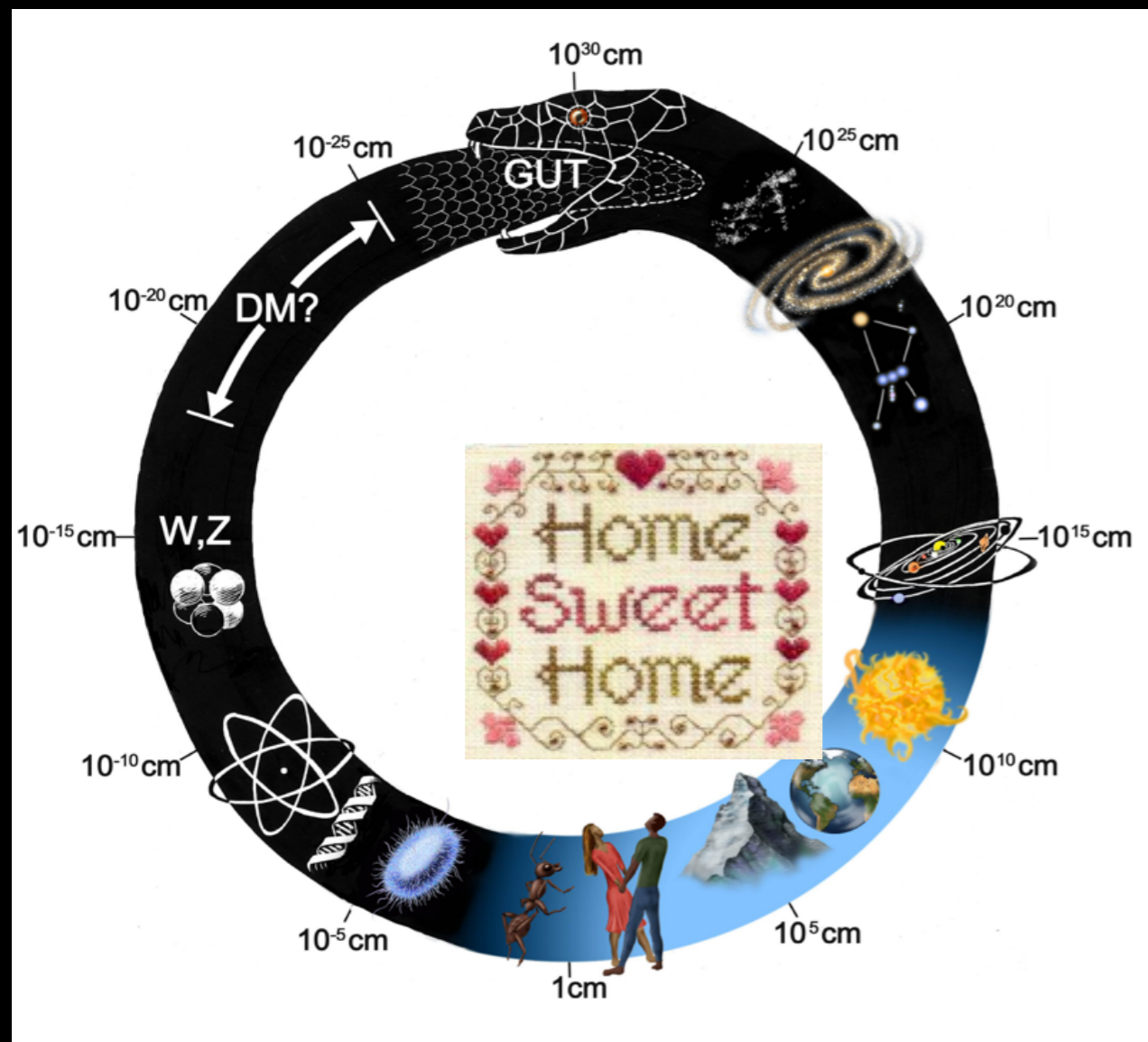
Human beings are central to the Universe, not geographically but in at least 7 different ways all of which follow directly from astronomy and physics.



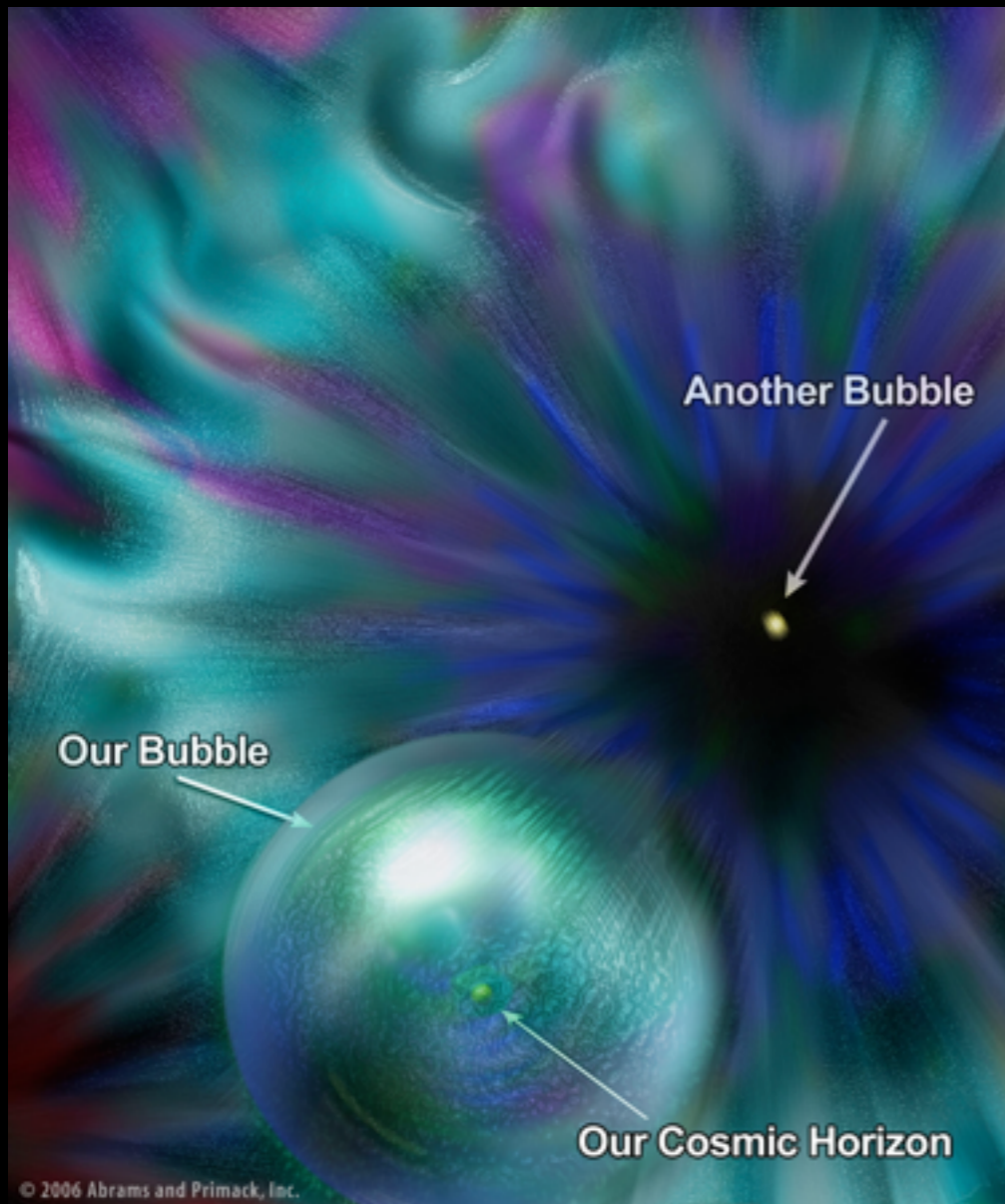
1) We live at the center of our Cosmic Spheres of Time. The finite speed of light makes this inevitable.



2) We are made of the rarest stuff in the universe: stardust.

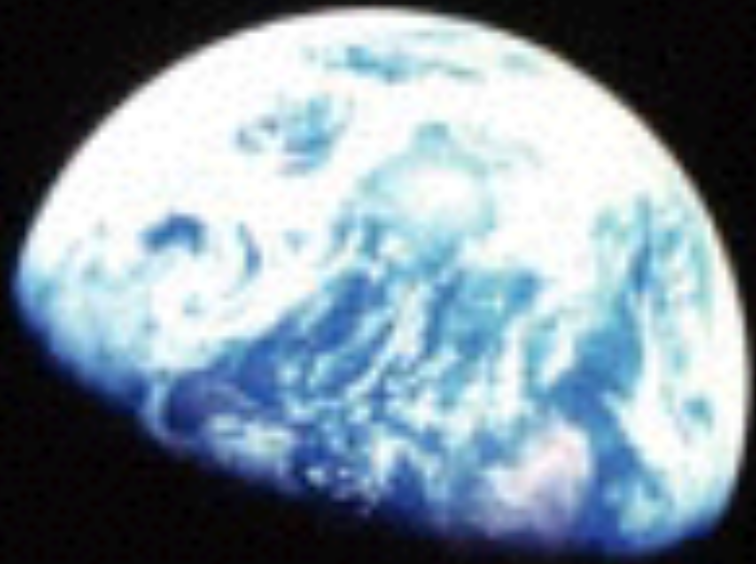


3) We live at the middle of all possible sizes – where the possibility of tremendous variety and complexity coming in small packages keeps life interesting. Life of our complexity could bloom nowhere else on the Cosmic Uroboros.



4) We live in a universe that may be a rare bubble of spacetime in the infinite, seething cauldron of the eternal superuniverse. Outside our unique and isolated bubble, which we call the Big Bang, there is neither space nor time as we know it. But here inside there is time for evolution and history, and there is space across which connections can form and structures can develop.

5) We live at the midpoint of time, which is also the peak moment in the entire evolution of the universe for astronomical observation. The most distant galaxies – which we have *just* acquired the technological ability to see – are beginning to disappear over the cosmic horizon now that the once-slowing expansion of the universe has begun instead to accelerate.

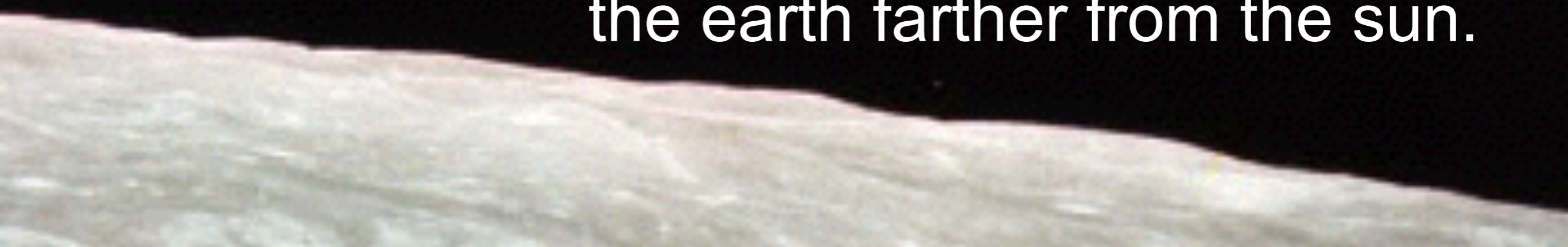


6) We live at the midpoint in the life of our planet. It formed, along with the sun and the other planets,

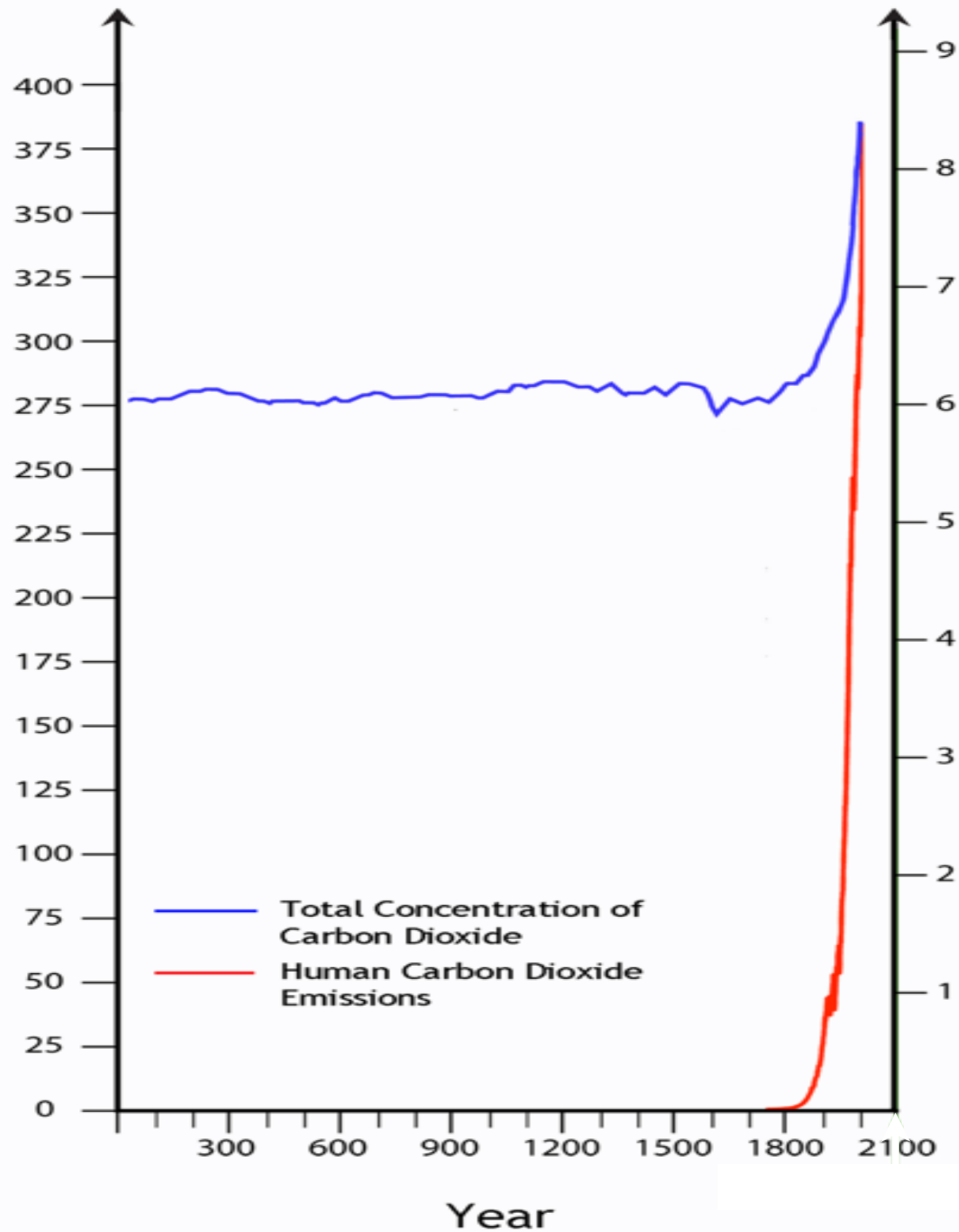
about four and a half billion years ago. It has about six billion years to go before it is roasted when our sun swells into a red giant star.

Complex life evolved about half a billion years ago, and has about half a billion years to go until the warming sun overheats the earth.

Or billions of years if our descendants move the earth farther from the sun.



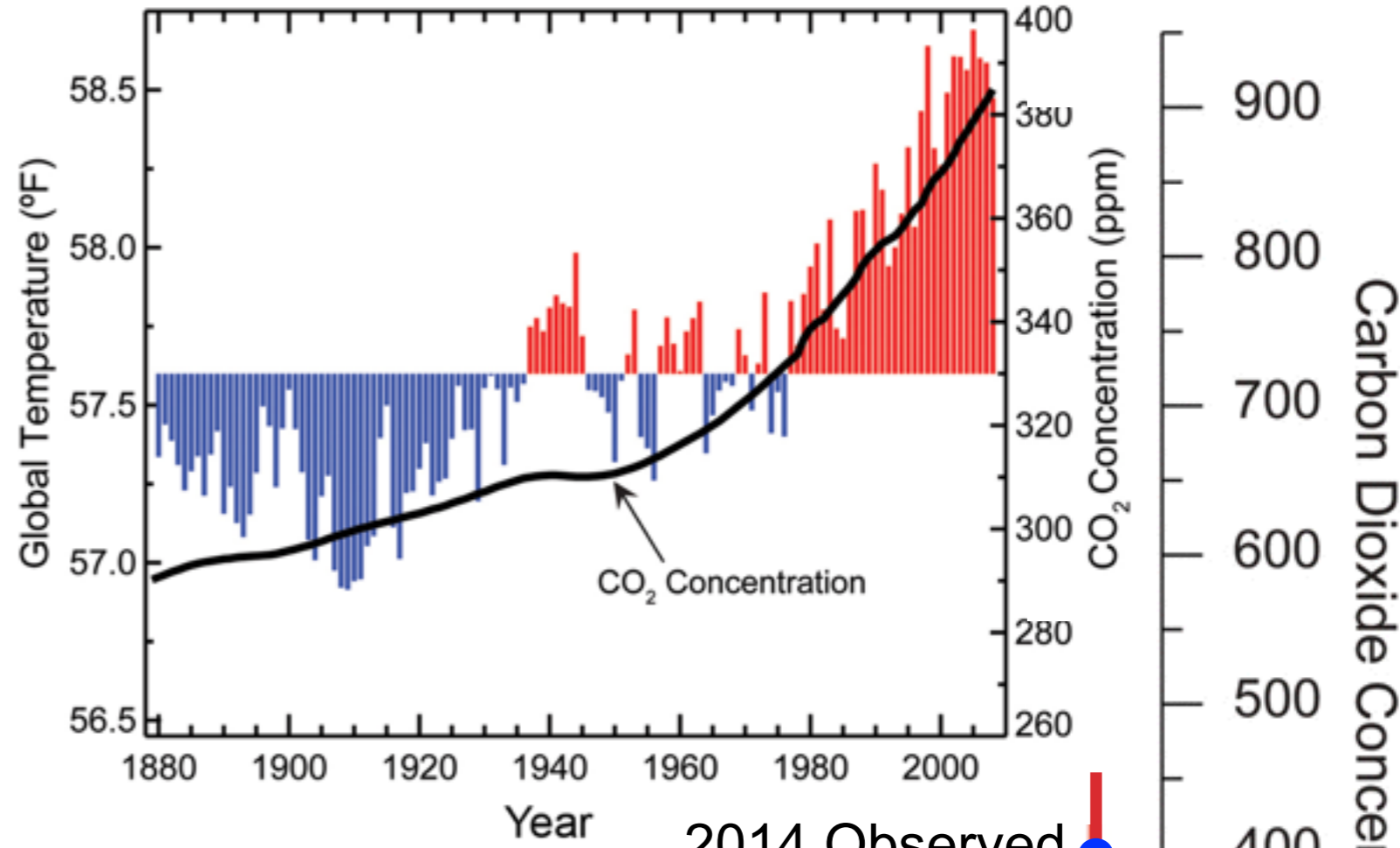
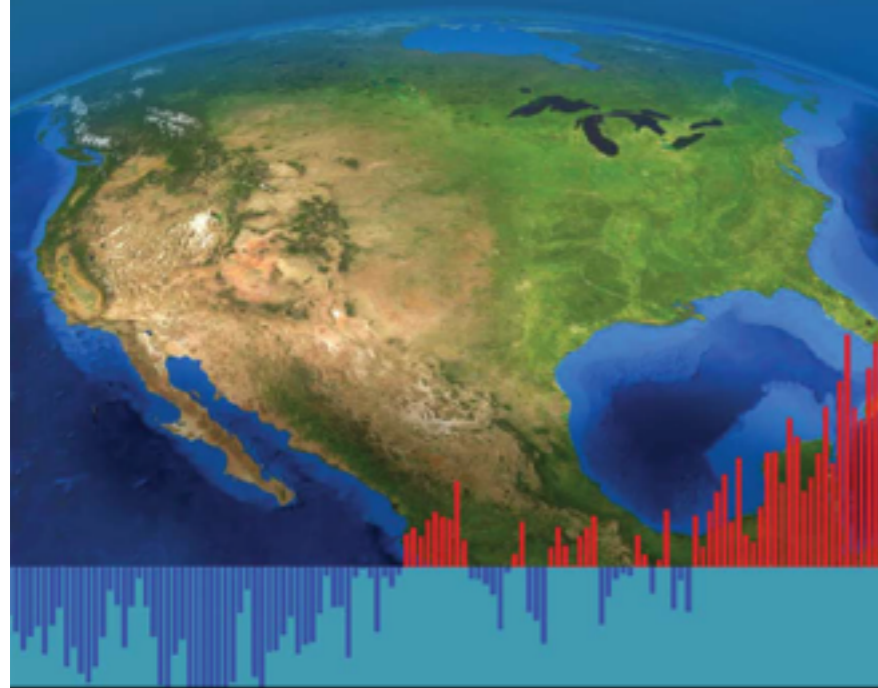
Atmospheric
Carbon
Dioxide
(ppm)



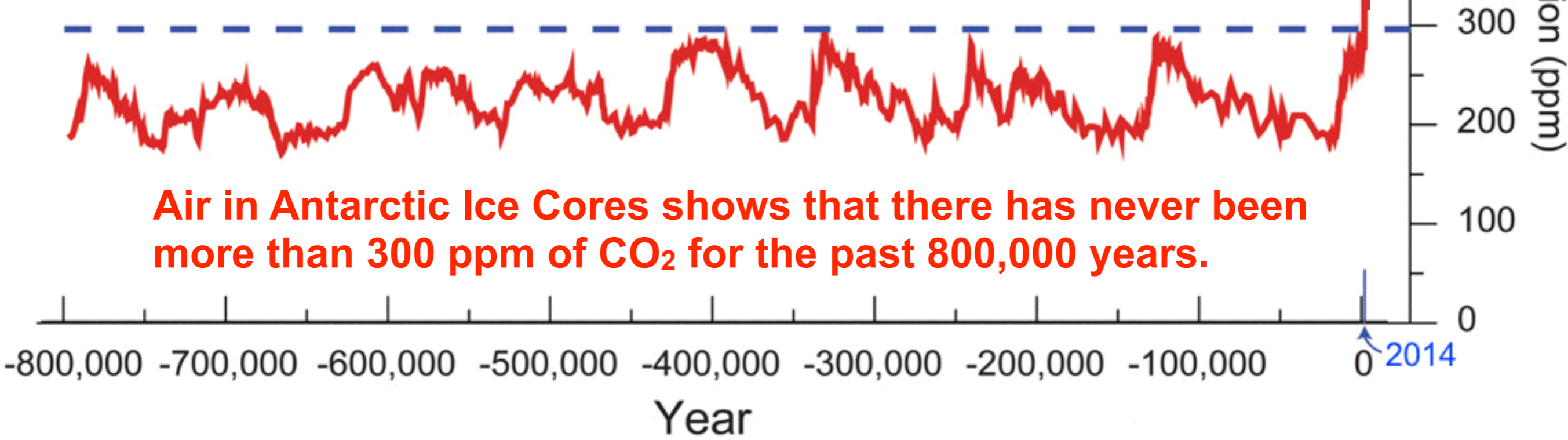
Human
Carbon
Dioxide
Emissions
(Gigatons of
Carbon per
year)

Global Climate Change Impacts in the United States

U.S. GLOBAL CHANGE RESEARCH PROGRAM



2014 Observed

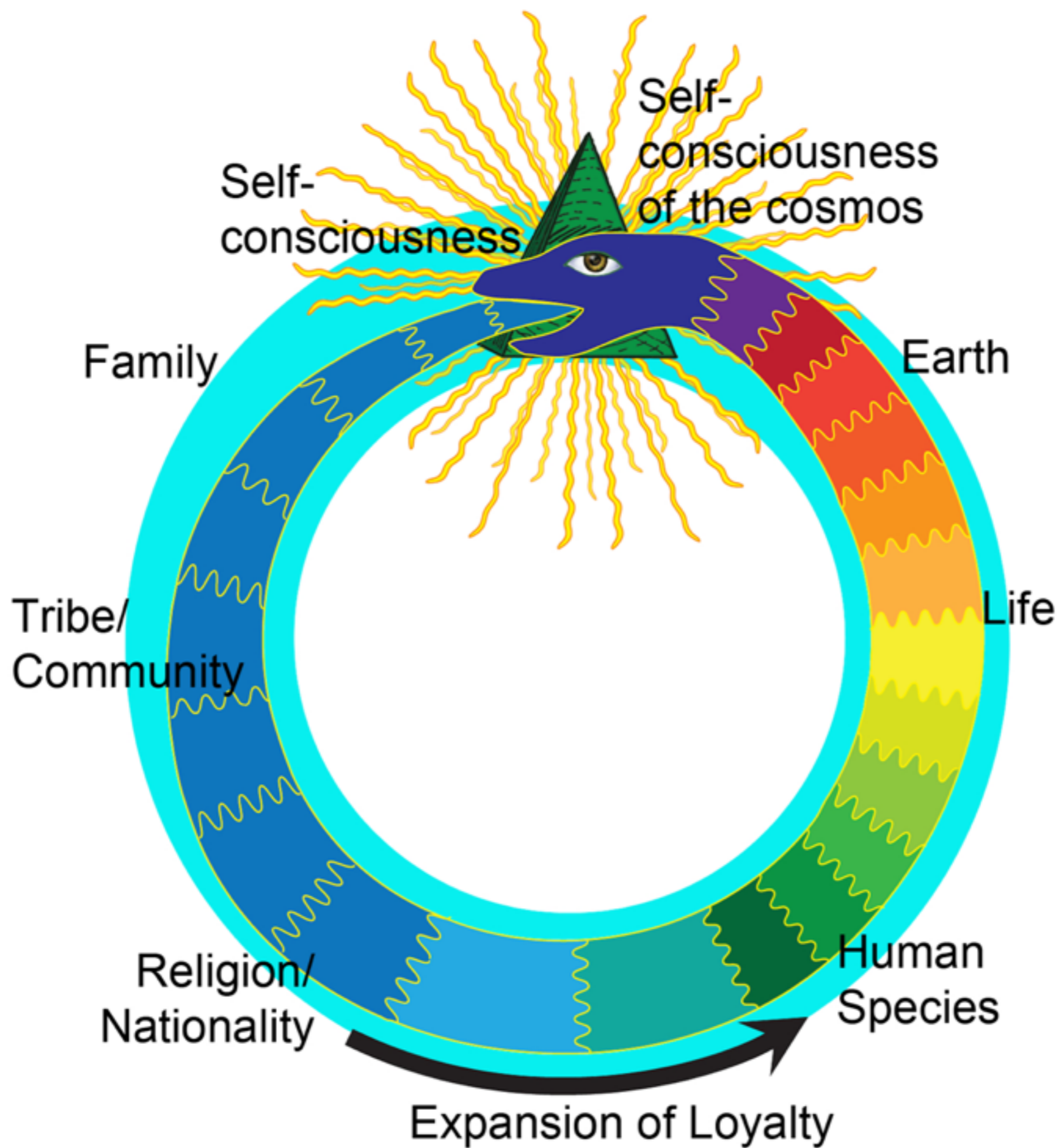


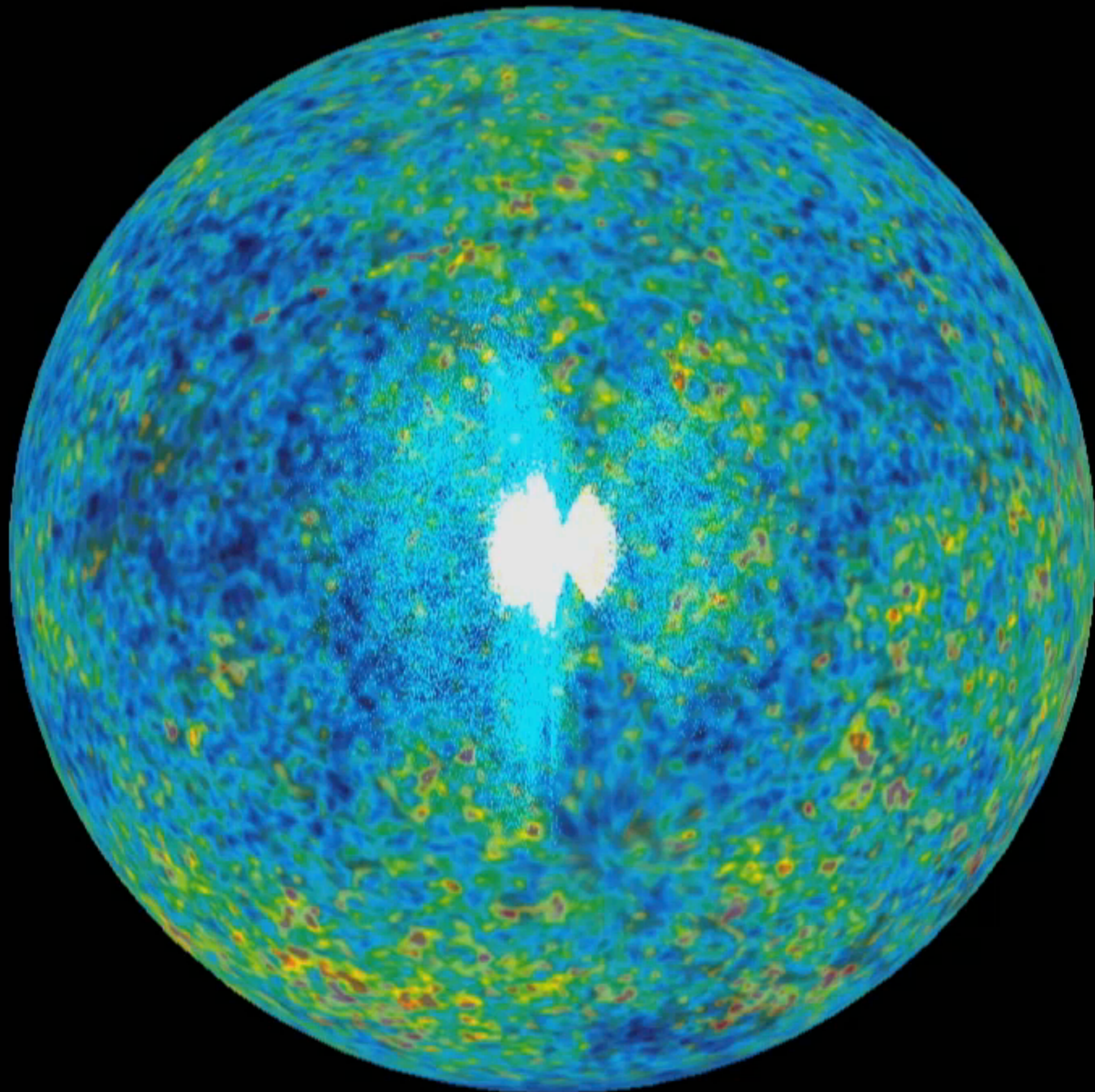
Air in Antarctic Ice Cores shows that there has never been more than 300 ppm of CO₂ for the past 800,000 years.

THEATER
AN INCONVENIENT TRUTH

THEATER
A REASSURING LIE

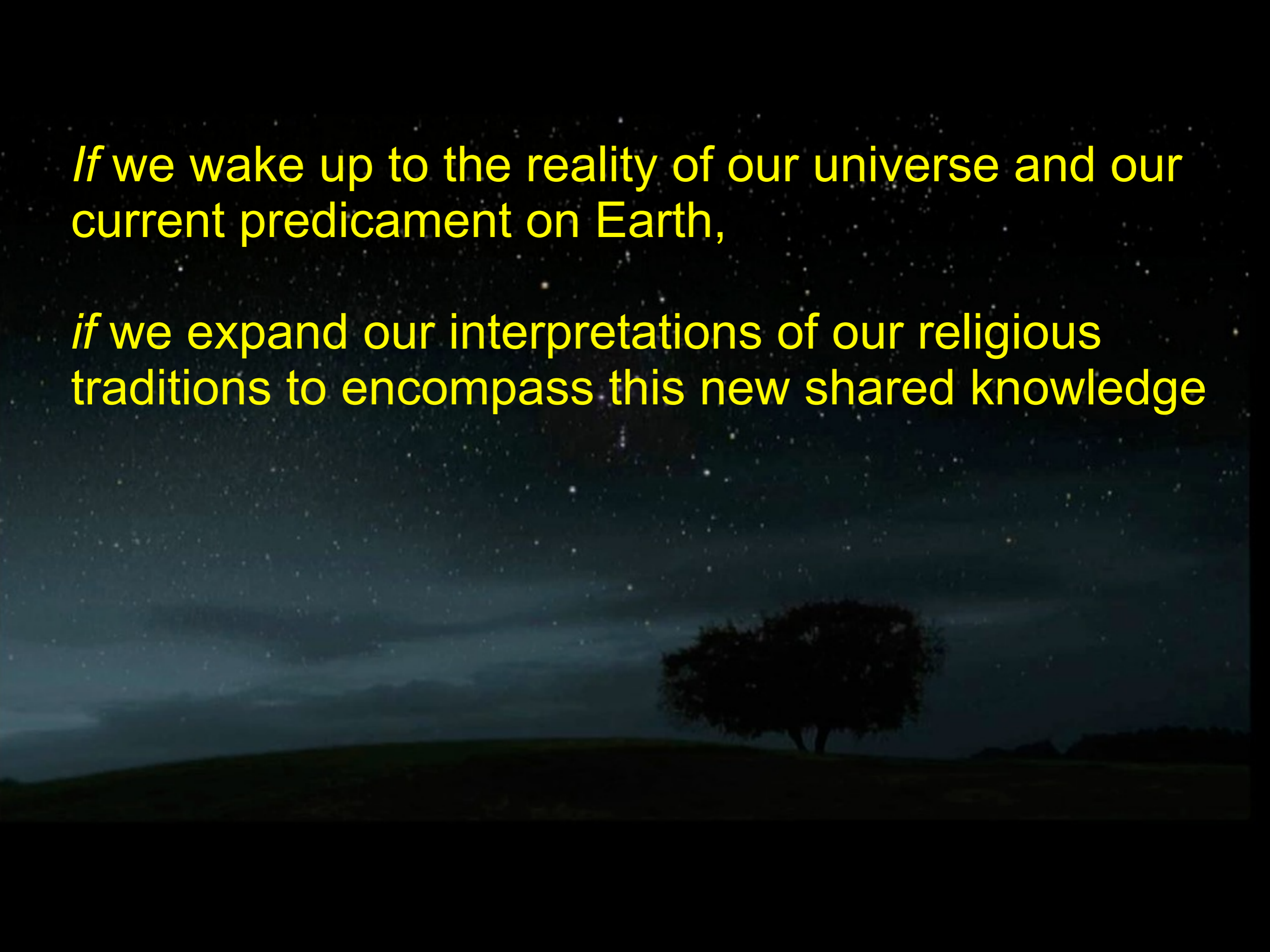






If we wake up to the reality of our universe and our current predicament on Earth,

if we expand our interpretations of our religious traditions to encompass this new shared knowledge

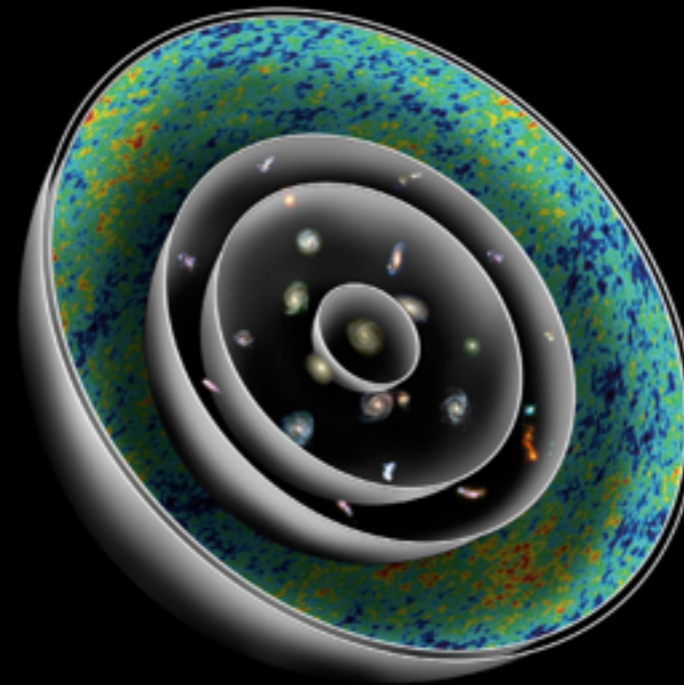


if we begin to teach this new picture of the universe to our children and integrate it into our thinking and our art

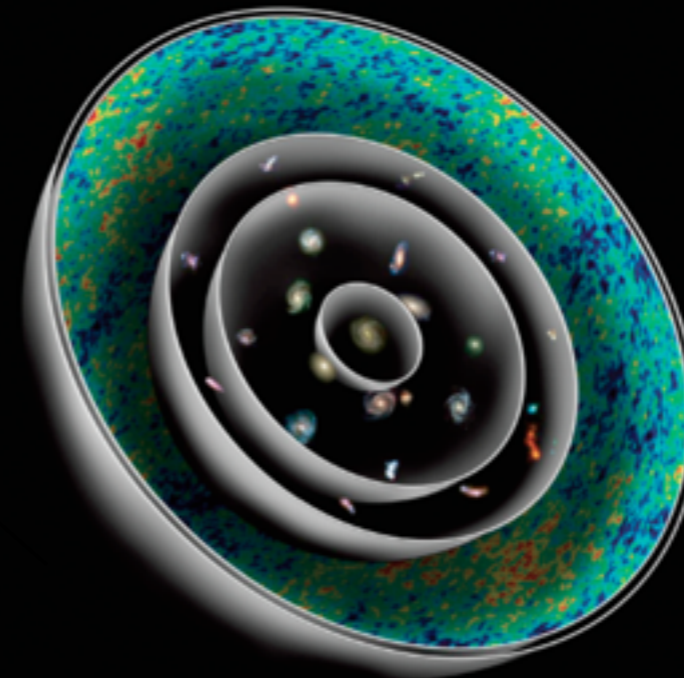
then we will begin to think cosmically



THINK COSMICALLY
ACT GLOBALLY
EAT LOCALLY



THINK COSMICALLY
ACT GLOBALLY
EAT LOCALLY



Book Website with images and videos:

New-Universe.org

Visit us on Facebook at

**The New Universe
and the Human Future**

THE NEW UNIVERSE
AND THE
HUMAN FUTURE

How a Shared Cosmology Could Transform the World

NANCY ELLEN ABRAMS AND JOEL R. PRIMACK

Credits

Video - Author	Music: Title	Artist	Album
Voyage to Virgo Cluster - Donna Cox and Stuart Levy for R. Brent Tully et al.	"Abraham was Listening"	Nancy Abrams	<i>Alien Wisdom</i>
Powers of Ten Zoom - <i>Cosmic Voyage</i> IMAX film, by permission of Producer/Director Bayley Silleck			
Sloan Digital Sky Survey - Mark Subbarao et al.	"Handwriting of God"	Nancy Abrams	<i>Alien Wisdom</i>
Expanding Simulation - Ben Moore et al.	"French Resolution"	L. Subramanian & Stephane Grapelli	<i>Conversations</i>
Bolshoi Cluster Fly-Thru - Joel Primack, Anatoly Klypin, Chris Henze	"Her Knees Deep in Your Mind"	Ray Lynch	<i>Nothing Above My Shoulders But the Evening</i>
Return to Earth - Denise Gallant et al.	"Bachianas Brasilieras #5"	Hector Villa-Lobos	<i>Classical Moods</i>