

Vorlesungsreihe

ASTRONOMIE

FH Astros
Sommersemester 2017



Die FH Astronomen – der gemeinsame Schreibtisch

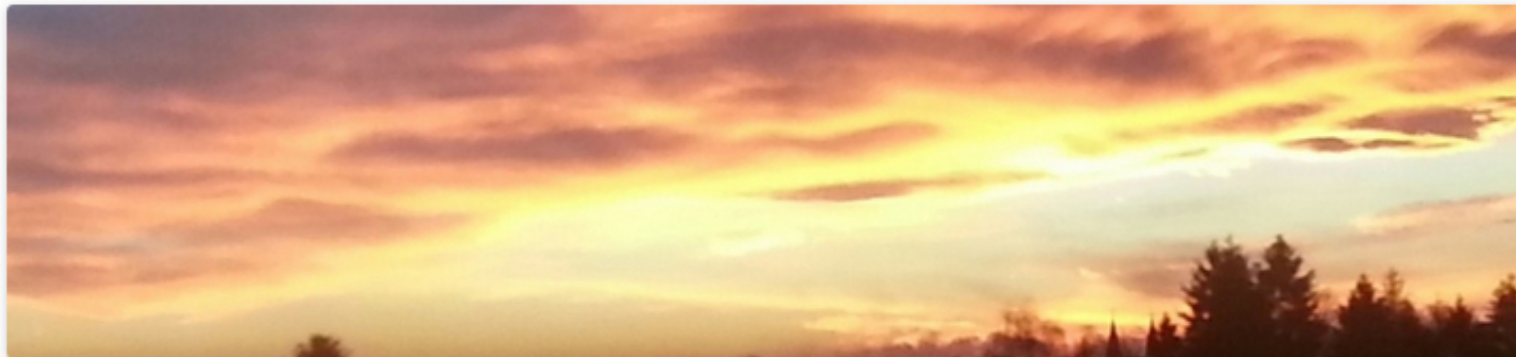
Wir bewohnen den Elfenbeinturm zu unserer gedankenverlorenen Erbauung.

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FHAstros.wordpress.com

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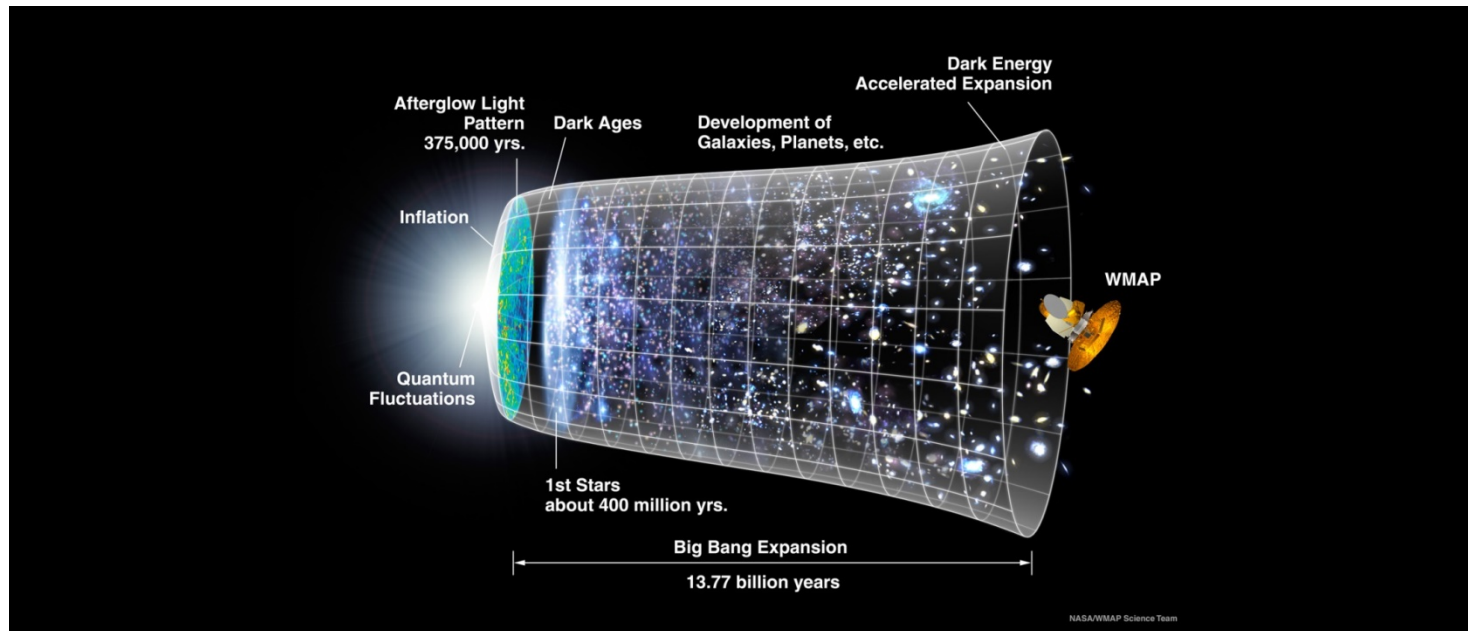


18. April 2017 – 18:00 Uhr, FH Wels, A2

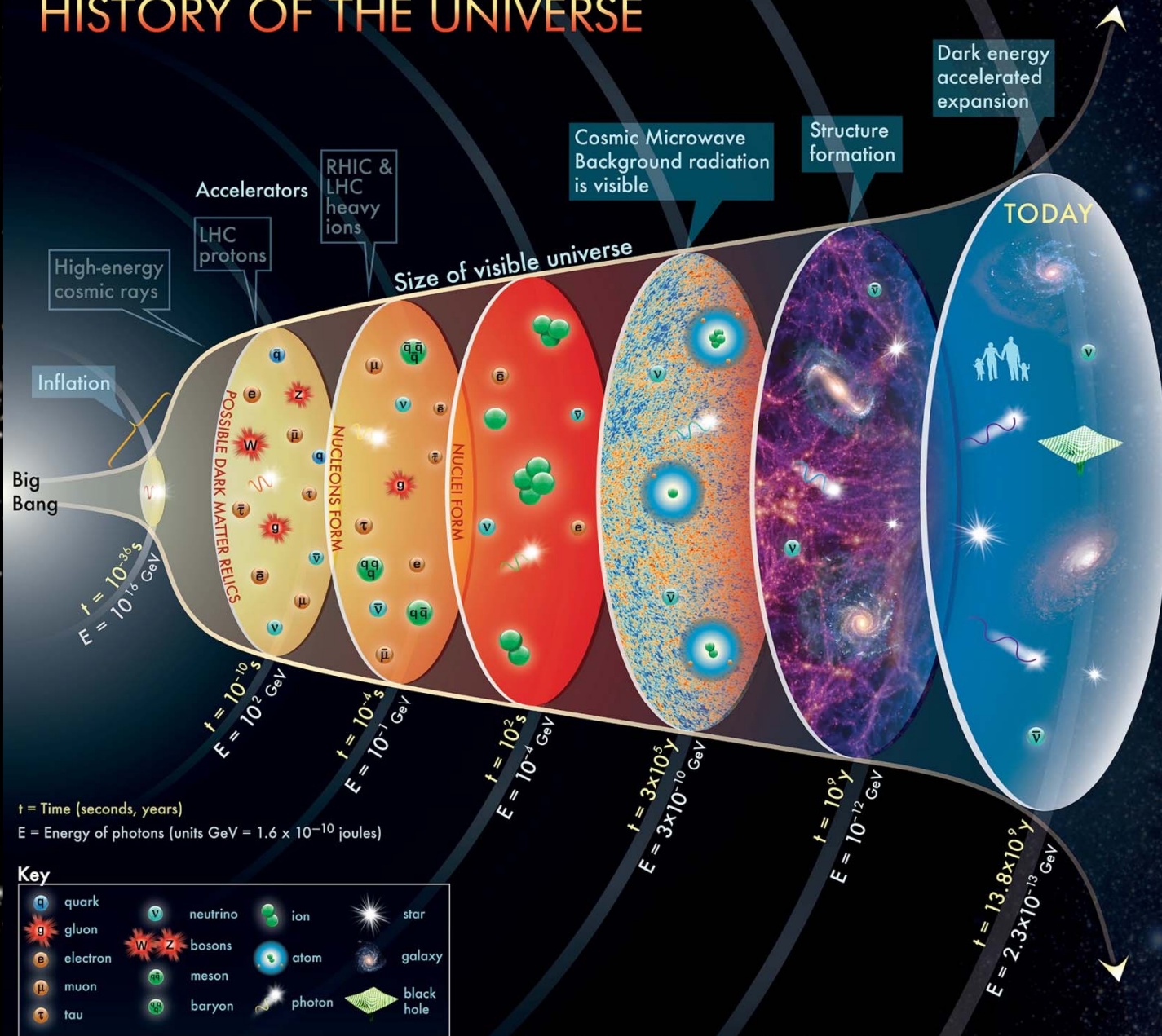
Kosmologie - Aktueller Stand, Unsicherheiten, Entwicklungen (Kurt Niel)

May, 31st 2017 – 6 pm, FH Wels, A1

Cosmology – Actual status, uncertainties, developments (Kurt Niel)



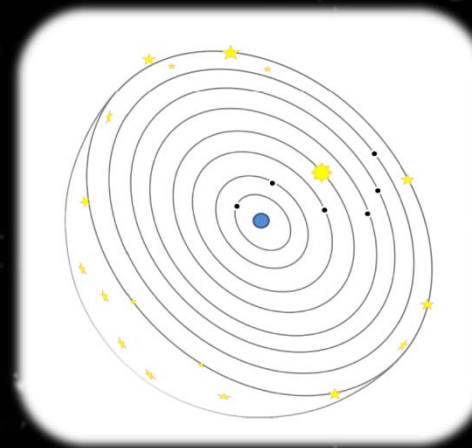
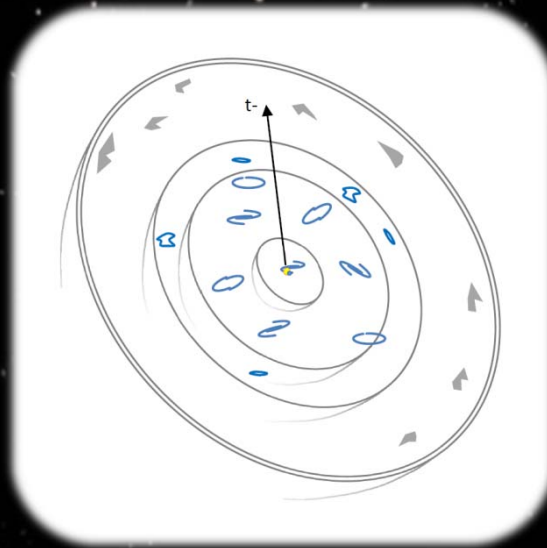
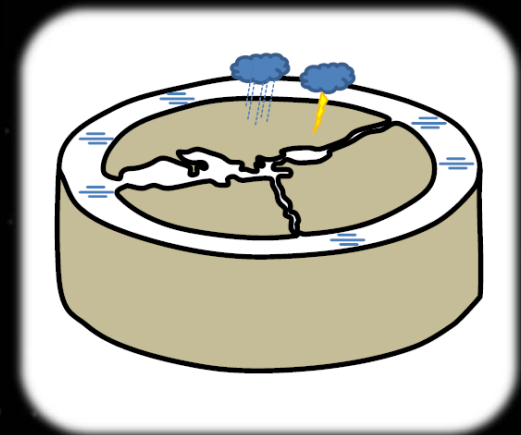
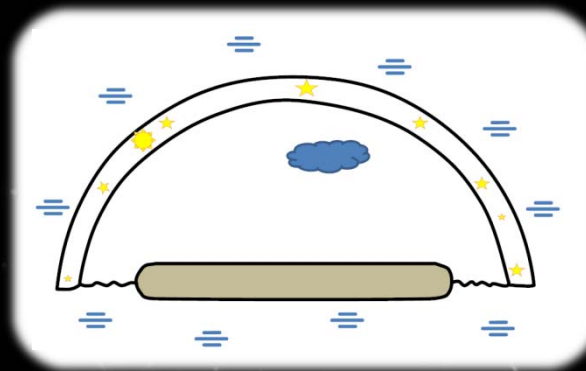
HISTORY OF THE UNIVERSE

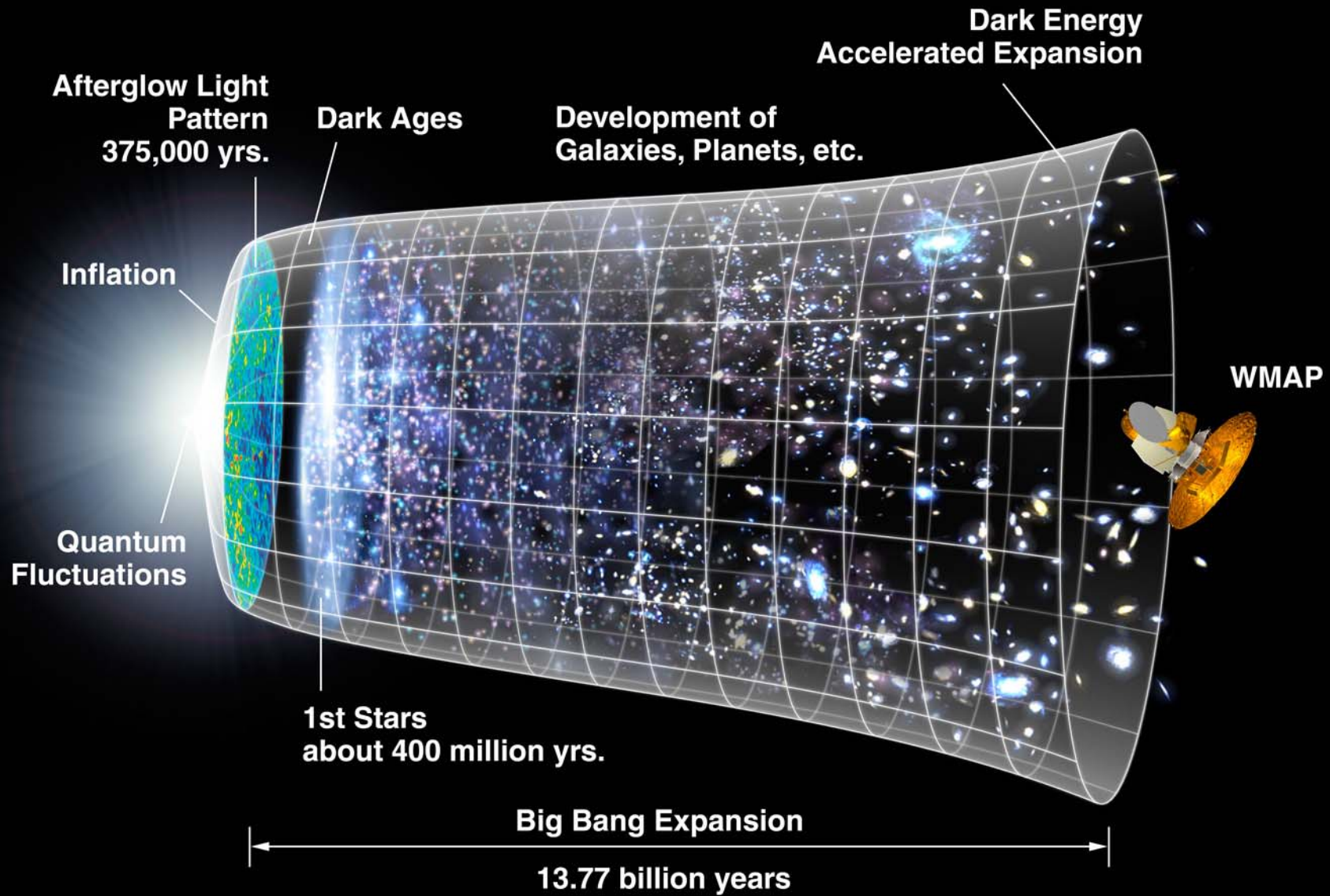


The concept for the above figure originated in a 1986 paper by Michael Turner.

Particle Data Group, LBNL © 2015

Supported by DOE

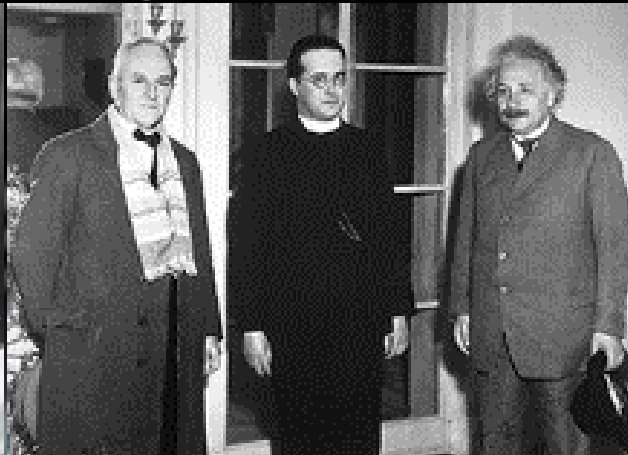




NASA/WMAP Science Team



Edwin Hubble
1924 galaxy ex Milky Way
1929 red shift - expansion



Robert Millikan George Lemaître Albert Einstein
1910 oil drops/elementary charge
1927 equation of expansion
1917 relativity



Alexander Friedmann
1927 equation of expansion



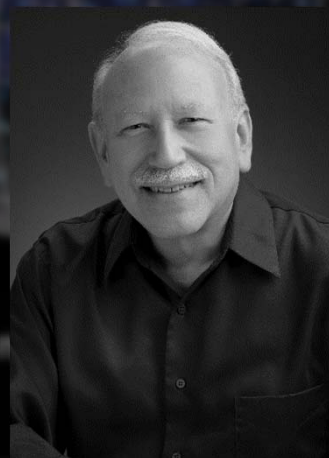
Stephen Hawking
1971 event horizon black hole



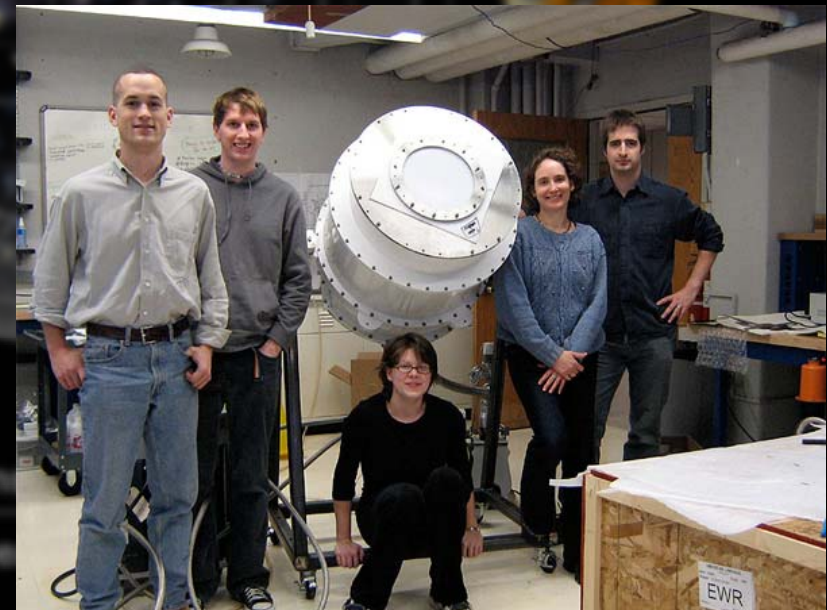
Alan Guth
1981 inflate universe



Roger Penrose
1996 quantum gravitation
2010 CCC



Joel R. Primack
2011 CANDELS,
Bolshoi simulation



Team QUIET e.g. Columbia University
2011 measurement of CMB polarization - QUaD

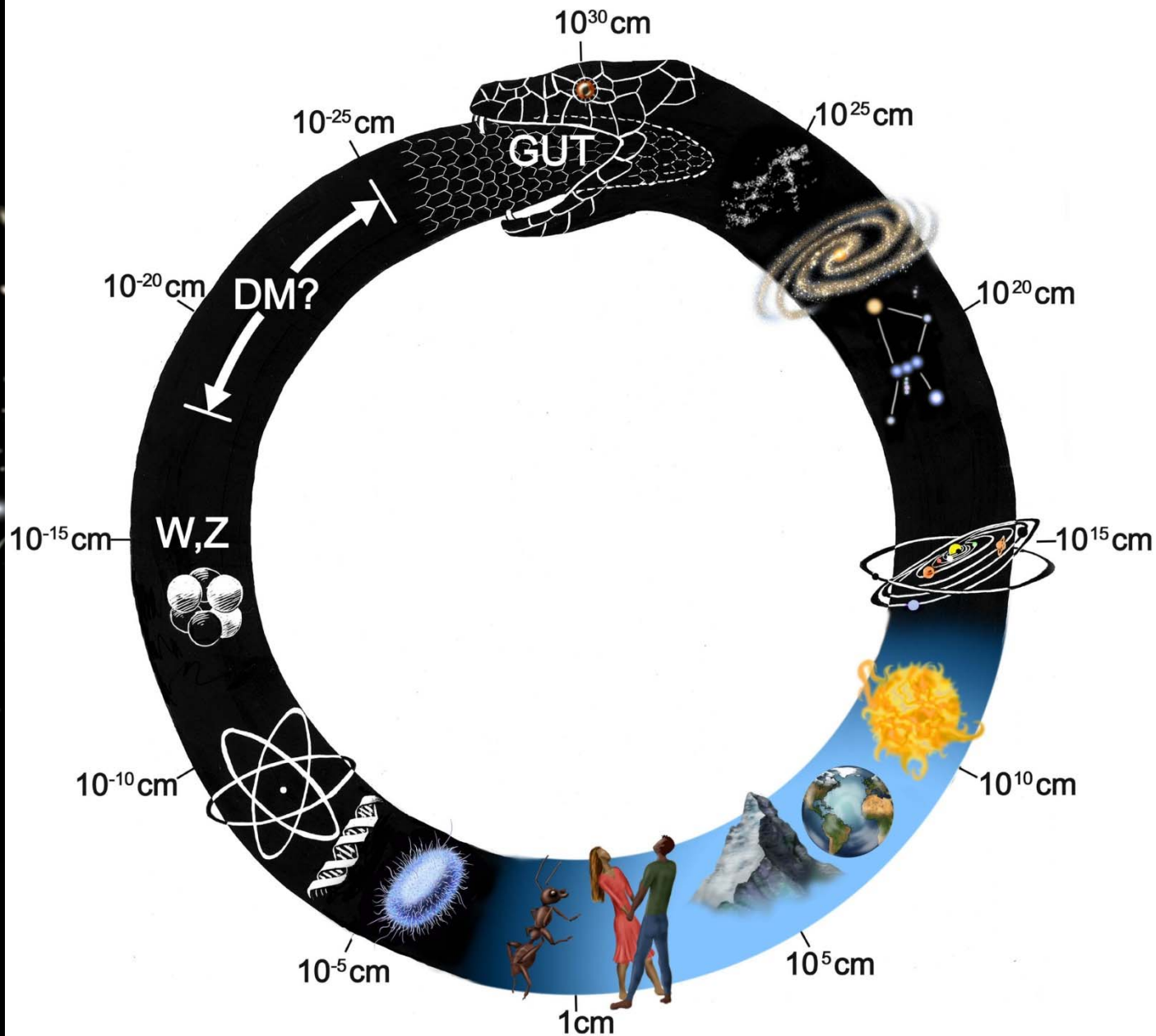
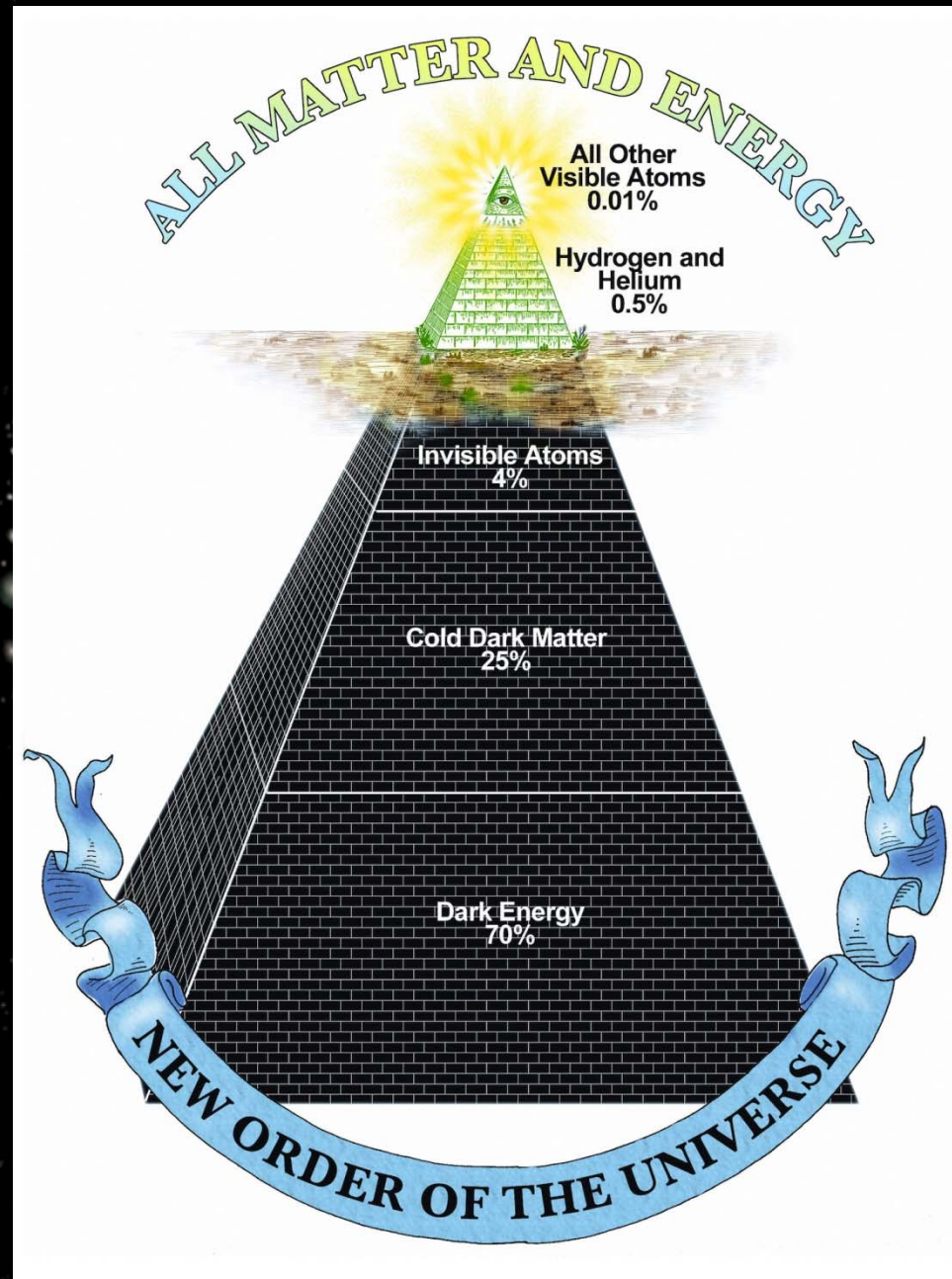
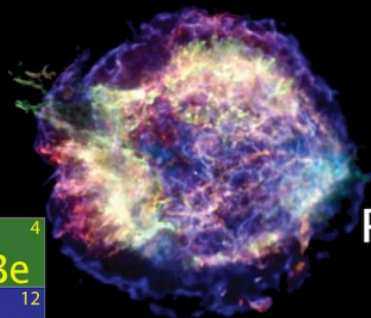


Image: <http://new-universe.org> Primack/Abrams

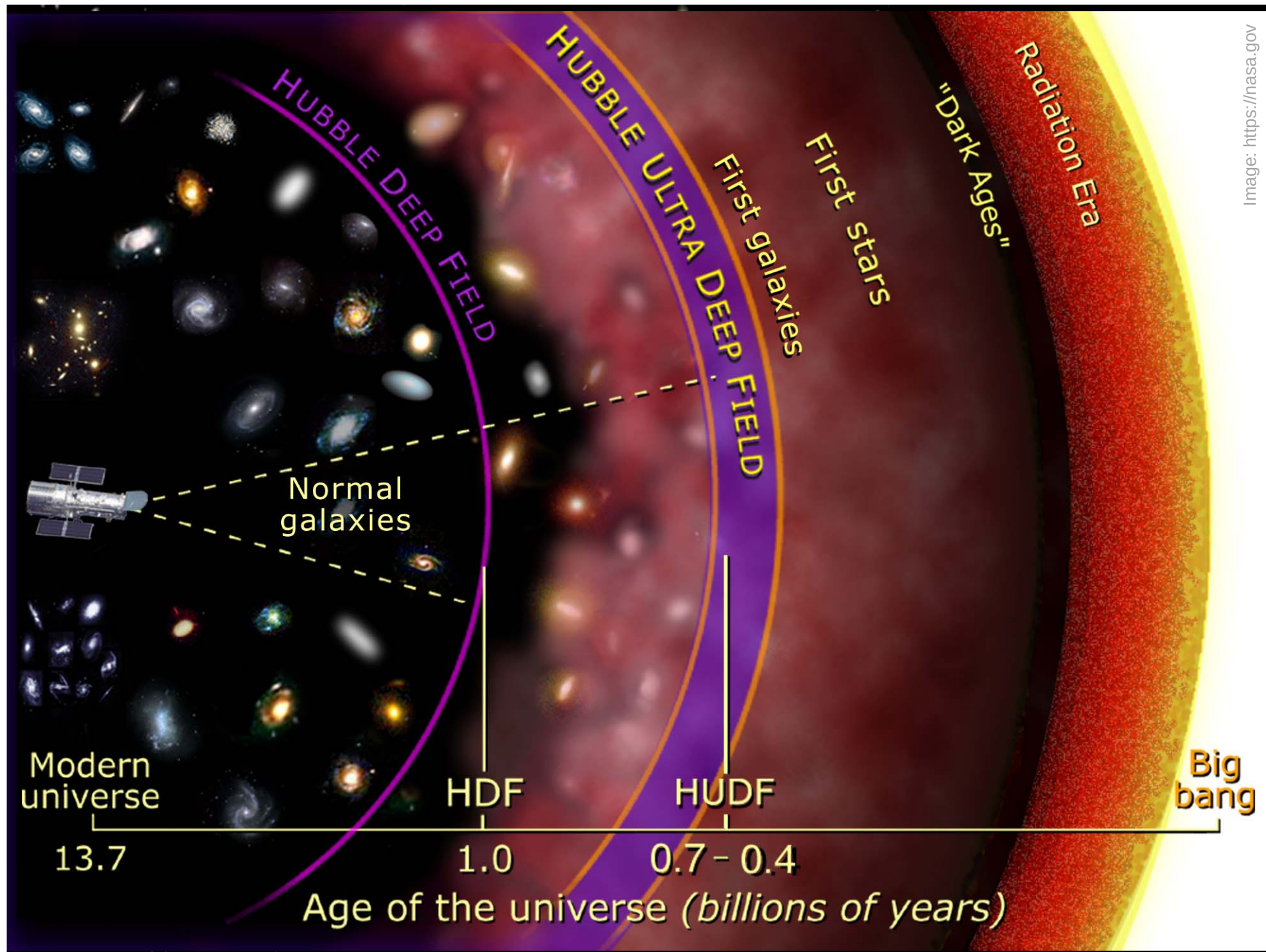




Periodic Table of Elements

1 H	2 He																	3 Li	4 Be																	5 B	6 C	7 N	8 O	9 F	10 Ne																				
11 Na	12 Mg																	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar																	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr				
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe																	55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn										
87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn																	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og																	119 Uue	120 Uub	121 Uut	122 Uuq	123 Uup	124 Uuh	125 Uus	126 Uuq	127 Uup	128 Uuh	129 Uus	130 Uuq

Dull gray - Made in Lab



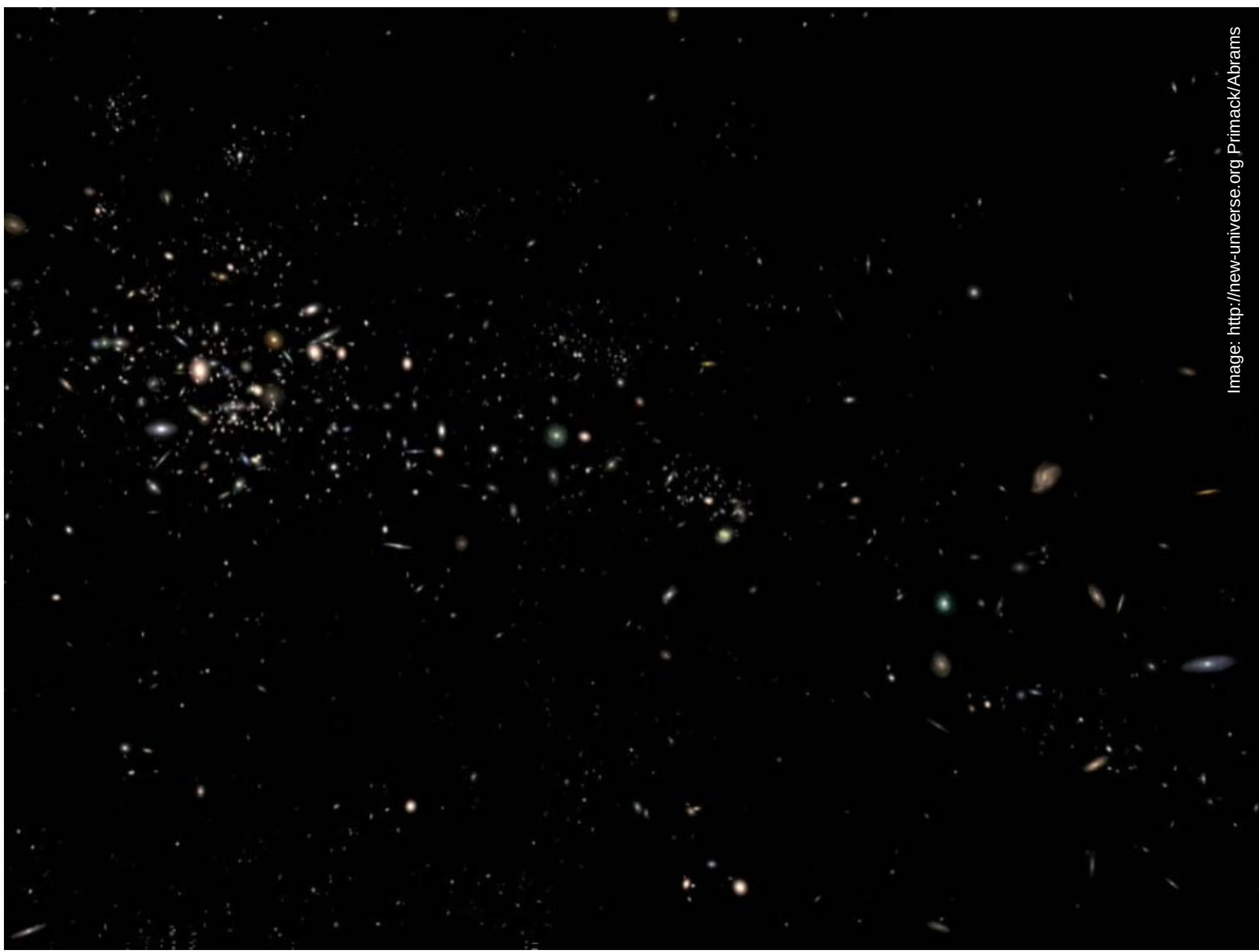


Image: <http://new-universe.org> Primack/Abrams

POWER

90°

2°

1°

0.5°

0.2°

0.1°

Angular Scale

Double Dark Theory

6000

5000

4000

3000

2000

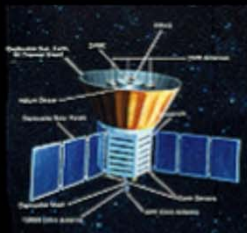
1000

0

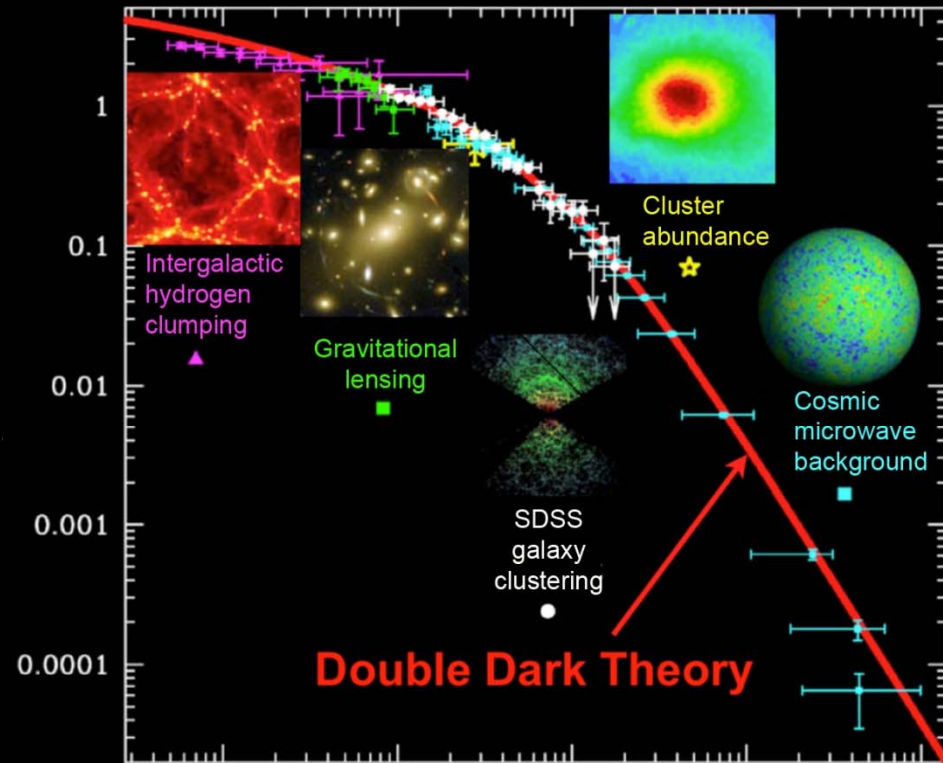
10

1

Cosmic
Background
Explorer
COBE
1992



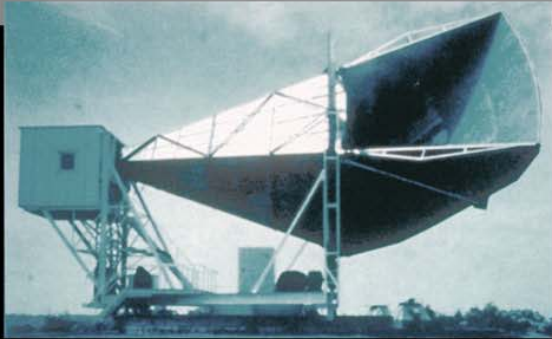
Density fluctuations



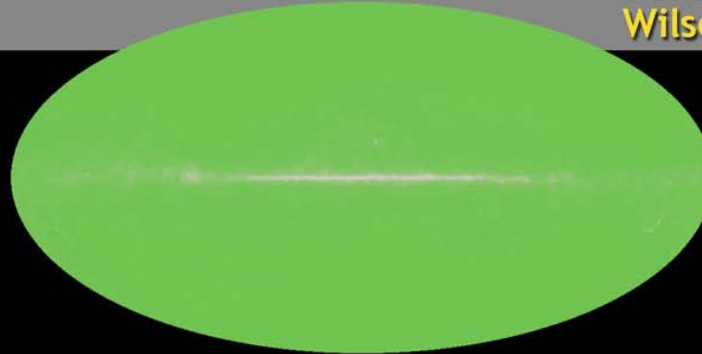
Double Dark Theory

Scale (millions of lightyears)

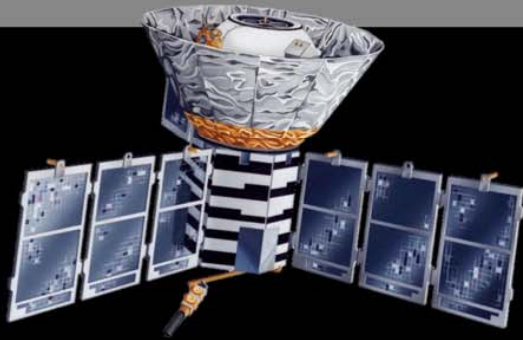
1965



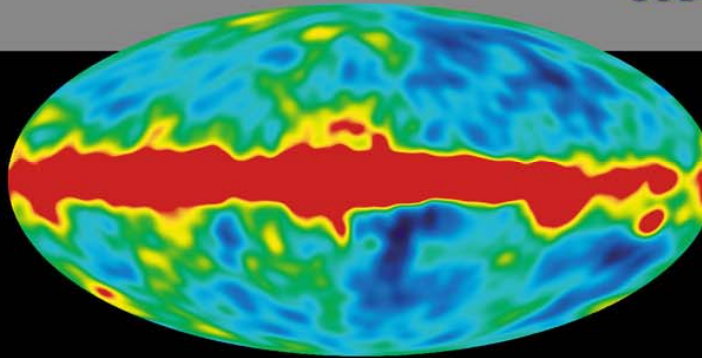
Penzias and
Wilson



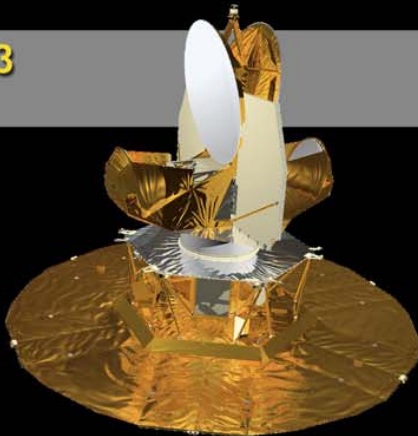
1992



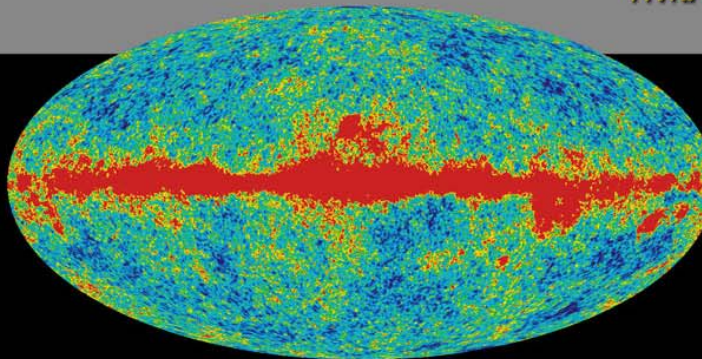
COBE



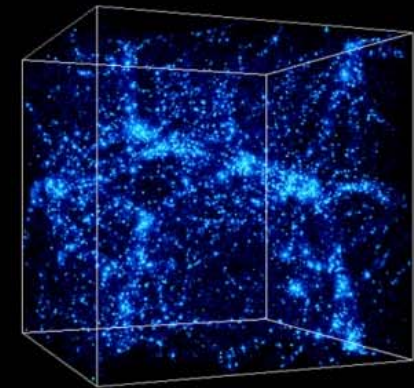
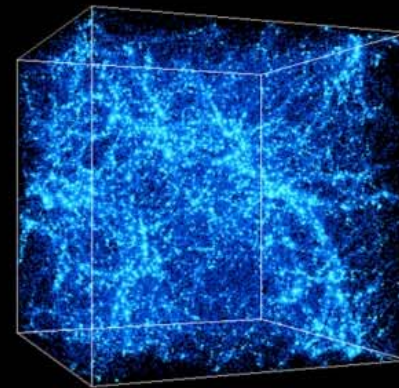
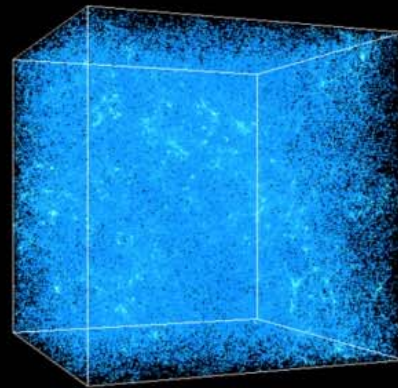
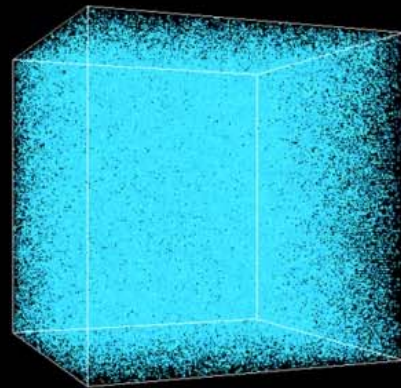
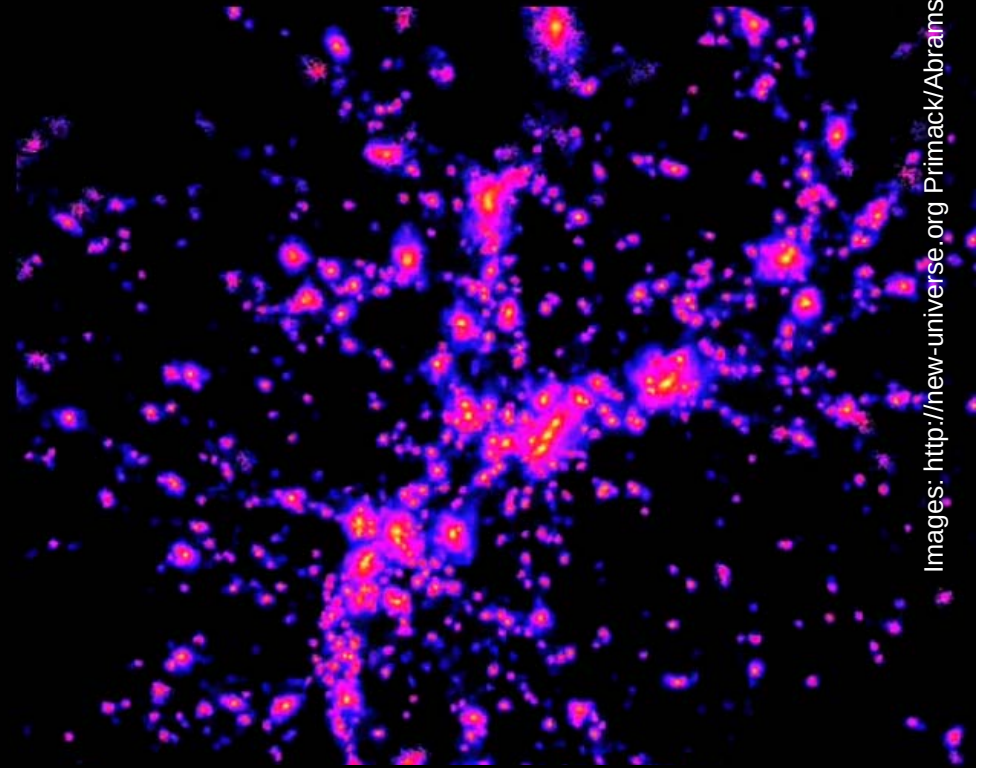
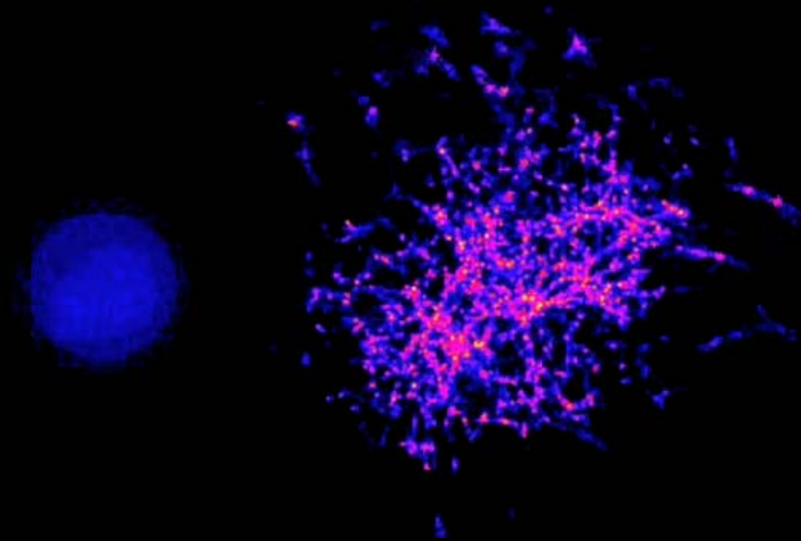
2003



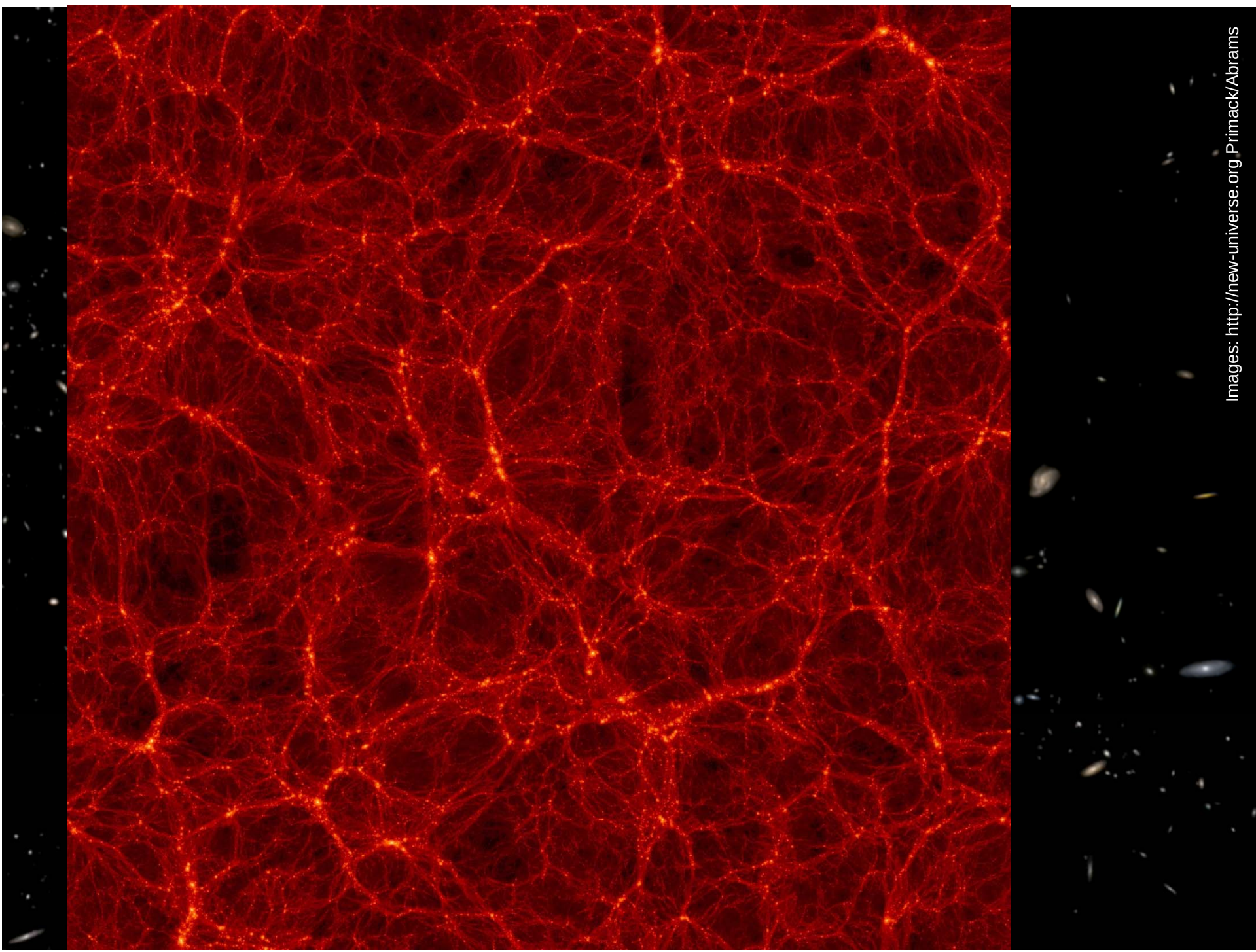
WMAP



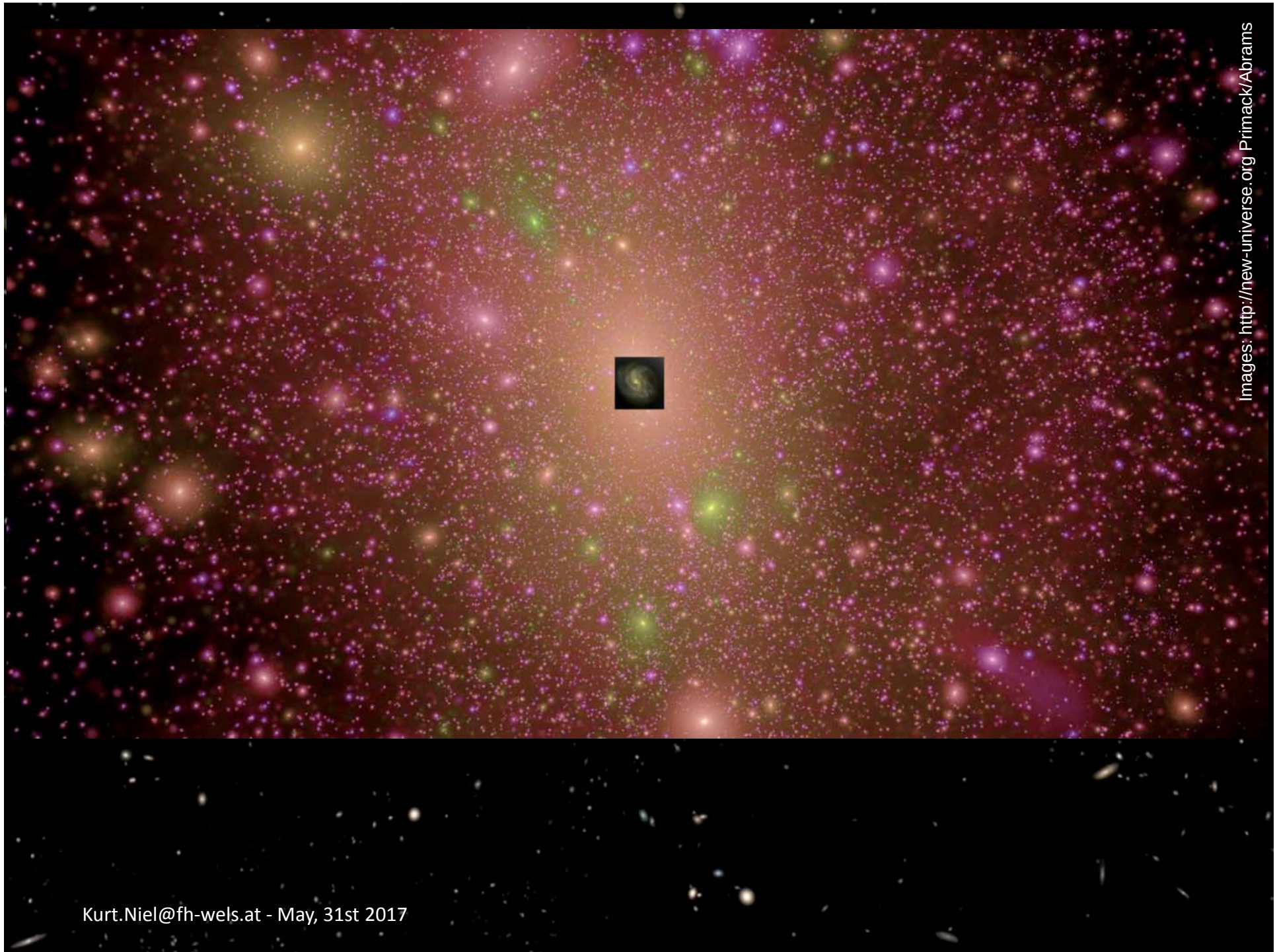
Expansion...



Images: <http://new-universe.org> Primack/Abrams



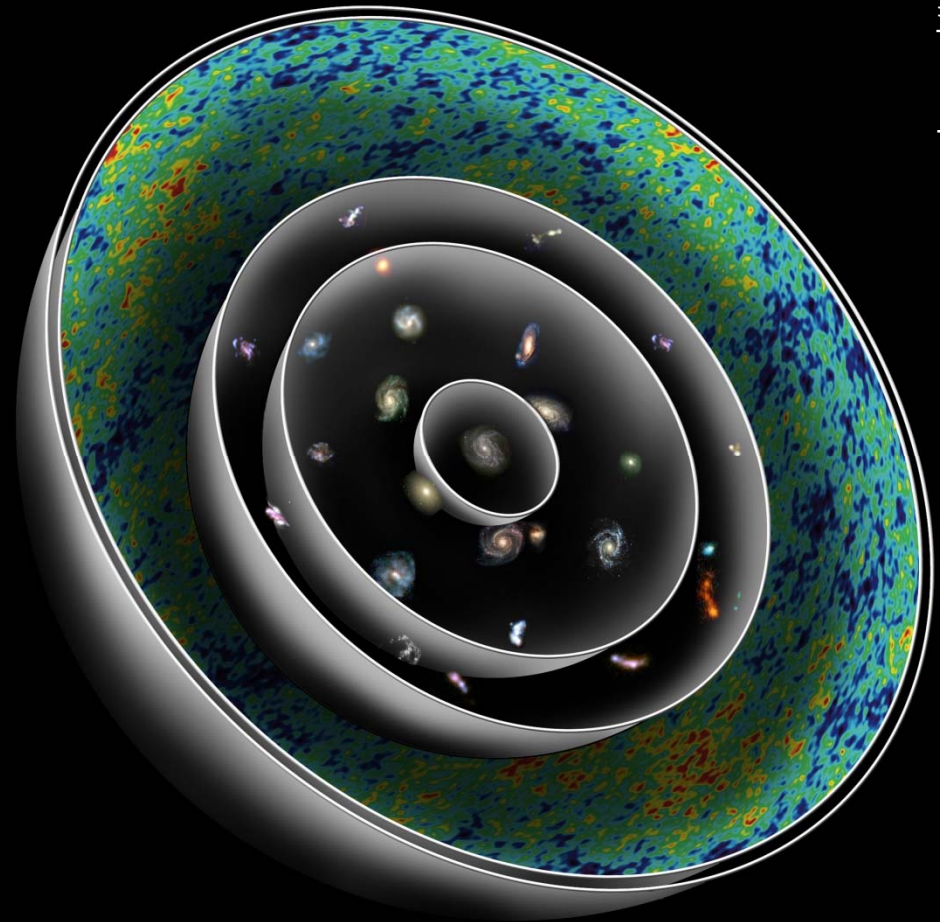
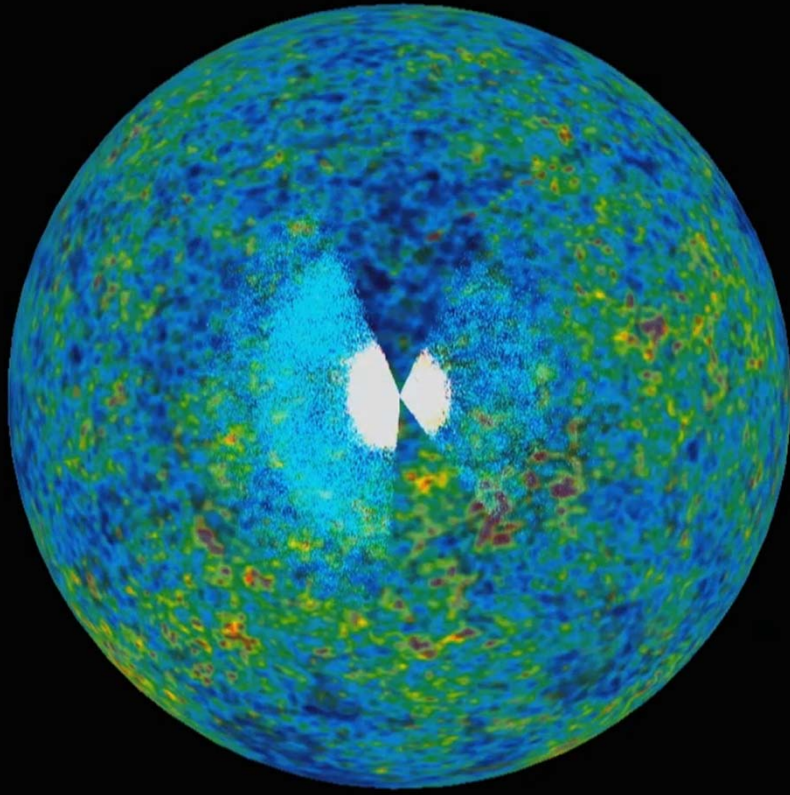
Images: <http://new-universe.org> Primack/Abrams

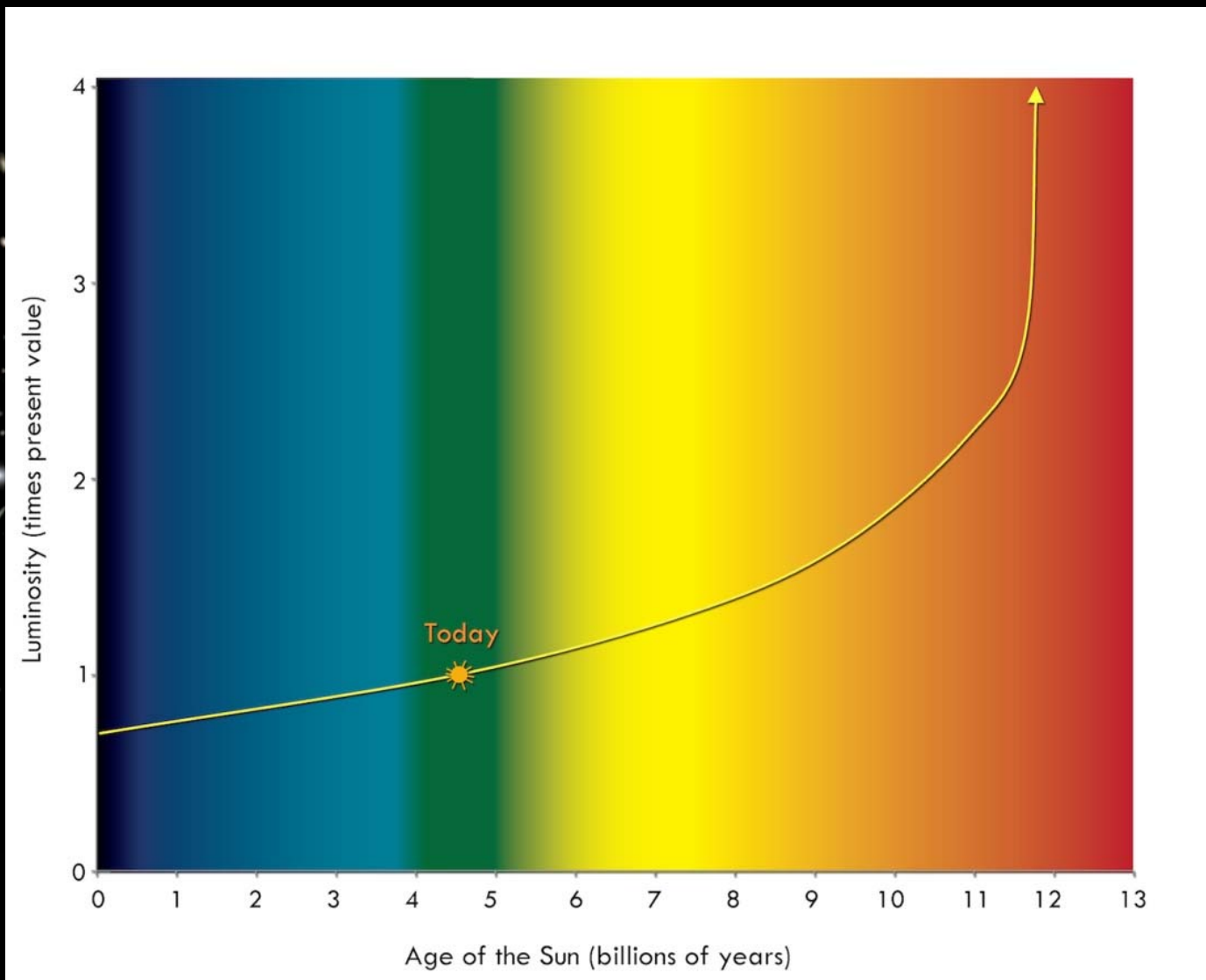


Images: <http://new-universe.org> Primack/Abrams

Kurt.Niel@fh-wels.at - May, 31st 2017

Real image of the hole universe
based on measurements (no simulation!)







Uncertainties

- Even until now no direct evidence of dark matter (Axon?)
- Dark energy as a field scalar within space – no exploration
- Model of inflation: too much parameter variability; either too simple or too complicate - does not strictly define possible genesis

Alternatives

MOND – Modified Newtonian Dynamics 1987 e.g. Erik Verlinde

<https://www.wired.com/2017/01/case-dark-matter/>

Explains twisting of galaxies without dark matter

Space & time and length & mass convertible together – 2010 Wun-Yi Shu

While the universe is expanding permanently time is converted into space and mass into length – speed of light and gravitational constant are not constant

“The Geometry of the Universe”

<https://arxiv.org/abs/1007.1750>

SOURCES

Standard model - Spektrum.de

<http://www.spektrum.de/lexikon/physik/standardmodell-der-kosmologie/13743>

Bolshoi cosmological simulation

<http://hipacc.ucsc.edu/Bolshoi/>

Aquarius simulation

https://www.eso.org/public/germany/videos/aquarius_springel/

Joel R. Primack / Nancy Ellen Abrams

<http://viewfromthecenter.com/>

<http://new-universe.org/index.html>

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18. April 2017 – 18:00 Uhr, FH Wels, A2

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May, 31st 2017 – 6 pm, FH Wels, A1

Cosmology – Actual status, uncertainties, developments (Kurt Niel)

6. Juni 2017 – 18:00 Uhr, FH Wels, A2

Entwicklungen von Messinstrumenten für den Raumflug -

Funktionell, autark, strahlungsresistent, langlebig, irreparabel

(Dr. Manfred Steller, Institut für Weltraumforschung, Österreichische Akademie der Wissenschaften)

26. Juni 2016 – ggf. Exkursion

noch offen

Cosmologic Epoch

- Planck-epoch
 $< 10^{-43}$ seconds
all four forces united
- GUT-epoch (Grand Unified Theory)
 $< 10^{-33}$ to 10^{-30} s
Inflation, expansion 10^{30} to 10^{50}
- Quark-epoch (electroweak)
 $< 10^{-7}$ s
Quarks, Leptons, Photons; unbalanced matter/antimatter Baryon syntheses
- Hadron-epoch
 $< 10^{-4}$ s
Protons, Neutrons according Antiparticle; Muons, e^- , e^+ , Neutrinos, Photons
- Lepton-epoch
 < 10 s
Muons decay, $e^- e^+$ annihilate (produce Photons)
- Primordial nucleon syntheses
 < 3 min
H, He, Li are generated
- Radiation-epoch
 $< 300\,000$ j
Universe opaque; boarder of visibility CMB (Cosmic Microwave Background)
- Matter-epoch
until today
Universe transparent, galaxies develop.

Technical Specification Universe

- Age: 13.77 bn years
- Elongation: 100 bn ly (10^{30} cm)
- Volume: 10^{87} cm³
- Number of Galaxies: 100 bn, each 100 bn stars, each 10^{58} Protons
- Density of Protons: 10^{-7} per cm³ or 1 per 10 m³
- Density of Photons: 400 per cm³ (from Planck & $T_{\text{background radiation}}$)
- Density of Molecules air: $2,55 \cdot 10^{19}$ per cm³

Physical Limits – Planck

- time: 10^{-43} s
- length: 10^{-35} m