11. Beschleunigte Expansion des Universums durch Galaxien-Löcher und Galaxien-Wände

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First let us discuss a possible alternative Explanation for the Acceleration of the Expansion.

- Is it allowed to average the universe over 500 Mpc to otain a homogeneous universe?

- Does such an averaged universe develope in the same way as a inhomogeneous universe with Galaxy Walls and Voids (empty holes) and averaged afterwards?

Is the accelerating expansion an Illusion?

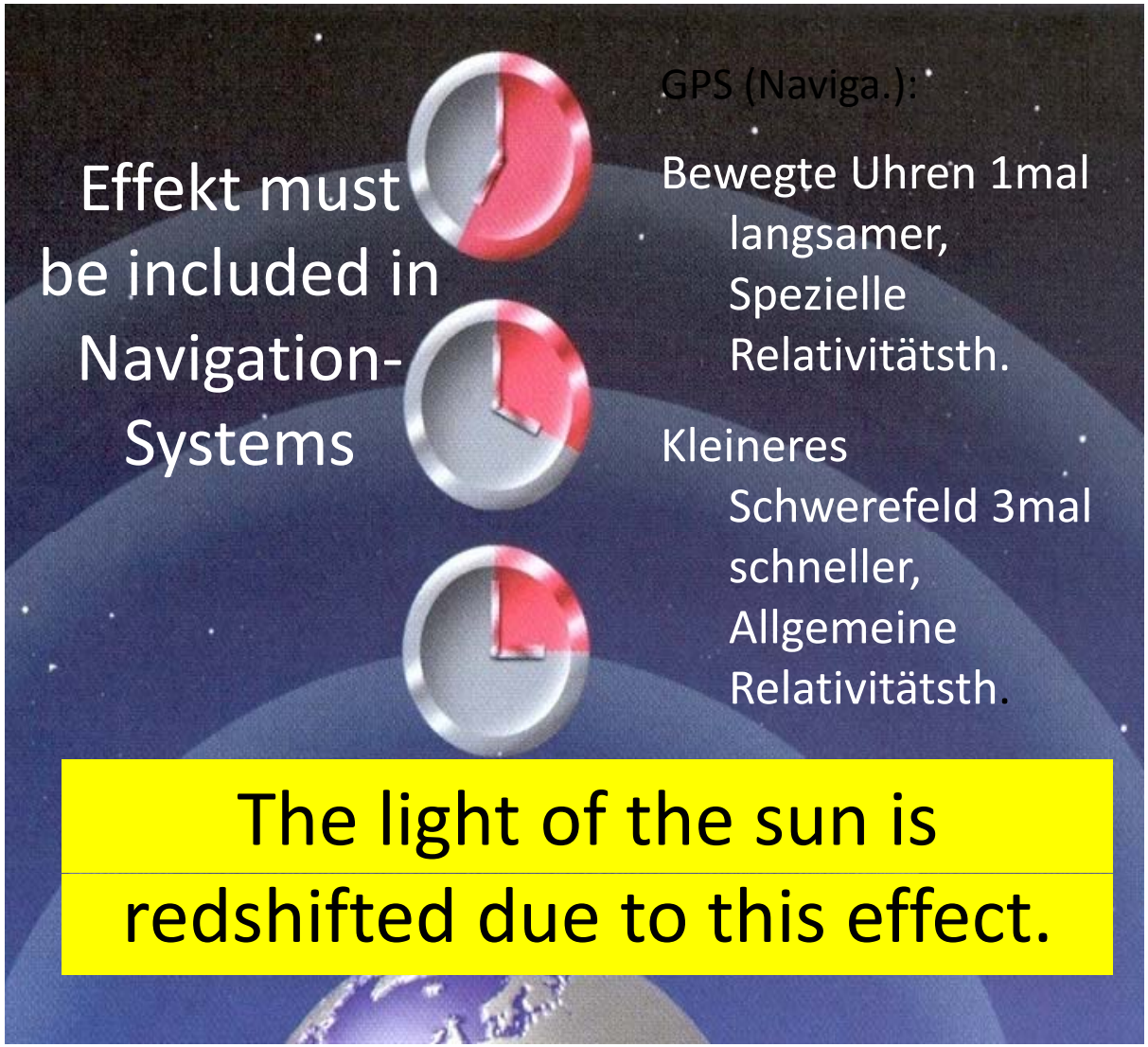
- David L. Wiltshire: „Cosmic clocks, cosmic variance and cosmic average“ New Jounal of Physics 9 (22. October 2007) 377-440
- David L. Wiltshire: „Exact Solution of the Averaging Problem in Cosmology“ Phys. Rev. Lett. 99 (21. December 2007) 251101.
- Thomas Buchert: „Dark Energy from Structure“ arXiv: astro-ph/0707.2153; 3. December 2007.
- Earlier papers of Kolb, Wiltshire and Leith:
- B. M. N. Carter, Leith, Wiltshire et al. :“Type Ia supernovae tests of fractal bubble universe with no cosmic acceleration“ arXiv: astro-ph/0504192v3
- Many opposing papers.

Popular article in the January 2008 issue of „Sterne und Weltraum“ with the title:

„Ist die Dunkle Energie nur eine Fata Morgana“.

This article does not point out, that the effect is mainly due to the different expansion velocities in the Galaxy Walls and in the Voids.

1. Clocks run slower in Galaxy Walls than in the Voids (empty space).



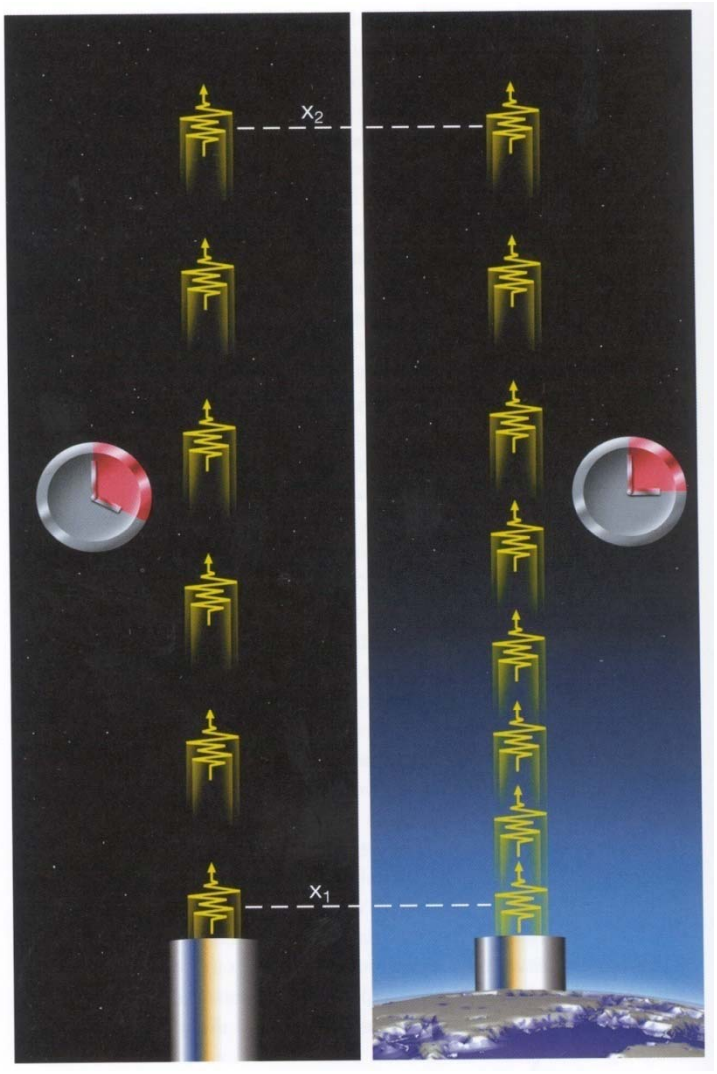
Effekt must be included in Navigation-Systems

GPS (Naviga.):

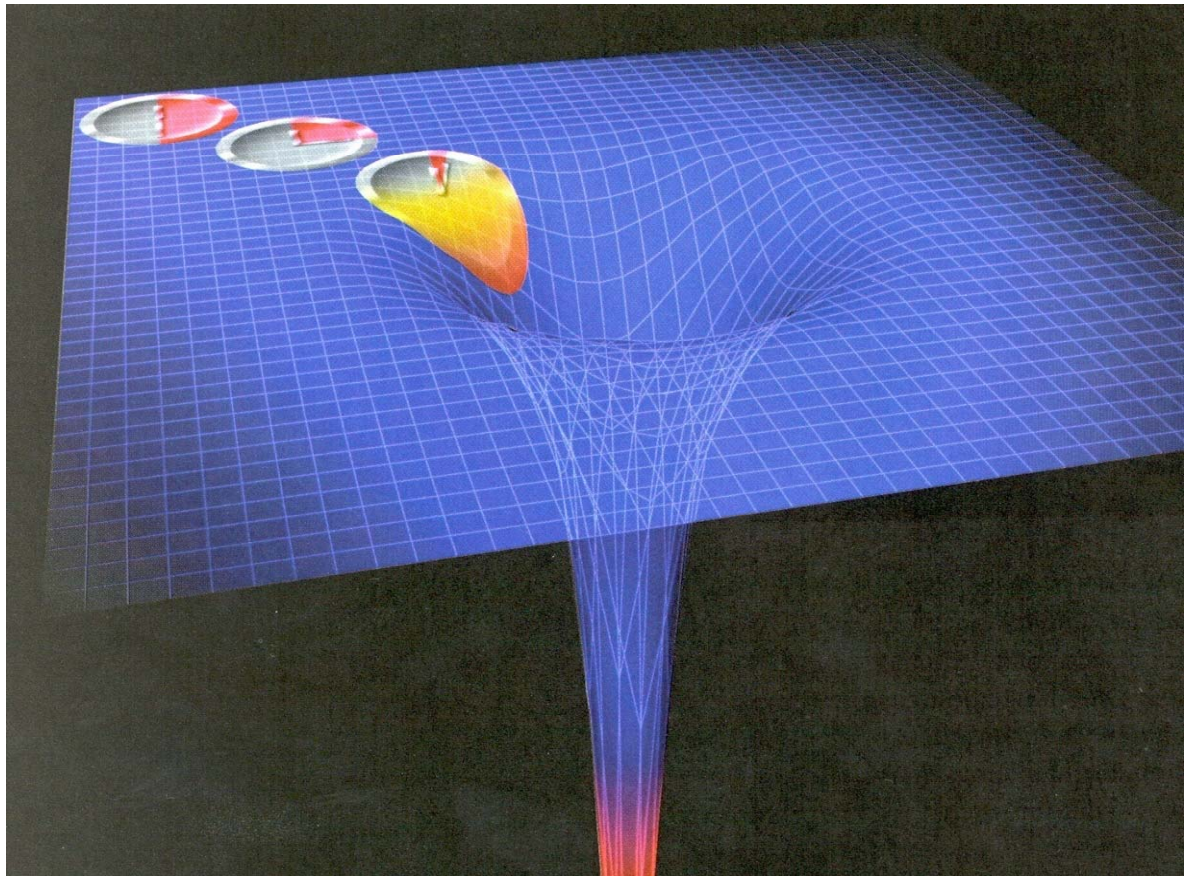
Bewegte Uhren 1mal langsamer, Spezielle Relativitätsth.

Kleineres Schwerefeld 3mal schneller, Allgemeine Relativitätsth.

The light of the sun is redshifted due to this effect.

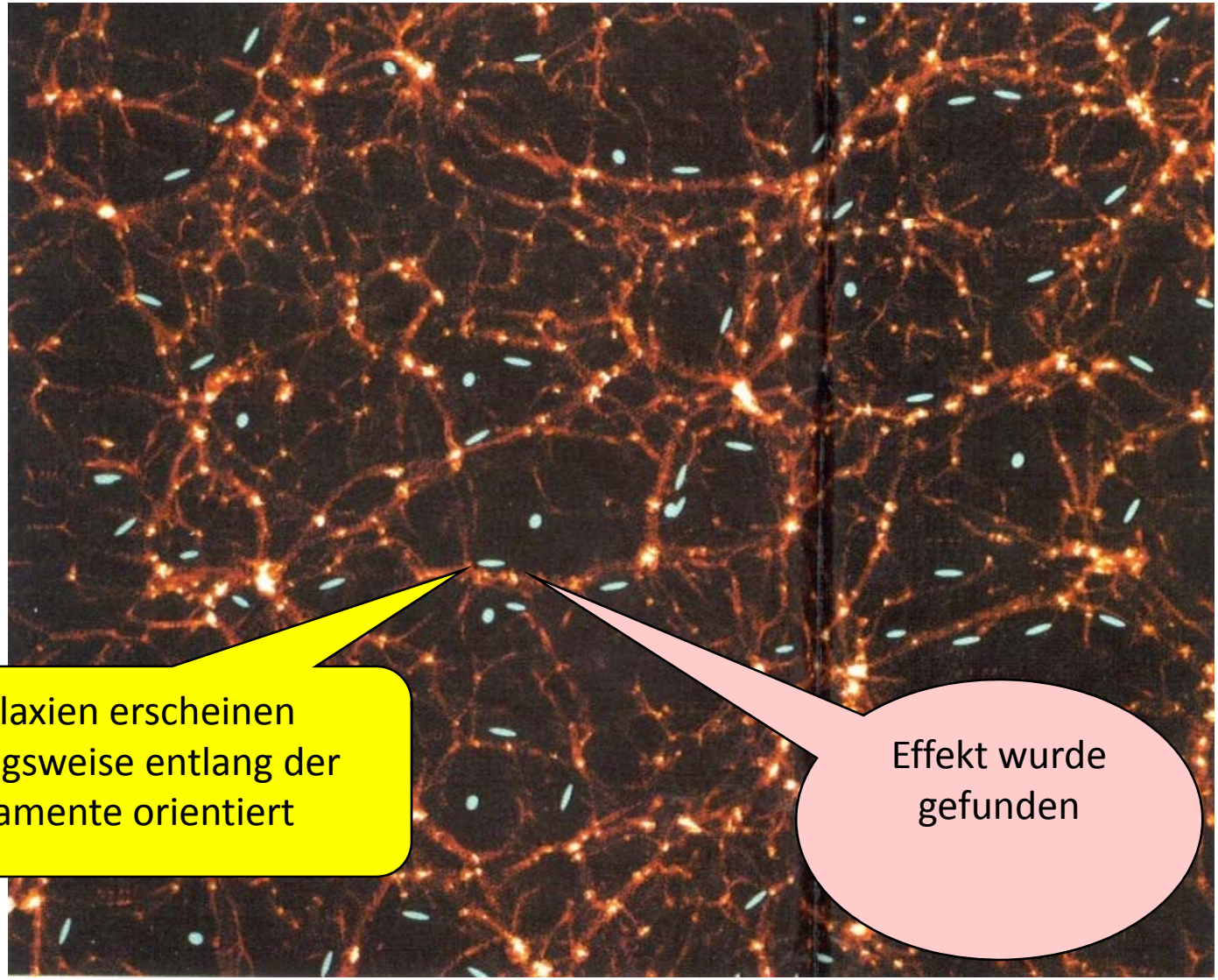


Am Rande eines Schwarzen Loches ist das Gravitationsfeld so stark, dass die Uhren für einen äußeren Beobachter still stehen.



Simulation for today. (Simon White, MPI München)

This filament structure corresponds to the data



Appearent Magnitude of a star m minus the absolute Magnitude M.

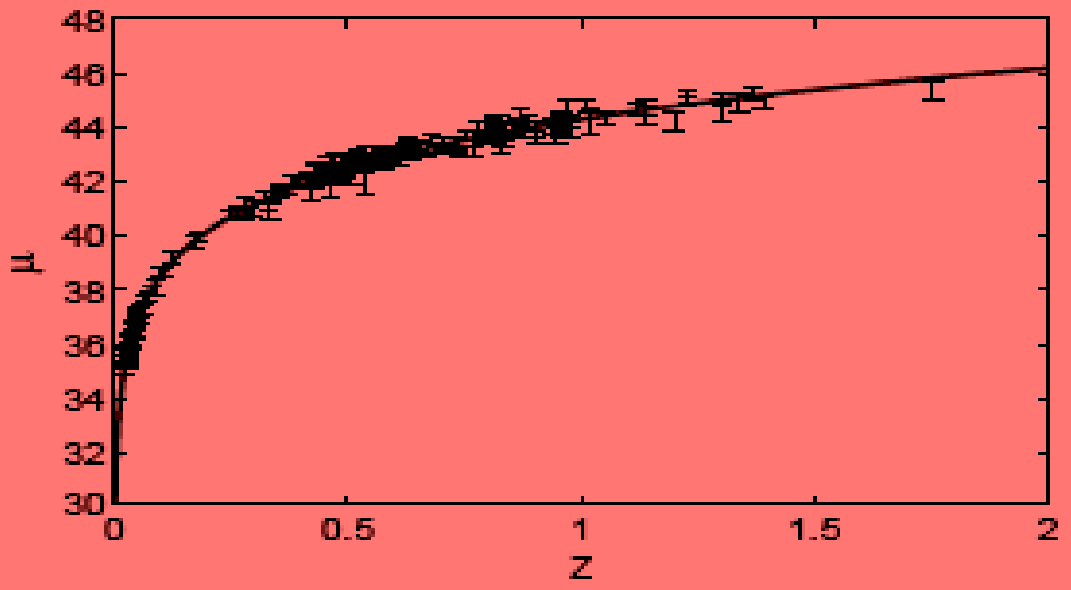


Figure 2. *Distance modulus, $\mu = m - M = 5\log_{10}(d_L) + 25$, versus redshift, z, with d_L in units Mpc. The theoretical curve for a FB model with $H_0 = 62.0$ km sec^{-1} Mpc^{-1}, $\bar{\gamma}_0 = 1.38$, $f_{v0} = 0.759$ is compared to the 182 SneIa, excluding the "Hubble bubble" points at $z \leq 0.023$ of the Riess et al. Gold06 data set [51]. For these parameter values $\chi^2 = 183.2$, or 0.9 per degree of freedom.*

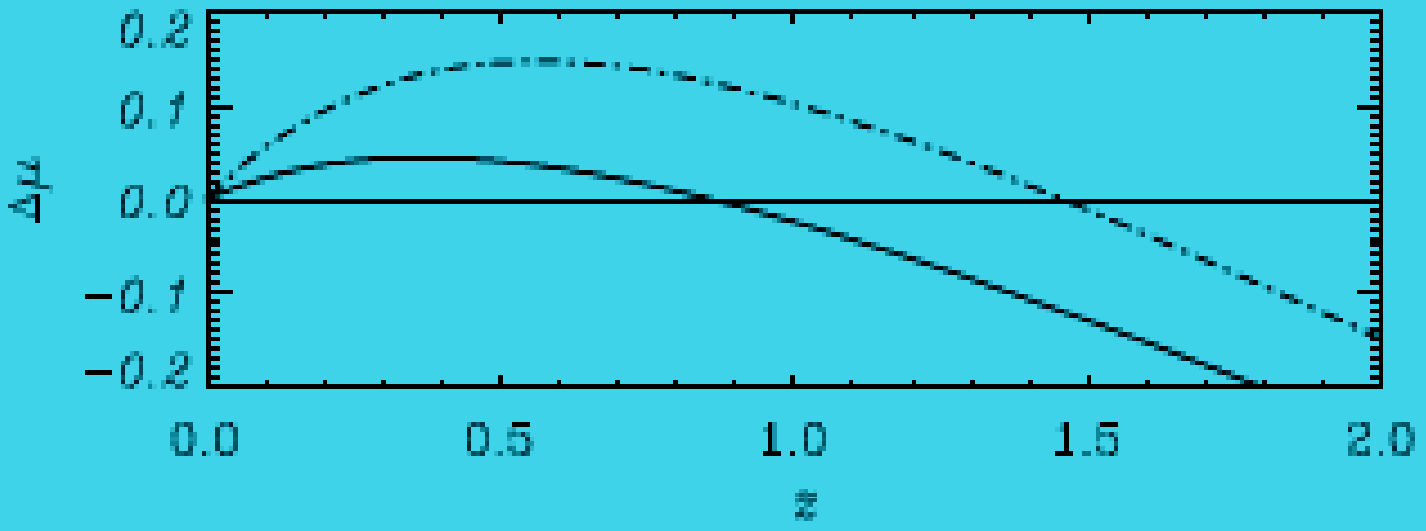
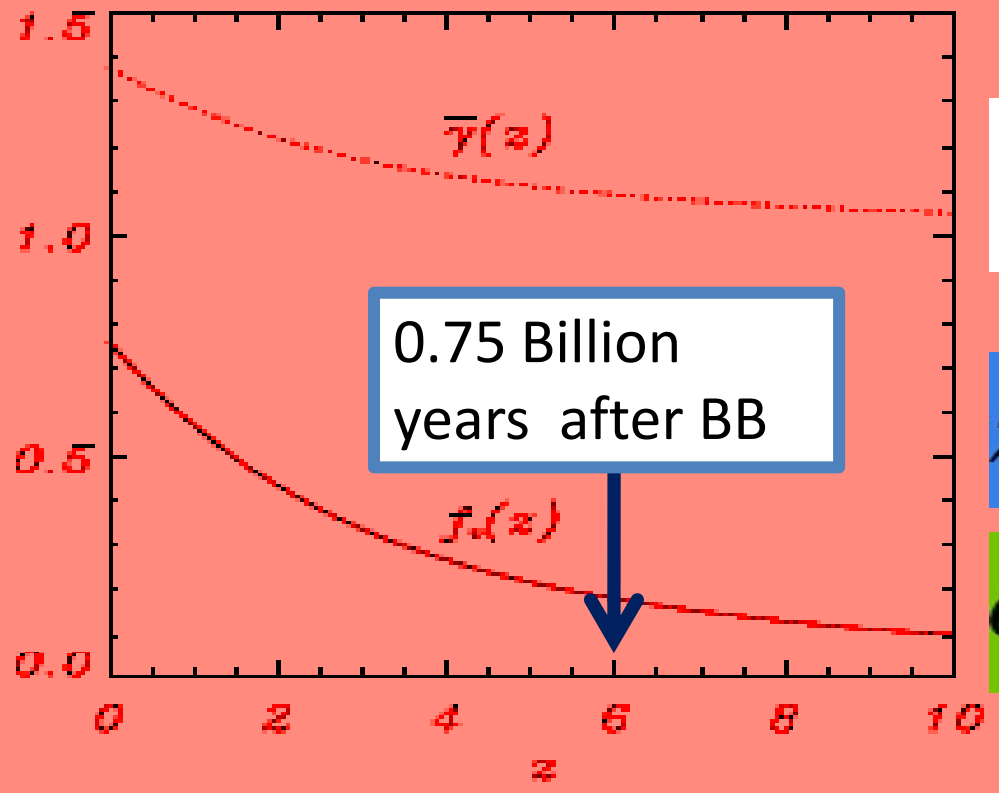


Figure 3. The difference, $\Delta\mu = \mu_{\rm FB} - \mu_{\rm empty}$, of the distance modulus of the FB model with $H_0 = 62.0\,{\rm km\ sec^{-1}\,Mpc^{-1}}$, $\tilde{\gamma}_0 = 1.38$, $f_{\nu 0} = 0.759$ and the distance model that of an empty coasting (Milne) universe with the same Hubble constant, versus redshift (solid line). Positive values of $\Delta\mu$ correspond approximately to apparent acceleration. As a comparison we plot the corresponding difference of distance moduli, $\Delta\mu = \mu_{\Lambda\rm CDM} - \mu_{\rm empty}$ for a flat ΛCDM model with $\Omega_M = 0.268$, $\Omega_\Lambda = 0.732$, and the same value of the Hubble constant (dot–dashed line).

Void Fraction f and Clock Rate γ in the Voids (Wiltshire).



0.75 Billion years after BB

z = 1: origin of solar system

$$z+1=\frac{1}{a}$$

$$a=\frac{1}{z+1}$$

Figure 4. *The void fraction, f_v, (solid line), and clock rate of volume-average observers with respect to wall observers in a galaxy, $\bar{\gamma}$, (dotted line) as a function of redshift for the FB model with $H_0 = 62.0$ km sec^{-1} Mpc^{-1}, $\bar{\gamma}_0 = 1.38$, $f_{v0} = 0.759$.*

Observers are sitting in the Galaxy-Walls: Clocks go slower in Galaxies than in Voids.

At Decoupling 400 000 years after BB the clocks were running synchronized. But now the clocks in galaxies are retarded.

2. Acceleration Equation requests Deceleration without Cosmological Term in Walls.

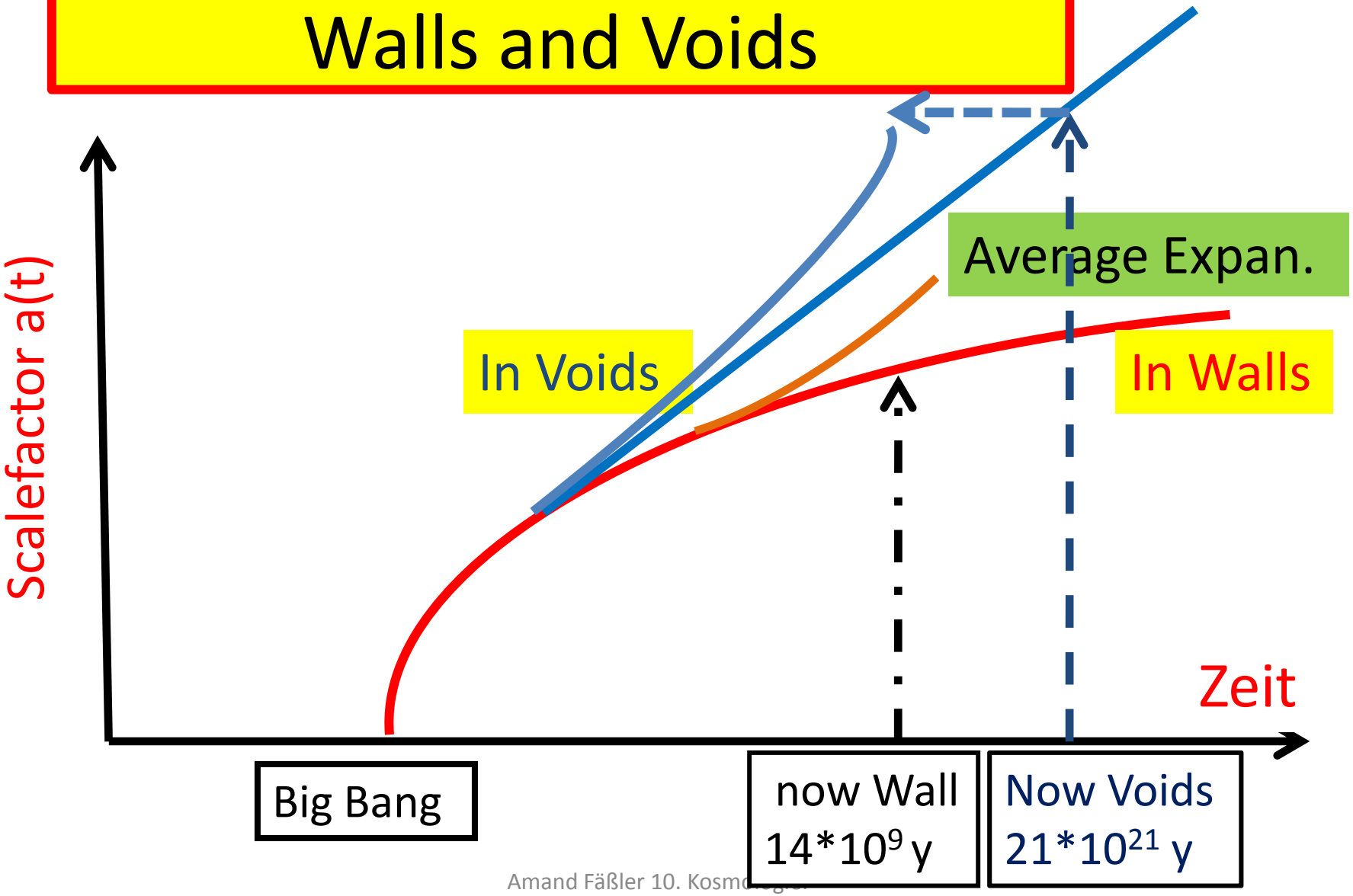
$$\frac{\ddot{a}}{a} = -\frac{4\pi G}{3}\left(\rho + \frac{3p}{c^2}\right)$$

No Deceleration in Voids !!!

Expansion slowed down in Galaxy Walls, but expansion goes on with almost the same velocity in the Voids.

- Till ~ 60 000 years after Big Bang: Radiation dominated; no structure formation by clumping.
- 60 000 years till 9 Billion years after Big Bang: Matter dominated; structure formation after decoupling 400 000 years after BB, clumping.
- 8 Billion years after Big Bang till today: Void dominated (instead Dark Energy dominated).

Inhomogeneous Expansion in Walls and Voids



Wiltshire et al: Simplified Model of Voids and Walls of Galaxies

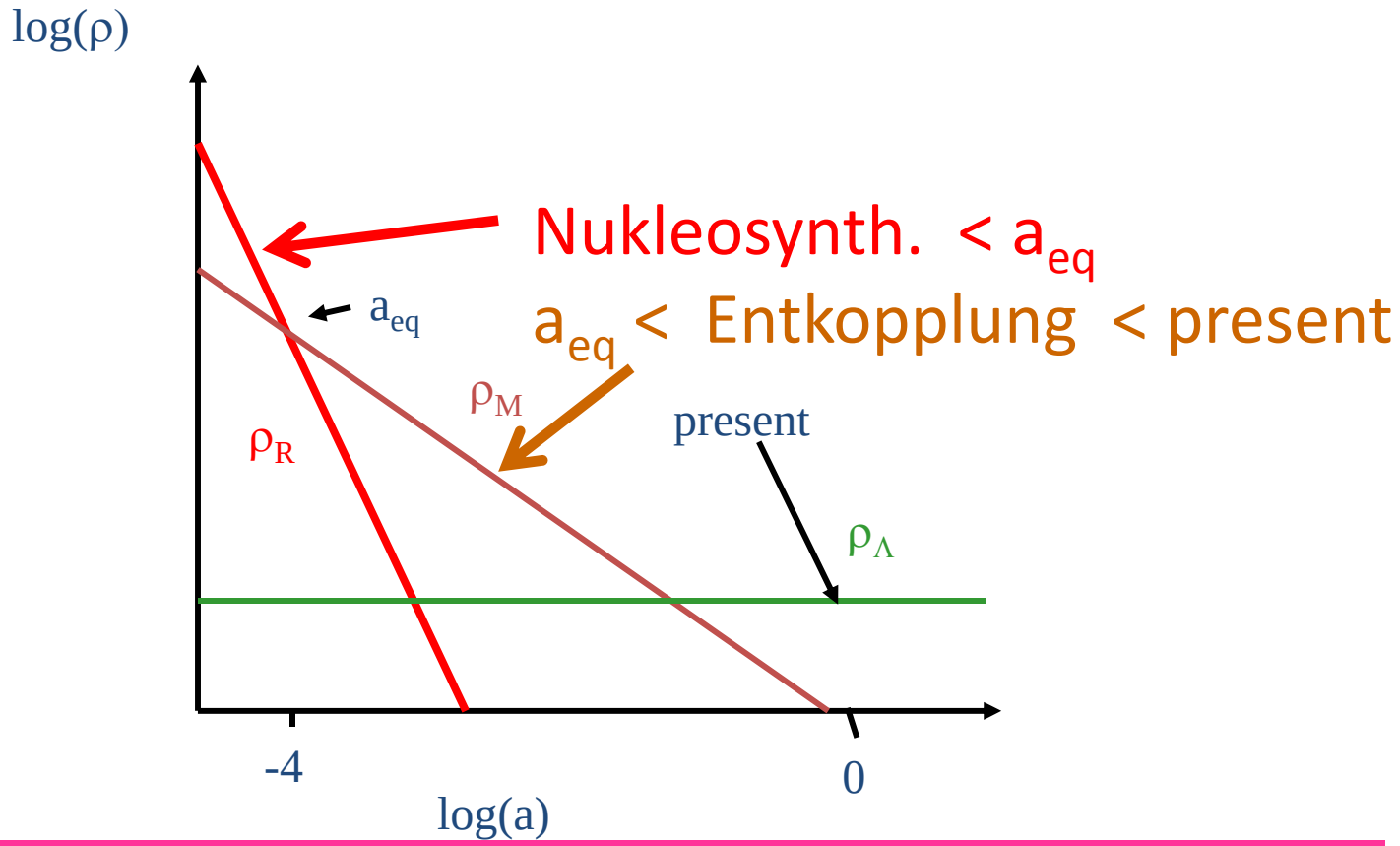
- New parameters:
- Hubble Constant: 62 km/(sec*Mpc)
  instead of 71 km/(sec*Mpc)
- Age of Univ.: 14.7 Billion years in „walls“ and 21 Billion years in „voids“
  instead of 13.7 Billion years
- Dark Matter 75 %; Baryonic Matter 25 %
  (Big Bang Nucleosynthesis 4% Matter)
- No Dark Energy

Large majority still favors the Lambda Cold Dark Matter Model (ΛCDM).

Contra - Niayesh Afshordi/Smithsonian Center, Havard:
On the averaged scale of 200 Mpc needed, the density differs in Walls and Voids just 0.001 % (measured by gravity bends of light); too small.

Pro – Syksy Rasanen/CERN:
From „2-degree Field Galaxy Redshift Survey“ the difference is larger, but still only 20% of the needed difference between Walls and Voids.

$\rho_{rad} \sim 1/a^4$ $\rho_M \sim 1/a^3$ $\rho_\Lambda \sim$ const.



Radiation -> Matter -> Dark Energy (Voids?)

~ 60 000 y; $8*10^9$ y after BB

Kosmologie 11

Acceleration of the Universe by Voids and Walls

The END