INDICATION FROM THE SUPERNOVAE IA DATA OF A STATIONARY BACKGROUND UNIVERSE

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A simple stationary universe model turns out to represent the SNe-Ia data in the high redshift range surprisingly well. Here it is shown how, instead of acceleration, a local Hubble contrast seems to result in reasonable agreement with the low redshift data, too.

With redshift parameters z independent of time and $c^* \equiv dl^*/dt^*(\mathrm{d}\sigma^*_{\mathrm{SUM}} = 0) = c$ the simplest cosmological solution of General Relativity

$$\mathrm{d}\sigma^{*2}_{\mathrm{SUM}} = \mathrm{e}^{2Ht^*}\mathrm{d}\sigma^{*2}_{\mathrm{SRT}} \equiv \mathrm{e}^{2Ht^*}\left(c^2\mathrm{d}t^{*2} - \mathrm{d}l^{*2}\right) \tag{1}$$

stands out from all others. Implying Euclidean space on large scales it is free of horizon problems, and requires a negative 'dark' gravitational pressure of −1/3 the critical density. This stationary universe model (SUM) — not the 'Steady-state'-Theory — may describe the background on ultra-large scales, embedding our evolutionary cosmos therein. It turns out to represent the SNe-Ia data of Riess *et al.* 2004/07 [1, 2] in the high redshift range $z > 0.1$ surprisingly well. Only in the low range $0.01 < z \leq 0.1$ its predictions differ from those of today's Cosmological Concordance Model (CCM) significantly. Here it is shown how, instead of acceleration, a local Hubble contrast of about $7 \pm 2\,\%$ as reported by Jha, Riess, Kirshner 2007 [3] seems to result in reasonable agreement with the low redshift data, too.

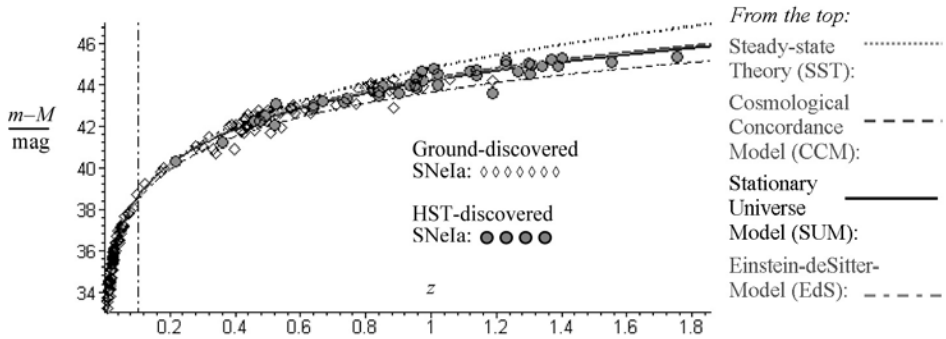

Fig. 1. The magnitude-redshift prediction of the SUM compared to the SNe Ia data of Riess *et al.* 2004/2007 (in addition the predictions of today's CCM and its 'parents' SST, EdS).

The original gold-sample of the Riess *et al.* SNe-Ia data compilation [1, 2] is used in the following [4] containing 140 ground-discovered plus 30 HST-discovered gold SNe-Ia. — The line element (1) leads to the SUM magnitude-redshift relation

$$m_{\mathrm{SUM}} - M = 5\log\left[(1+z)\ln(1+z)\right] + 25 + 5\log\left(\frac{c/H}{\mathrm{Mpc}}\right). \tag{2}$$

Figure 1 shows the corresponding SUM prediction (solid line) together with those of the CCM and two flat space models once prominent in the history of relativistic cosmology: The Steady-state Theory (SST) at the top and the Einstein-deSitter (EdS) model at the bottom. — Ten years ago an observational breakthrough to completely unexpected SNe-Ia data seemed to require a 'strange recipe'. Mixing about 2/3 of the old SST to about 1/3 of the EdS cosmology led to today's CCM which according to

$$m_{\mathrm{CCM}} - M \;=\; 5\log\left[(1+z)\int_0^z \frac{\mathrm{d}z'}{(1-\Omega_\Lambda)(1+z')^3+\Omega_\Lambda}\right] + 25 + 5\log\left(\frac{c/H}{\mathrm{Mpc}}\right) \quad (3)$$

is represented by the middle broken line, fitting the SNe-Ia data numerically well (an insignificant contribution due to radiation is neglected as usual). Altogether, the data of the Supernova Cosmology Project (Perlmutter *et al.* [5]) and the High-Z Team (Riess *et al.* [6]) were understood to provide 'evidence' for a universal acceleration driven by dark energy. But there is another chance [7, 8], in fact for a universe without unnecessary coincidences, horizon problems or more peculiarities.

Even straight away, the SUM-prediction (2) would fit the data much better than EdS or SST. In addition, a vertical shift of $\Delta m = 0.17$ has been used in Figure 1 to remove all *visible* differences of the solid SUM-line and the broken CCM-line there. This vertical shift does mean nothing but a reduction of about 9 % in the Hubble constant (if for example $H_{\mathrm{CCM}} = 71\,\mathrm{km/s/Mpc}$ then $H_{\mathrm{SUM}} = 65\,\mathrm{km/s/Mpc}$).

However, since the bold broken CCM-line is a best-fit of the SNe-Ia data, one has to compare their Δm-residuals. If temporarily using the same Hubble constant $H_0 = 65\,\mathrm{km/s/Mpc}$ for both models, this would show a global deviation for the SUM-line [4]. That is why such a model has not been taken seriously so far.

Despite of the Δm-shift in Figure 1 there remain some hidden differences which come to light by plotting the residuals with respect to the SUM prediction.

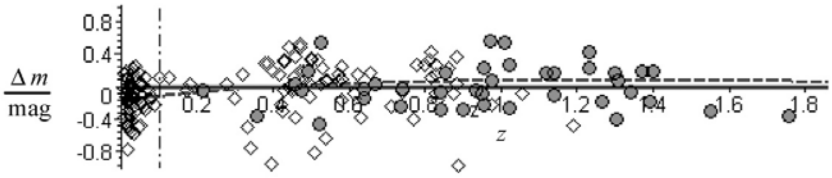

Fig. 2. The SNe Ia magnitude-redshift residuals and the CCM deviation, both with respect to the SUM prediction and neglecting any local Hubble contrast.

Though Figure 2 shows still significant deviations between the CCM- and the SUM-residuals, now the remaining problem is only a *local* one concerning the low redshift-range $z \leq 0.1$, whereas both, CCM and SUM, describe the observed *universal* SNe-Ia-range $0.1 < z$ comparably well (the SUM fits slightly better than the CCM there). This strongly suggests a local Hubble contrast. — In Figure 3 the solid line on the top represents real SNe-Ia observations accordingly. A Hubble contrast +9 % corresponds to a maximum deviation $\delta z = 0.002$ in the data.

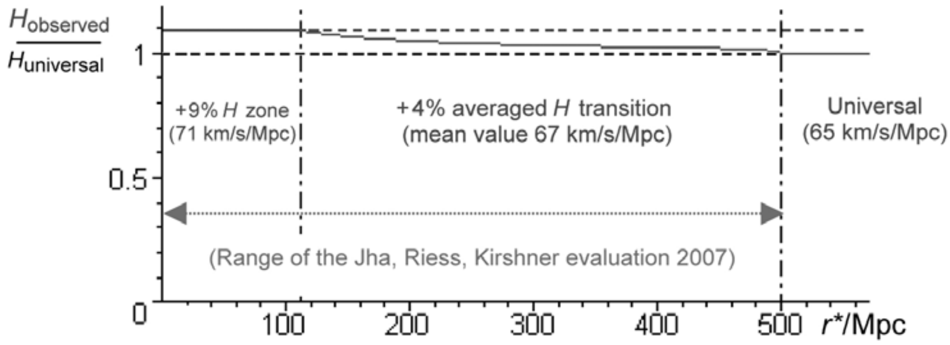

Fig. 3. The solid line on the top is representing a local Hubble contrast according to SNe-Ia observations, the broken line below it a *universal Hubble constant* neglecting inhomogeneities. (An asterisk means universal coordinates, i.e. 'comoving' space $\vec{r}^*$ and 'conformal' time t^*.)

With $H_{\text{universal}} = 65\,\text{km/s/Mpc}$ e.g. this would mean $H_{\text{local}} = 71\,\text{km/s/Mpc}$ within $r^* < 113\,\text{Mpc}$ ($z < 0.025$), while the mean value in the transition zone is about $67\,\text{km/s/Mpc}$. The difference $(71-67)\,\text{km/s/Mpc} = 4\,\text{km/s/Mpc}$ corresponds roughly to what Jha, Riess, Kirshner [3] reported to be $6.5\,\% \pm 1.8\,\%$.

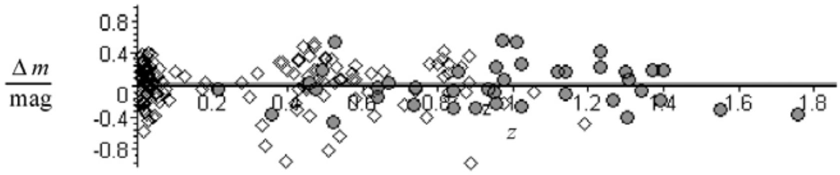

Fig. 4. The SUM-residuals given a local Hubble contrast according to Figure 3.

Figure 4 shows that after taking into account the local Hubble contrast of Figure 3, now the SUM-residuals would result in reasonable agreement with the low redshift data, too (whereas in this case the CCM would face a serious problem there).

Finally, I want to point out to the straightforward agreement on *universal* scales $z > 0.1$ according to Figures 1, and 2 once more; there (on the right of the vertical dashed lines) are compared pure model predictions without any local corrections.

Whether or not only 'local bangs' might take place in a stationary background universe as has been argued elsewhere [7, 8], the SUM evaluated here seems capable of embedding the whole CCM-cosmos, too.

References

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