DIPOLE TEST ON SCP SUPERNOVAE
confirming
THE EXPANSION CENTER MODEL

by Luciano Lorenzi

XLVIII Congresso Nazionale della SAIt
Milano, 19 - 23 Aprile 2004

ABSTRACT

A dipole test of the expansion center model (ECM) is here carried out on high-redshift Type Ia supernovae from the Supernova Cosmology Project. After a brief review of the main ECM equations, two samples of high-z SNe Ia (Perlmutter et al. 1999; Knop et al. 2003) plus two other combined samples are tested through the ECM dipole equation (Lorenzi 2003b) with luminous distances based on peak magnitudes corrected for Galactic extinction and for the cross-filter K-correction. The successful check of the mere cosine dipole equation confirms the model for remote high-redshift supernovae, also through a check atlas of ECM dipoles from 12 r_z range-samples of SNe Ia. Finally one finds that the ECM cosmological distances D_C, according to the solution for the nearby Universe, give SNe Ia absolute magnitudes which slowly increase with square distance.

1 Introduction

Following the on line paper (Lorenzi 2003b: hereafter paper V) "The expansion center model as a challenge to cosmology, based on data, results and 3 historical models", which is the "attached paper" to that entitled "An expected revolution of the Galaxy around the expansion center" (Lorenzi 2003a: paper IV), here we deal with SNe Ia tests, specifically addressed to check the ECM dipole equation on the remote Universe, by high-z supernovae (Perlmutter et al. 1999; Knop et al. 2003) of the Supernova Cosmology Project (SCP).

2 Main ECM equations

The best values for H_0 and R_0 have been obtained from the solution of the ECM equation

$$\frac{\dot{r}}{r} = H_0 \cdot \left(\frac{1+x}{1-x} \right) - a_0 (1-x)^{-\frac{2}{3}} \cos\gamma \tag{1}$$

, applied to the sample of 83 individual nearby galaxies, listed by S&T (1975) in their Tables 2,3,4, with $x = 3H_0 r/c$ and distances r obtained by calibration of galaxy luminosity classes from known H II region sizes, being $\gamma = 0$ for the expansion center direction ($\alpha_{VC} \approx 9^h ; \delta_{VC} \approx +30^0$: Bahcall & Soneira 1982). The final solution in Hubble units, after introducing $\dot{r} = cz$ (see paper V) with light-distances r referring to the epoch of the light emission, is that of paper II (Lorenzi 1999b), and here summarized in **Table 0**.

Table 0

$H_0 = 70 \pm 3$	$q_0 \cong -0.0605$	$R_0 \simeq 260$	$a_0 \simeq 12.66$

Note that recently the WMAP mission has furnished $H_0 = 71 \pm 4$ H.u.(Bennett et al., 2003).

More concisely eq. (1) can be written, according to the new general Hubble law (see eqs. (59)(53)(39)(37)(36)(35) of paper I: Lorenzi 1999a), as follows

$$\frac{cz}{r} = H_* - a \cdot \cos\gamma \tag{2}$$

being

$$H_* = H_0 + 2\Delta H \qquad\qquad a = KR \tag{3}$$

with

$$\begin{aligned} \Delta H &= H - H_0 = Kr \qquad H = H_0/(1-x) \qquad x = 3H_0 r/c \\ K &= K_0/(1-x) \qquad K_0 = 3H_0^2/c \qquad R = R_0 (1-x)^{1/3} \end{aligned} \tag{4}$$

3 ECM dipole formula

As eq. (1) and (2) are equivalent, it results

$$\frac{1+x}{1-x} = \frac{H_*}{H_0} \qquad\qquad \textit{and} \qquad\qquad a = a_0 (1-x)^{-\frac{2}{3}} \tag{5}$$

Consequently the cosmological luminous distance $D_C \equiv D_L$ of paper V (Lorenzi 2003b), also recalling the density law (15) and eq. (9) of paper III (Lorenzi 2002), takes the following multiple formulation

$$D_C = r \cdot (1+z)\left(\frac{1+x}{1-x}\right) = r \cdot (1+z) \cdot \frac{H_*}{H_0} = r \cdot (1+z)\left[1 + 2\frac{\Delta\rho}{\rho_0}\right] \qquad (6)$$

where it is $\Delta\rho = \rho(t) - \rho_0$. After transferring the second formulation of D_C from eq. (6) into eq. (2), one obtains

$$\frac{cz(1+z)}{D_L} = H_0 - a\frac{H_0}{H_*} \cdot \cos\gamma \qquad (7)$$

or, from (5), the mere cosine dipole equation of paper V

$$\frac{cz \cdot (1+z)}{D_L} = H_0 - a^*(x) \cdot \cos\gamma \qquad \textit{with} \qquad a^*(x) = a_0 \cdot \frac{(1-x)^{1/3}}{1+x} \qquad (8)$$

or the final **ECM dipole formula** with both the constant H_0 and a_0, that is

$$\frac{cz \cdot (1+z)}{D_L} = H_0 - a_0 \cdot X \qquad \textit{with} \qquad X = \frac{(1-x)^{1/3}}{1+x}\cos\gamma \qquad (9)$$

together with

$$M = m - 5\log D_L - 25 \Rightarrow D_L = 10^{0.2(m-M)-5} \qquad (10)$$

4 Dipole test on SCP supernovae

The cosine dipole test carried out on 7 range-samples of remote Abell clusters of Richness 3 (Abell,Corwin,Olowin 1989) has given 7 values of the coefficient a^* ($\cong +4.5 \pm 6.7, +6.1 \pm 6.1, +8.2 \pm 4.9, +8.2 \pm 5.1, +7.8 \pm 5.0, +6.1 \pm 4.9, -1.4 \pm 4.6$ for $n = +1$ respectively, with an average value $\langle a^* \rangle \cong +5.6$) and the expected value of H_0 in the dipole fitting, by the listed absolute magnitude M_d in paper V. Assuming directly $H_0 \equiv 70$ H.u. means limiting the fitting to one unknown, through the eqs. (8)(9) rewritten in the form

$$Y = -a^* \cdot \cos\gamma \qquad Y = -a_0 \cdot X \qquad \textit{with} \quad Y = \frac{cz(1+z)}{D_L} - H_0 \qquad (11)$$

where the adopted absolute magnitude M_d according to (10) minimizes the standard deviation of the fitting. In this case a^* takes the values $+6.3 \pm 6.1, +8.4 \pm 5.5, +9.7 \pm 4.5, +9.6 \pm 4.7, +8.9 \pm 4.6, +6.9 \pm 4.7, -0.3 \pm 4.4$, which, with an average value $\langle a^* \rangle = +7.1 \pm 1.4$, are clearly nearer to the expected a^*_{ECM} ($\cong +9.0, +8.9, +8.7, +8.6, +8.5, +8.5, +8.4$ respectively). Thus this dipole test on remote rich clusters proves to be in favour of the ECM and its solution of **Table 0**.

Further dipole tests, using both the first and second eq. (11), have been carried out on two SCP high-redshift Type Ia supernovae samples, the former of 42 SNe Ia (by Perlmutter et al.1999, hereafter P99) and the latter of 38 SNe Ia (by Knop et al. 2003, hereafter K03), and on two other combined samples of 53 SNe Ia, given by 42SNe/P99 plus 11 *HST* SNe of K03, and by 38SNe/K03 plus

15 SNe of P99. Such a check has been made possible thanks to the supernovae right ascensions and declinations listed on the Web (Harvard-IAU 2003). To this regard let us recall that

$$\cos\gamma = \sin\delta_{VC}\sin\delta + \cos\delta_{VC}\cos\delta\cos(\alpha - \alpha_{VC}) \tag{12}$$

The model eq.(1), where $\dot{r} = cz$ and $r = cx/3H_0$, can be now rewritten as

$$z = \frac{x}{3}\left(\frac{1+x}{1-x}\right)\left[1 + 3q_0\frac{(1-x)^{1/3}}{1+x}\cos\gamma\right] \tag{13}$$

The main data for the present analysis is listed in **Table A-B-C**, where 4 columns report in order: supernova IAU name by P99 and K03; $-\cos\gamma$ value of the supernova according to eq. (12); redshift z of supernova or host galaxy in Local Group restframe, after correction of the geogentric redshift listed in column (2) of Table 1 in P99, and of Table 3-4 in K03; inferred r_z distance of the supernova, as resulting from the numerical solution $x = 3H_0 r_z/c$ of eq. (13) with listed z, and H_0 and q_0 from **Table 0.** The dipole test was carried out by calculating the luminous distances D_L of eq. (10) with SNe Ia peak magnitudes corrected only for galactic extinction and for the cross-filter K correction, that is with $m_B = m_X - K_{BX} - A_X$ as listed in the 8^{th} column of Table 1 of P99 and in the 4^{th} column of Tables 3-4 of K03. Hence a single value of absolute magnitude M_B has been choosen that minimizes the standard deviation s of the dipole fitting. The main features of the SNe Ia samples by P99 and K03, numbered XI-XII-XIII-XIV respectively, are compared in **Table 1**, where the following data is listed in order: sample ordinal number; sample range of m_B; number N of supernovae of the sample; mean $\langle\cos\gamma\rangle$ of the corresponding sample $\cos\gamma$, from 2^{nd} column in **Table A-B-C**; unweighed mathematical mean $\langle m_B\rangle$ of the magnitudes m_B listed in the 8^{th} column of Table 1 in P99 and in the 4^{th} column of Tables 3-4 in K03; unweighed mathematical mean $\langle z\rangle$ of the corresponding redshifts in Local Group restframe; inferred value of the average distance of the sample, as $\langle r_z\rangle$ in Mpc; average cosmological luminous distance of the sample, as $\langle D_C\rangle$ in Mpc from the mean of eq. (6). One has to remark that a sufficiently rich and homogeneous distribution of sample members over both hemispheres of the expansion direction (cf. section 5.5 of paper V) ought to give $\langle\cos\gamma\rangle \simeq 0.0$, while in our case such a condition is not respected.

Table 1

Sample	*source*	N	$\langle\cos\gamma\rangle$	$\langle m_B\rangle$	$\langle z\rangle$	$\langle r_z\rangle$	$\langle D_C\rangle$
XI	42SNe/P99	42	+0.40	23.00	0.495	710	3388
XII	38SNe/K03	38	+0.48	23.15	0.515	723	3606
XIII	42SNe/P99 + 11HSTSNe/K03	$42+11$	+0.43	23.11	0.514	722	3576
XIV	38SNe/K03 + 15SNe/P99	$38+15$	+0.43	23.14	0.514	722	3576

The obtained results of the unweighed fitting of the first eq. (11), through the least squares method applied to each sample, are listed in **Table 2a**. Here, 4 columns report in order the following data and results: expected value a^*_{ECM} of the angular coefficient $a^*(x)$ of eq. (8), where $x = 3H_0\langle r_z\rangle/c$ with $H_0 \equiv 70$ and $a_0 = 12.66$ in H.u. from **Table 0**; minimum value of the fitting standard deviation, s_{Min}, in H.u., corresponding to the listed M_B; absolute magnitude M_B which minimizes the standard deviation s in the dipole fitting; resulting angular coefficient $a^*(x)$ in H.u. from the fitting. **Table 2b** lists the results of the unweighed fitting of the second eq. (11), that holding the function $-X$. In this case the X computation (see eq. (9)) requires the introduction of the distance r_z, which can be obtained (by trial and error) from the z eq. (13) for each SNe Ia according to the nearby solution of **Table 0**. Such r_z values have been listed in the 4^{th}column of the **Tables A-B-C**. **Table 2b** has only 3 columns, corresponding to the last three of **Table 2a**, as a_0 should take the constant value of **Table 0**.

Table 2a **Table 2b**

Sample	a^*_{ECM}	s_{Min}	$M_B(s_{Min})$	$a^*(x)$	s_{Min}	$M_B(s_{Min})$	a_0
XI	$+6.7$	10.8974	-19.55	$+4.9 \pm 2.8$	10.8951	-19.54	$+8.7 \pm 5.2$
XII	$+6.6$	9.83348	-19.51	$+5.8 \pm 2.7$	9.74438	-19.52	$+12.4 \pm 5.0$
XIII	$+6.6$	10.4225	-19.56	$+6.2 \pm 2.4$	10.3956	-19.56	$+12.0 \pm 4.5$
XIV	$+6.6$	10.3622	-19.53	$+6.0 \pm 2.4$	10.3314	-19.53	$+11.6 \pm 4.5$

All the previous dipole tests of **Table 2**, within the limits of the computed deviations of a^* and a_0, clearly confirm the ECM and its eqs. (11). Indeed, the results of **Table 2a** are very important as, in practice, the dipole anisotropy is model independent, having used only the H_0 value from **Table 0**. Finally, the **Figures 1a-1b-2a-2b-3a-3b-4a-4b** show the resulting plots and fittings of **Table 2a** and **Table 2b**, for each sample XI-XII-XIII-XIV, respectively.

Owing to the crucial importance of the **Table 2** results, dipole tests on range-samples have been explored and presented within the atlas section below.

5 1^{st} atlas of ECM dipoles from SCP SNe Ia data

As the supernovae of **Table A** and **Table B**, with only two exceptions, are all high-z SNe Ia lying in a r_z range of ~ 300 Mpc, at a distance between ~ 600 and 900 Mpc, a series of 12 r_z range-samples has been obtained by the 4 SNe mother samples of **Table 1**, and listed with relative features in **Table 3**.

Table 3

Sample	r_z sample range	N	$\langle\cos\gamma\rangle$	$\langle m_B\rangle$	$\langle z\rangle$	$\langle r_z\rangle$	$\langle D_C\rangle$
XI_1	$600 \le r_z \le 850$	37	+0.38	23.02	0.487	712	3267
XI_2	$650 \le r_z \le 900$	34	+0.44	23.29	0.537	742	3747
XII_1	$600 \le r_z \le 850$	32	+0.46	23.16	0.498	721	3378
XII_2	$650 \le r_z \le 900$	33	+0.47	23.39	0.550	749	3895
XIII_1	$600 \le r_z \le 800$	41	+0.38	23.00	0.476	706	3164
XIII_2	$625 \le r_z \le 825$	41	+0.45	23.16	0.504	725	3428
XIII_3	$650 \le r_z \le 850$	39	+0.45	23.23	0.520	735	3574
XIII_4	$675 \le r_z \le 900$	40	+0.46	23.40	0.568	759	4053
XIV_1	$600 \le r_z \le 800$	41	+0.38	23.03	0.476	706	3164
XIV_2	$625 \le r_z \le 825$	41	+0.45	23.19	0.504	725	3428
XIV_3	$650 \le r_z \le 850$	39	+0.45	23.26	0.520	735	3574
XIV_4	$675 \le r_z \le 900$	40	+0.46	23.43	0.568	759	4053

Analogously to **Table 2**, the results of the unweighed fittings of both the eqs. (11), through the least squares method applied to each range-sample, are listed in **Table 4a** and in **Table 4b**.

Table 4a **Table 4b**

Sample	a^*_{ECM}	s_{Min}	$M_B(s_{Min})$	$a^*(x)$	s_{Min}	$M_B(s_{Min})$	a_0
XI_1	$+6.7$	11.4963	-19.54	$+4.6 \pm 3.1$	11.4977	-19.54	$+8.8 \pm 5.9$
XI_2	$+6.5$	11.4407	-19.57	$+5.8 \pm 3.2$	11.4325	-19.57	$+11.3 \pm 6.2$
XII_1	$+6.7$	10.3530	-19.48	$+6.0 \pm 3.1$	10.2826	-19.49	$+12.7 \pm 5.8$
XII_2	$+6.5$	10.2172	-19.50	$+4.7 \pm 3.1$	10.1415	-19.51	$+10.7 \pm 5.9$
$XIII_1$	$+6.7$	11.4634	-19.53	$+6.4 \pm 3.0$	11.4569	-19.53	$+12.1 \pm 5.7$
$XIII_2$	$+6.6$	11.0719	-19.56	$+7.9 \pm 2.9$	11.0253	-19.56	$+15.4 \pm 5.5$
$XIII_3$	$+6.6$	11.0943	-19.57	$+6.8 \pm 3.0$	11.0763	-19.57	$+13.3 \pm 5.7$
$XIII_4$	$+6.4$	9.67730	-19.61	$+6.2 \pm 2.6$	9.68252	-19.60	$+11.5 \pm 5.2$
XIV_1	$+6.7$	11.3046	-19.49	$+6.2 \pm 3.0$	11.2989	-19.49	$+11.6 \pm 5.6$
XIV_2	$+6.6$	10.9449	-19.52	$+7.4 \pm 2.8$	10.9022	-19.52	$+14.6 \pm 5.4$
XIV_3	$+6.6$	11.0276	-19.53	$+6.4 \pm 3.0$	11.0104	-19.53	$+12.5 \pm 5.7$
XIV_4	$+6.4$	9.69904	-19.56	$+5.2 \pm 2.6$	9.69769	-19.56	$+10.3 \pm 5.2$

Here the solutions of 8 comparable range-samples, from $XIII_1$ to XIV_4, give the following means

$$\langle a^*(x) \rangle = 6.6 \pm 0.3 \qquad\qquad \langle a_0 \rangle = 12.7 \pm 0.6 \tag{14}$$

whose values closely confirm the ECM solution of **Table 0.**

6 SNe Ia absolute magnitudes slowly increase with square distance

A first indication of increase of the SNe Ia absolute magnitudes with distance r_z comes out experimentally from the range-samples results tabled in the previous section. Hence, as a further and more precise test of the model, after obtaining the absolute magnitude M_B of each SNe Ia according to the D_C formula of eq. (6) in eq. (10), which becomes

$$M_B = m - 5 \log \left(r_z \cdot (1+z) \cdot \frac{1+x}{1-x} \right) - 25 \tag{15}$$

the relation to be checked is the following MacLaurin formula

$$M_B = M_B(0) + r_z \cdot \left(\frac{dM_B}{dr_z} \right)_0 + \frac{r_z^2}{2} \left(\frac{d^2 M_B}{dr_z^2} \right)_0 \tag{16}$$

which can now be solved through the least squares method. The related fitting of M_B was carried out on 33 SNe Ia, those having more accurate magnitudes of B in K03, after correction for host galaxy extinction. The magnitudes m used in the fitting, $m_B, m_B^{eff}, m_B^{eff} + E.C.$, are listed in the $4^{th}5^{th}6^{th}$ columns of Tables 3 and 5 in K03, and refer to 10 high-z HST and 23 low-z SNe Ia, for a total of 33 supernovae of the dispersed **Sample XV**, with ECM' r_z varying between ~ 50 and ~ 900 Mpc. In **Table B** and **C**, **Sample XV** is identified through

SNe Ia bold names. The unweighed fitting results stem from the adoption of eq. (16); these results have been listed in **Table 5**, where the 2^{nd} order solution follows after fixing $(dM_B/dr_z)_0 \equiv 0$, having verified its negligibility.

Table 5

K03 samples	m	N	$M_B(0)$	$\left(\frac{d^2M_B}{dr_z^2}\right)_0$	s
XVa	m_B	33	-19.12 ± 0.06	$-1.4E-6 \pm 0.4E-6$	0.27
XVb	m_B^{eff}	33	-19.17 ± 0.05	$-1.3E-6 \pm 0.3E-6$	0.22
XVc	$m_B^{eff} + EC$	33	-19.24 ± 0.06	$-1.5E-6 \pm 0.4E-6$	0.26

The solutions reported in **Table 5** give the ECM absolute magnitude M_B slowly increasing with square distance. Let us remark that further fittings carried out on the whole sample of 58 K03 supernovae with $m = m_B^{eff} + EC$, each weighted by $w \propto 1/\sigma_m^2$, and even on its sub-sample of only high-z SNe Ia ($N = 35$), in practice give the same solution with respect to the unweighed one of **Sample XVc**, listed on **Table 5** last line. **Figure 5** shows the relative plot, of 33 M_B values from eq. (15) (with $m = m_B^{eff} + EC$) against the corresponding values of r_z.

7 Conclusion

The rendez-vous with high-redshift SNa Ie tests has permitted the successful confirmation of the ECM dipole equation, taking the check to the r_z distance-range from ~ 10 to ~ 1000 Mpc. The presented test has strong limitations as it involved only small samples of high-redshift supernovae; however the validation both of the new cosmological luminous distance $D_C \equiv D_L$ and of the related dipole equation of SNe Ia has important consequences within the general ECM development and comprehension. Future and more extensive tests should still be carried out, but, at present, one can certainly conclude that all the observed Universe is escaping from its expansion center, probably forever (see paper V) !

ACKNOWLEDGEMENTS

The author would like to thank the writers of the URL
"http://cfa-www.harvard.edu/iau/lists/Supernovae.html"
and the Central Bureau for Astronomical Telegrams of the International Astronomical Union, for making available on line right ascension and declination of the high-redshift supernovae discovered within the Supernova Cosmology Project (SCP).

The present work has been possible thanks to this URL.

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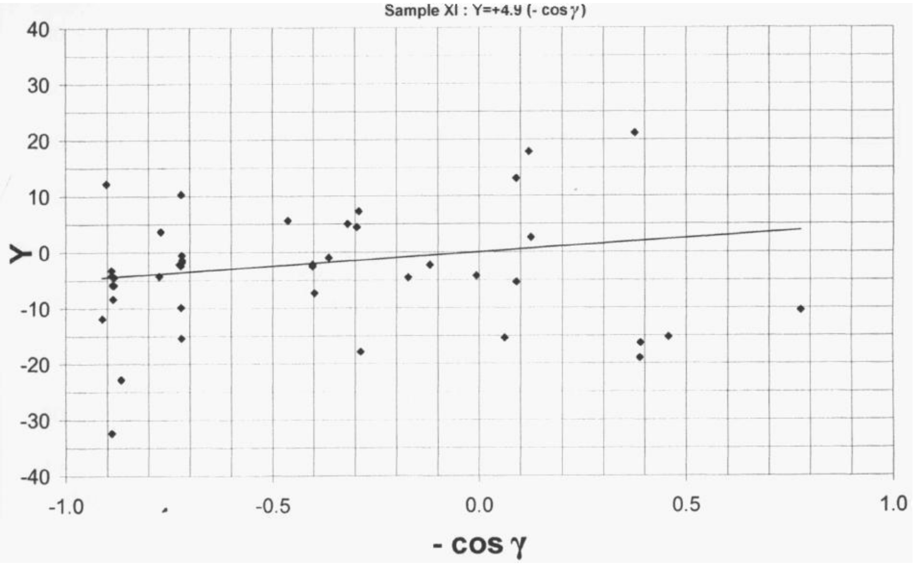

Figure 1: a - Plot of $Y = cz(1+z)/D_L - H_0$ against $-\cos\gamma$, for each SNe Ia of Sample XI

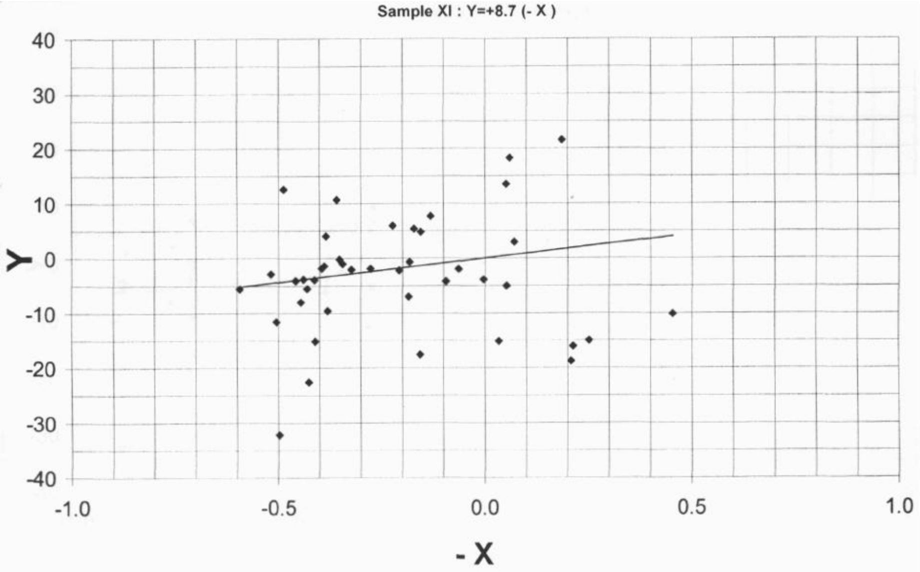

Figure 1: b - Plot of $Y = cz(1+z)/D_L - H_0$ against $-X$, for each SNe Ia of Sample XI

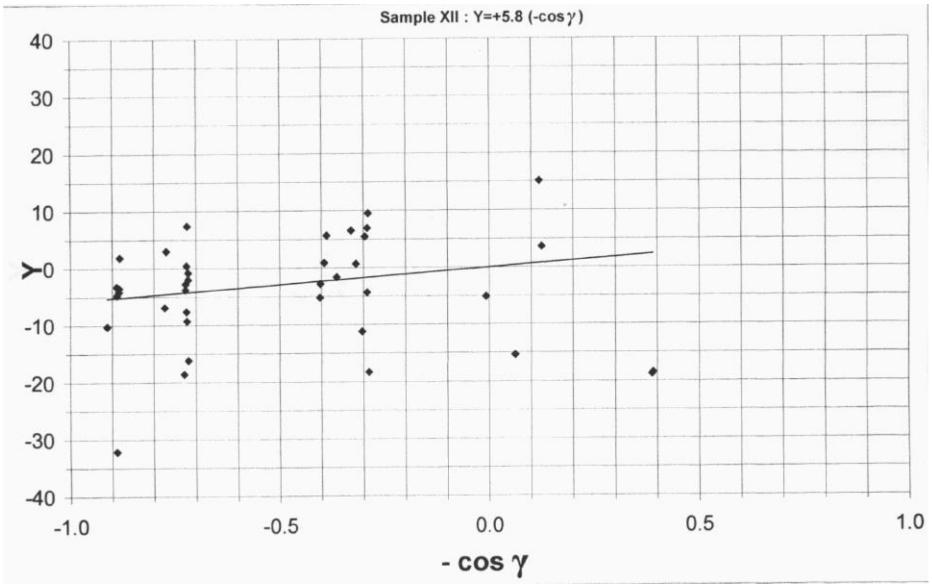

Figure 2: a - Plot of $Y = cz(1+z)/D_L - H_0$ against $-\cos\gamma$, for each SNe Ia of Sample XII

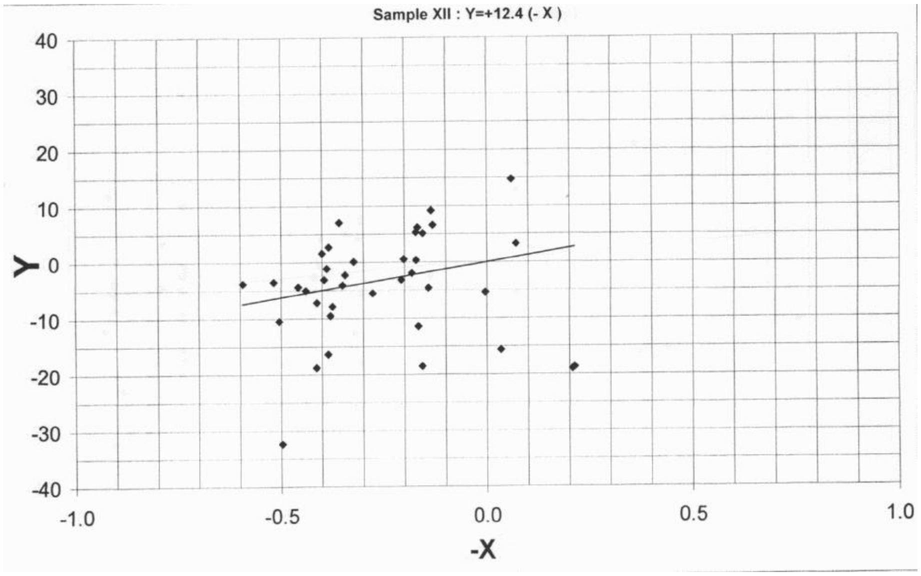

Figure 2: b - Plot of $Y = cz(1+z)/D_L - H_0$ against $-X$, for each SNe Ia of Sample XII

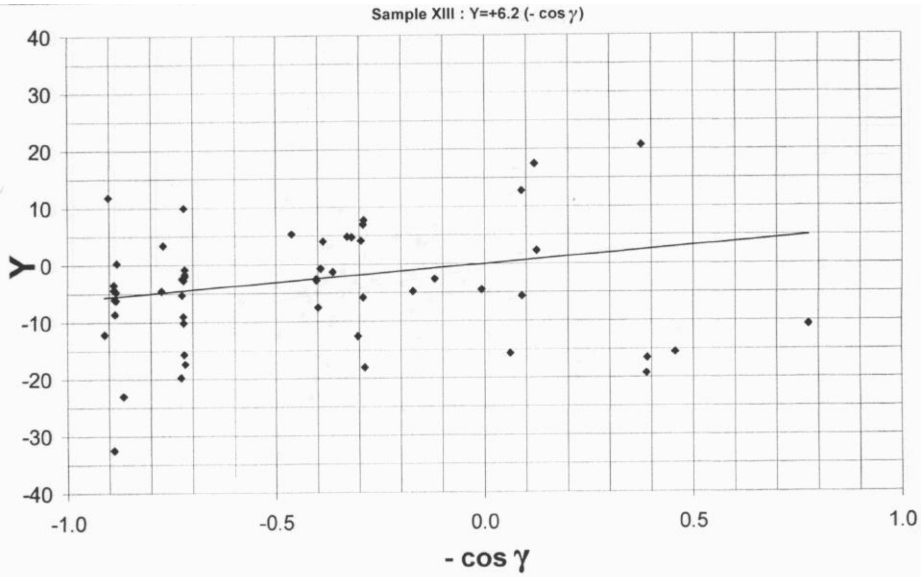

Figure 3: a - Plot of $Y = cz(1+z)/D_L - H_0$ against $-\cos\gamma$, for each SNe Ia of Sample XIII

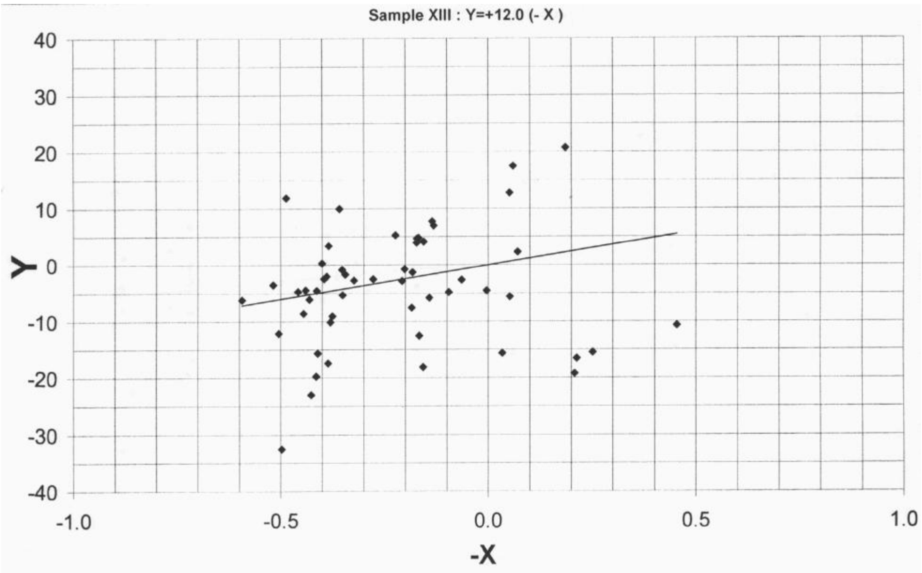

Figure 3: b - Plot of $Y = cz(1+z)/D_L - H_0$ against $-X$, for each SNe Ia of Sample XIII

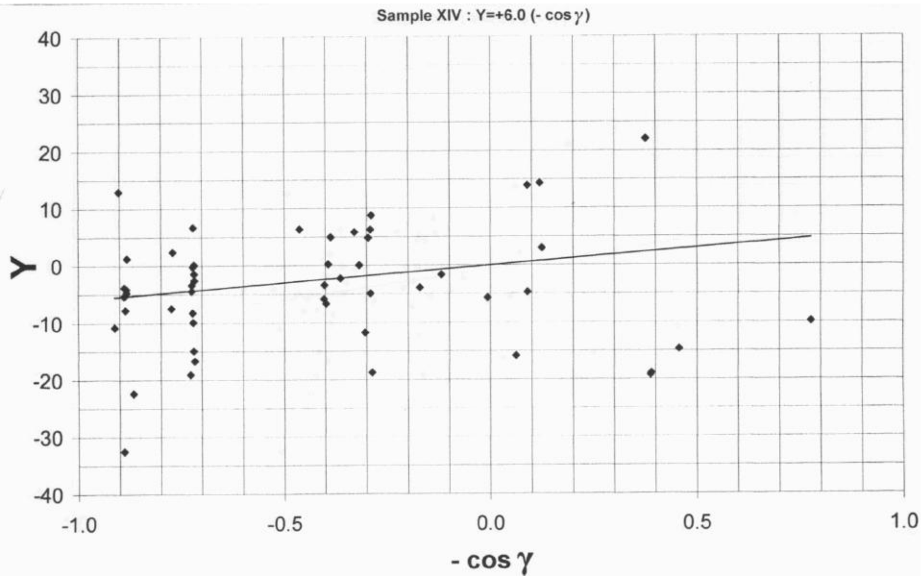

Figure 4: a - Plot of $Y = cz(1+z)/D_L - H_0$ against $-\cos\gamma$, for each SNe Ia of Sample XIV

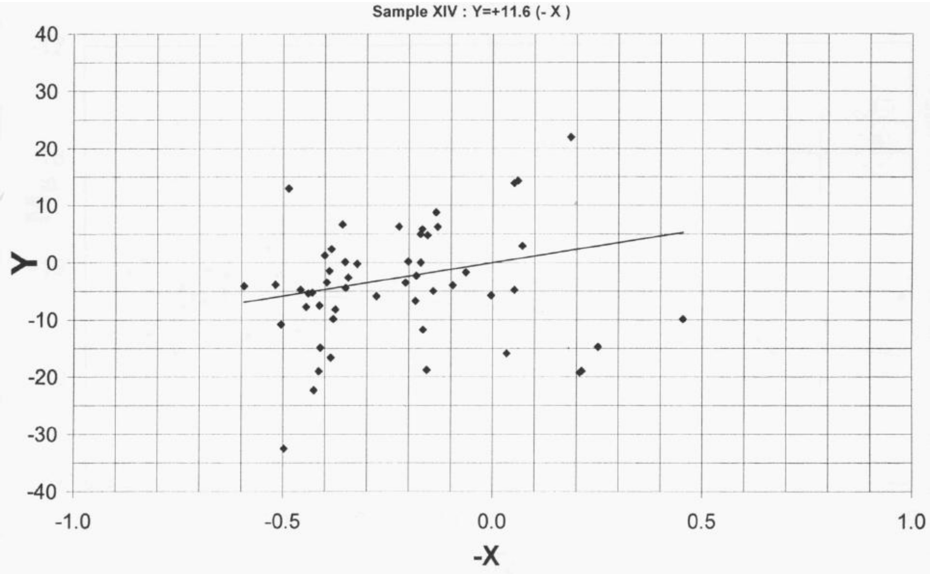

Figure 4: b - Plot of $Y = cz(1+z)/D_L - H_0$ against $-X$, for each SNe Ia of Sample XIV

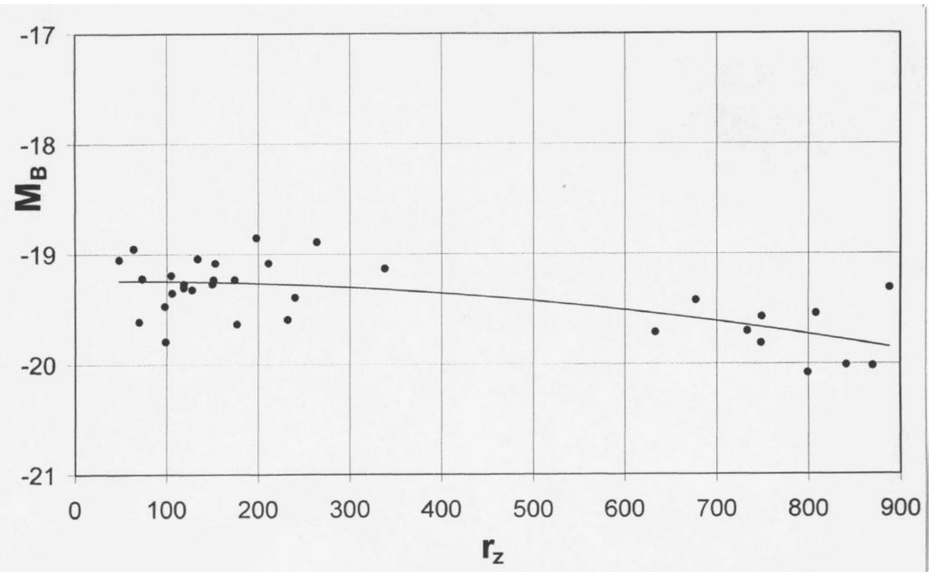

Figure 5: - Plot and fitting of the absolute magnitude $M_B = m - 5\log\left(r_z \cdot (1+z) \cdot \frac{1+x}{1-x}\right) - 25$ against the distance r in Mpc, for 33 SNe Ia of the K03 Sample XVc

Table A1

SN	$-\cos\gamma$	z	r_z
1992bi	−0.11927	0.459	691
1994F	−0.72034	0.354	632
1994G	−0.90186	0.425	692
1994H	+0.08912	0.374	623
1994al	−0.17191	0.420	666
1994am	+0.08955	0.372	621
1994an	+0.77686	0.379	606
1995aq	+0.45353	0.454	671
1995ar	+0.38990	0.465	680
1995as	+0.38784	0.498	701
1995at	+0.37608	0.655	786
1995aw	+0.12439	0.400	642
1995ax	+0.11937	0.615	774
1995ay	−0.00721	0.480	702
1995az	−0.31843	0.450	691
1995ba	−0.91169	0.387	665
1996cf	−0.77084	0.569	775
1996cg	−0.88376	0.489	734
1996ci	−0.29627	0.495	720
1996ck	−0.46304	0.656	809
1996cl	−0.72240	0.827	884

Table A2

SN	$-\cos\gamma$	z	r_z
1996cm	+0.06164	0.450	680
1996cn	−0.28709	0.430	677
1997F	−0.36392	0.580	770
1997G	−0.39891	0.763	853
1997H	−0.40342	0.526	741
1997I	−0.40358	0.172	422
1997J	−0.88712	0.619	804
1997K	−0.86660	0.591	790
1997L	−0.88618	0.549	768
1997N	−0.88404	0.179	448
1997O	−0.88918	0.373	653
1997P	−0.72138	0.471	717
1997Q	−0.71923	0.429	689
1997R	−0.71913	0.656	816
1997S	−0.71946	0.611	795
1997ac	−0.88962	0.319	608
1997af	−0.88925	0.578	784
1997ai	−0.77453	0.449	705
1997aj	−0.72106	0.580	780
1997am	−0.72528	0.415	680
1997ap	−0.29119	0.830	875

Table B

SN	$-\cos\gamma$	z	r_z
1997ek	-0.38753	0.863	888
1997eq	-0.39364	0.538	748
1997ez	-0.88218	0.777	870
1998as	-0.72788	0.354	633
1998aw	-0.71776	0.439	696
1998ax	-0.72248	0.496	733
1998ay	-0.72530	0.637	808
1998ba	-0.30350	0.430	677
1998be	-0.29143	0.644	799
1998bi	-0.28897	0.740	841
2000fr	-0.32936	0.543	749

Table C

SN	$-\cos\gamma$	z	r_z
1990O	+0.32279	0.030	105
1990af	+0.83642	0.050	153
1992P	−0.57004	0.026	106
1992ae	+0.84906	0.075	211
1992ag	−0.11901	0.026	99
1992al	+0.93003	0.014	48
1992aq	+0.89252	0.101	264
1992bc	+0.30293	0.020	73
1992bg	+0.06689	0.036	128
1992bh	+0.20458	0.045	151
1992bl	+0.86310	0.043	134
1992bo	+0.57801	0.018	64
1992bp	+0.02634	0.079	240
1992br	+0.56887	0.088	246
1992bs	+0.21443	0.063	198
1993B	−0.37094	0.071	232
1993O	−0.00014	0.052	174
1993ag	−0.38824	0.050	177
1994M	−0.52881	0.024	98
1994S	−0.70057	0.016	70
1995ac	+0.84258	0.049	150
1995bd	−0.47322	0.016	68
1996C	−0.54708	0.030	119
1996ab	−0.16341	0.125	338
1996bl	+0.39927	0.035	119
199bo	+0.16099	0.160	61