Preliminary results of analysis of Ia type events redshift distributions on data of the Open and Asiago Supernovae Catalogues

I.V. Arkhangelskaja,

National Research Nuclear University MEPhI, Moscow, Russia

The shape of redshift distribution for uniform sources set in our Metagalaxy defined by cosmological parameters and properties of space.

The type Ia supernovae usually considered as a homogeneous subsample ⇔ **suggestion: these luminous events could be used as standard candles for cosmological measurements**

1938: This mention occurs since the earliest studies of supernovae

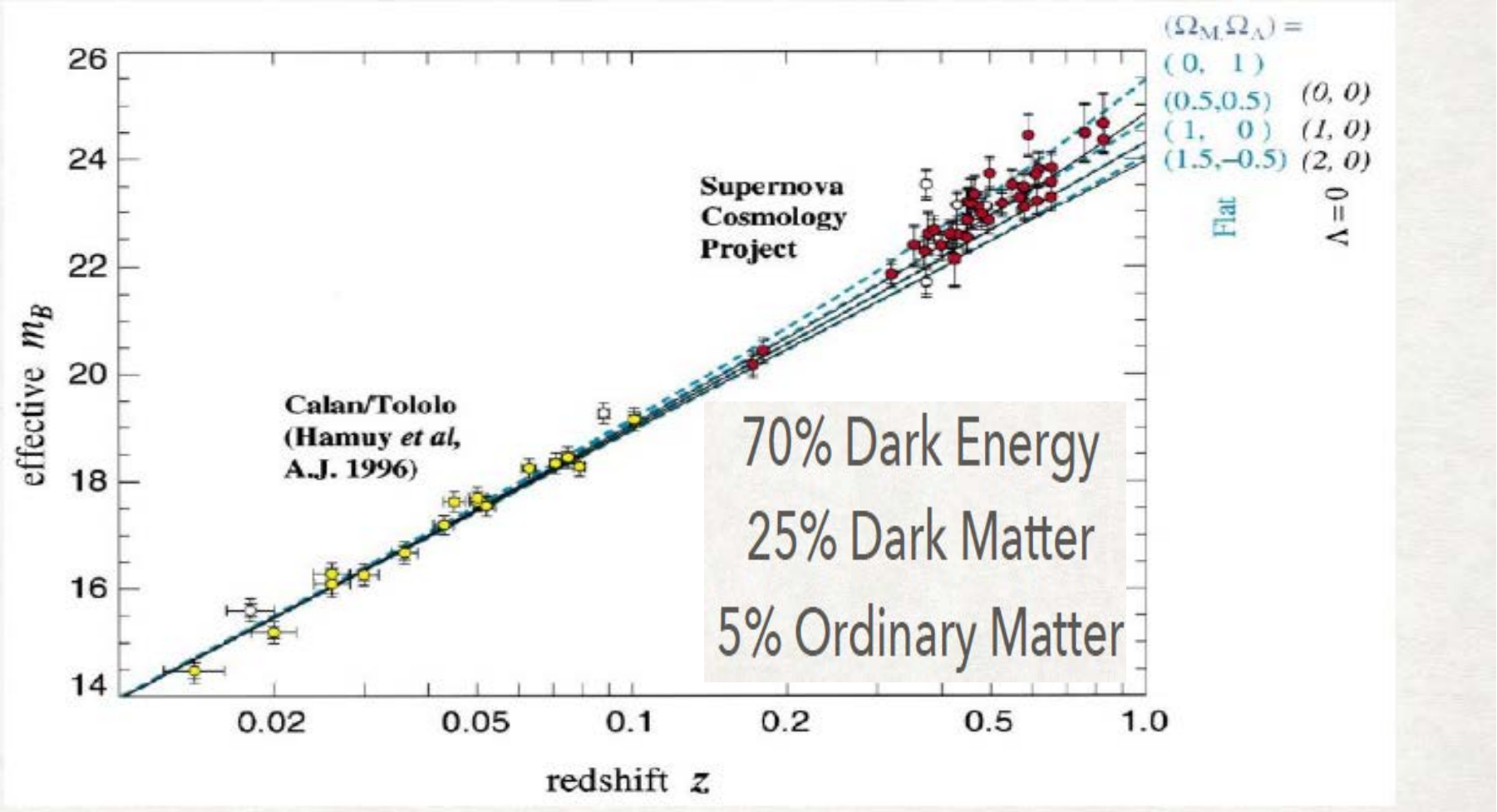
The interest of the scientific community on supernovae (SNe) has increased in the recent years for several reasons. Mostly they are the advances in the understanding of the SN phenomena obtained with the intensive study of nearby SNe, first of all SN 1987A, which have raised new more fundamental questions with regard to progenitor evolution, explosion mechanism and nucleosynthesis

two facts have renewed the interest for the using of SNIa as distance indicators up to cosmological distances in the present time

1) the calibration of the absolute magnitudes of a few SNIa obtained using the Cepheid variables found in their parent galaxies ⇔ **2) the discovery of empirical relations between the absolute magnitudes at maximum and the shape of the light curves of SN Ia**

Other exciting advances are expected for the association of some SNe with the other interest objects, for example, GRBs

Firstly the parameters of our Metagalaxy Ω and Λ were determine due sample of Ia supernovae from the Supernova Cosmology Project analysis in 1998. The space in our Metagalaxy is Euclidean at small redshifts and de-Sitter at z>0.2.



The Open Supernova Catalogue is online collection of observations and metadata. Now the Open Supernova Catalog (OSC) contain data of 67796 SN, and ~678000 individual photometric detections

lists contain more than 1000 supernovae:

(1) Asiago Supernova Catalogue ⇐
(2) Sloan Digital Sky Survey,
(3) Latest Supernovae,
(4) JLA supernovae,
(5) SIMBAD astronomical database,
(6) Transient Name Server,
(7) A unified supernova catalogue,
(8) NED-D,
(9) Catalina Sky Survey,
(10) Pan-STARRS 3Pi,
(11) THE SLOAN DIGITAL SKY SURVEY-II SUPERNOVA SURVEY,
(12) WISeREP—An Interactive Supernova Data Repository,
(13) NASA/IPAC Extragalactic Database,
(14) Sternberg Astronomical Institute Supernova Light Curve Catalogue.

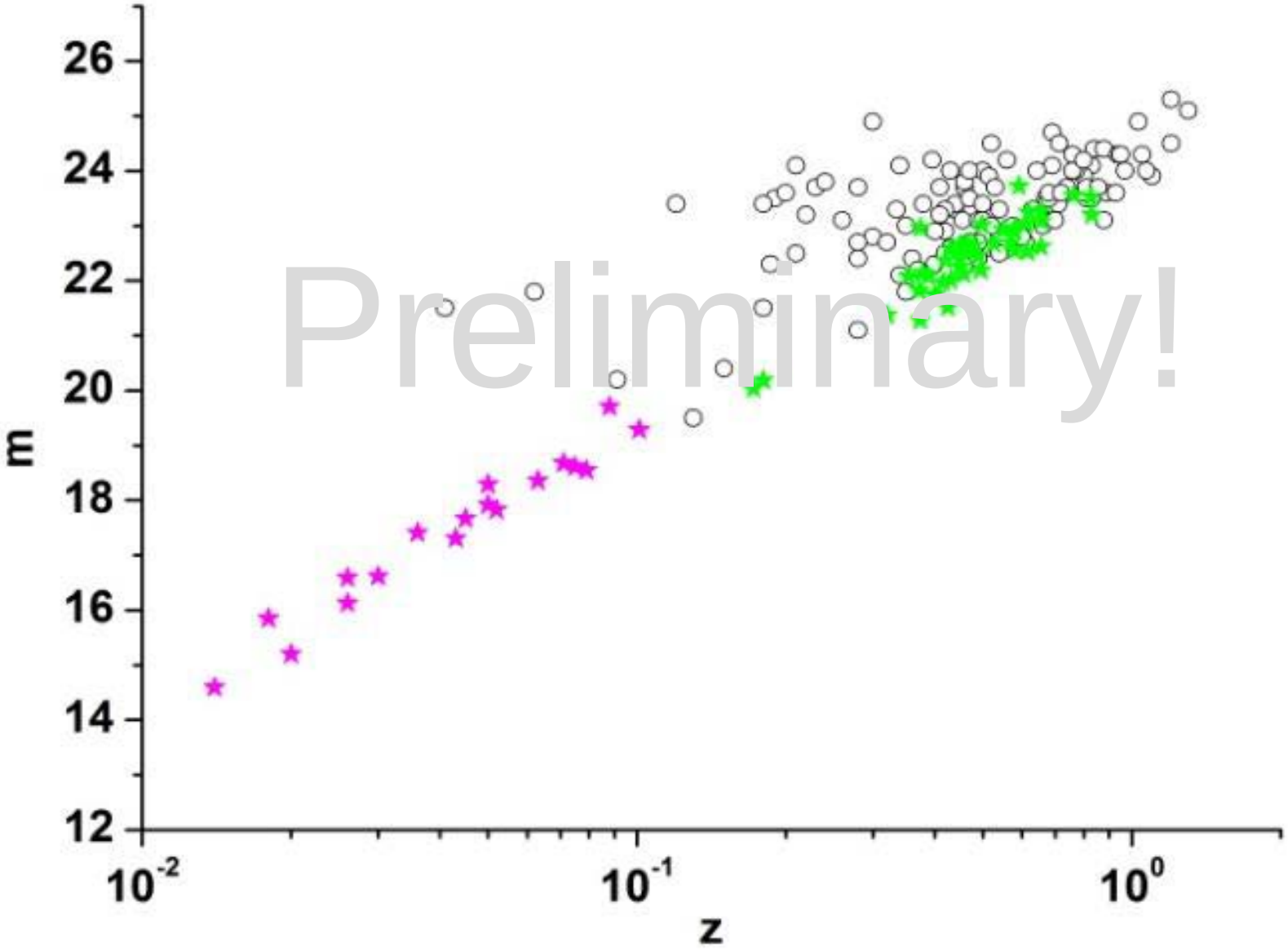
lists contain more than 100 supernovae:

(1) SDSS-II,
(2) LOSS,
(3) LOTOSS,
(4) ESSENCE,
(5) Puckett,
(6) SCP,
(7) HZSST.

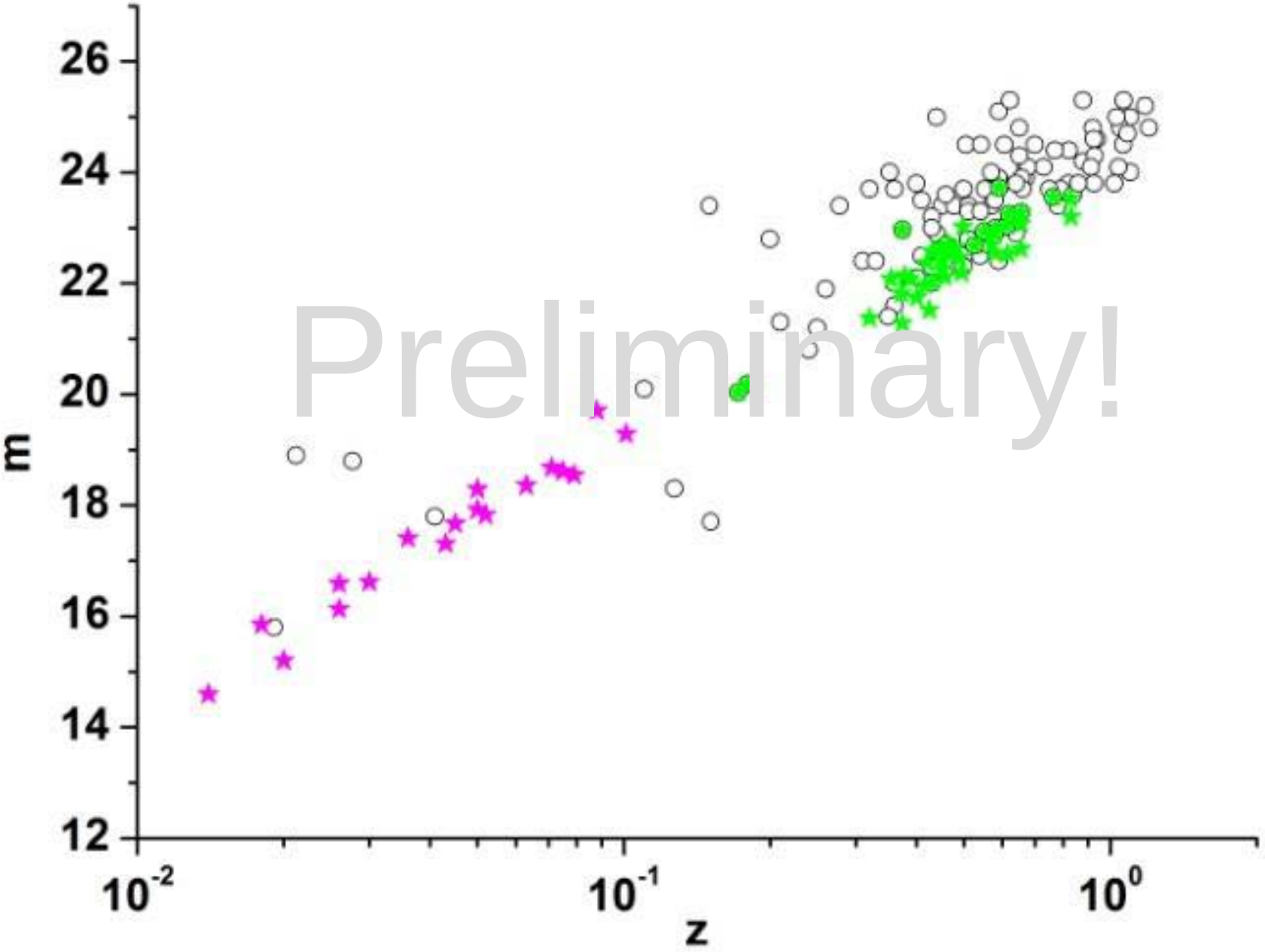
Other 27 SN datasets consist of less amount of members (BAOSS:34, CFHT-LSSP:13)

Other 828 SN lists consist of 5 – 919 objects (DES Bright Transients: 17)

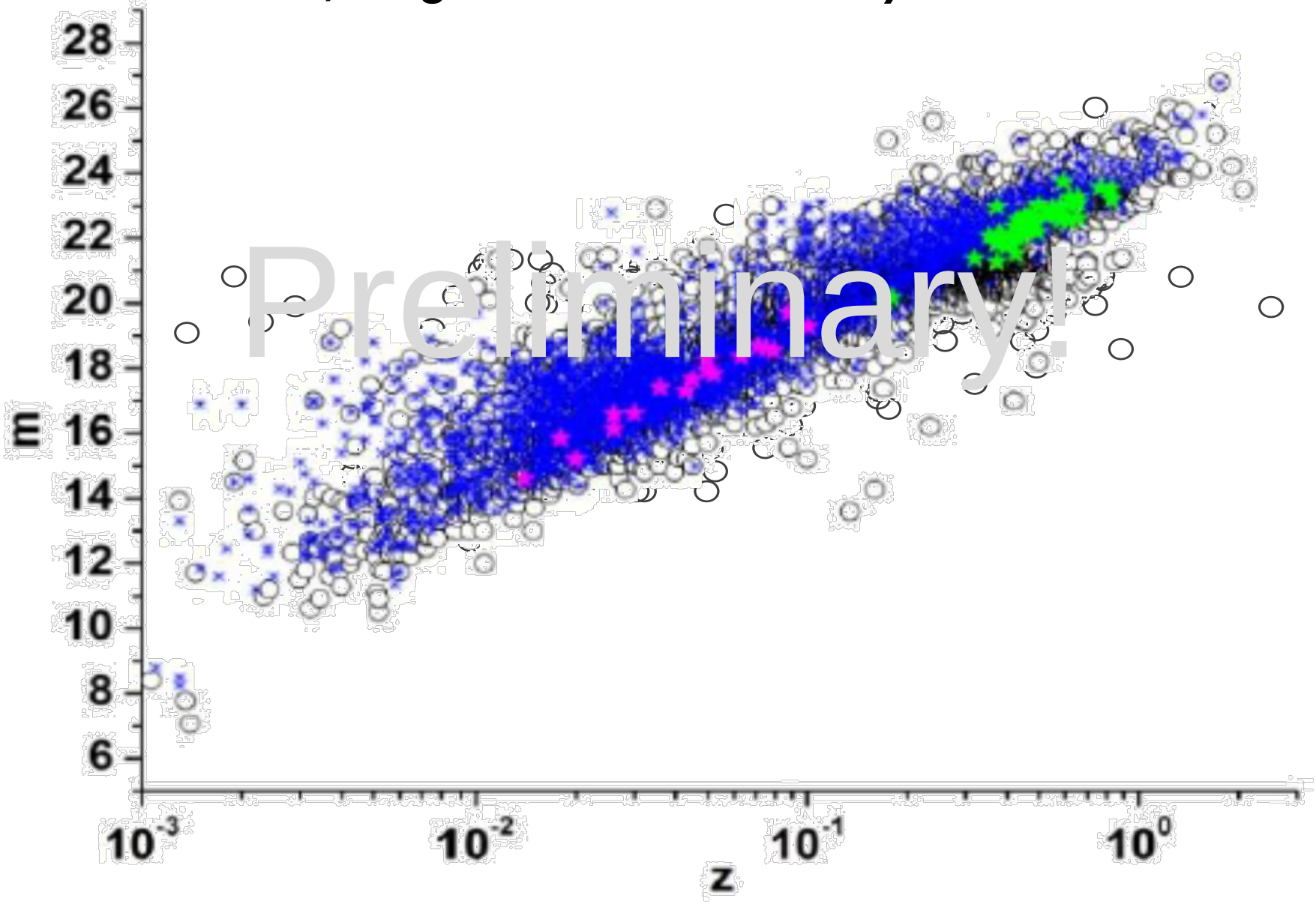
Plot of magnitude dependence on redshift for HZSST experiment (green – Perlmutter data, magenta – Calan/Tololo)



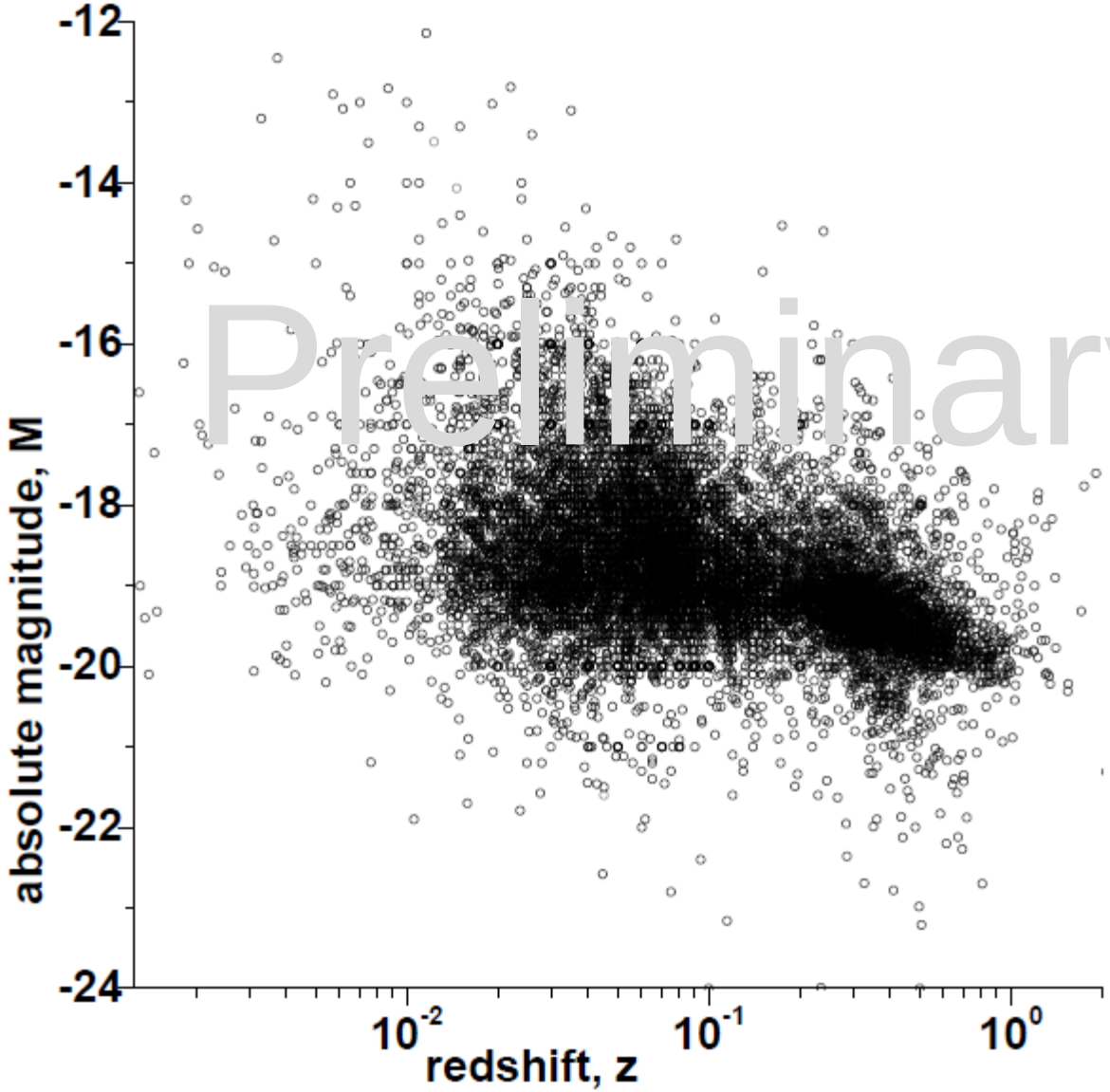
Plot of magnitude dependence on redshift for SCP experiment (green – Perlmutter data, magenta – Calan/Tololo)



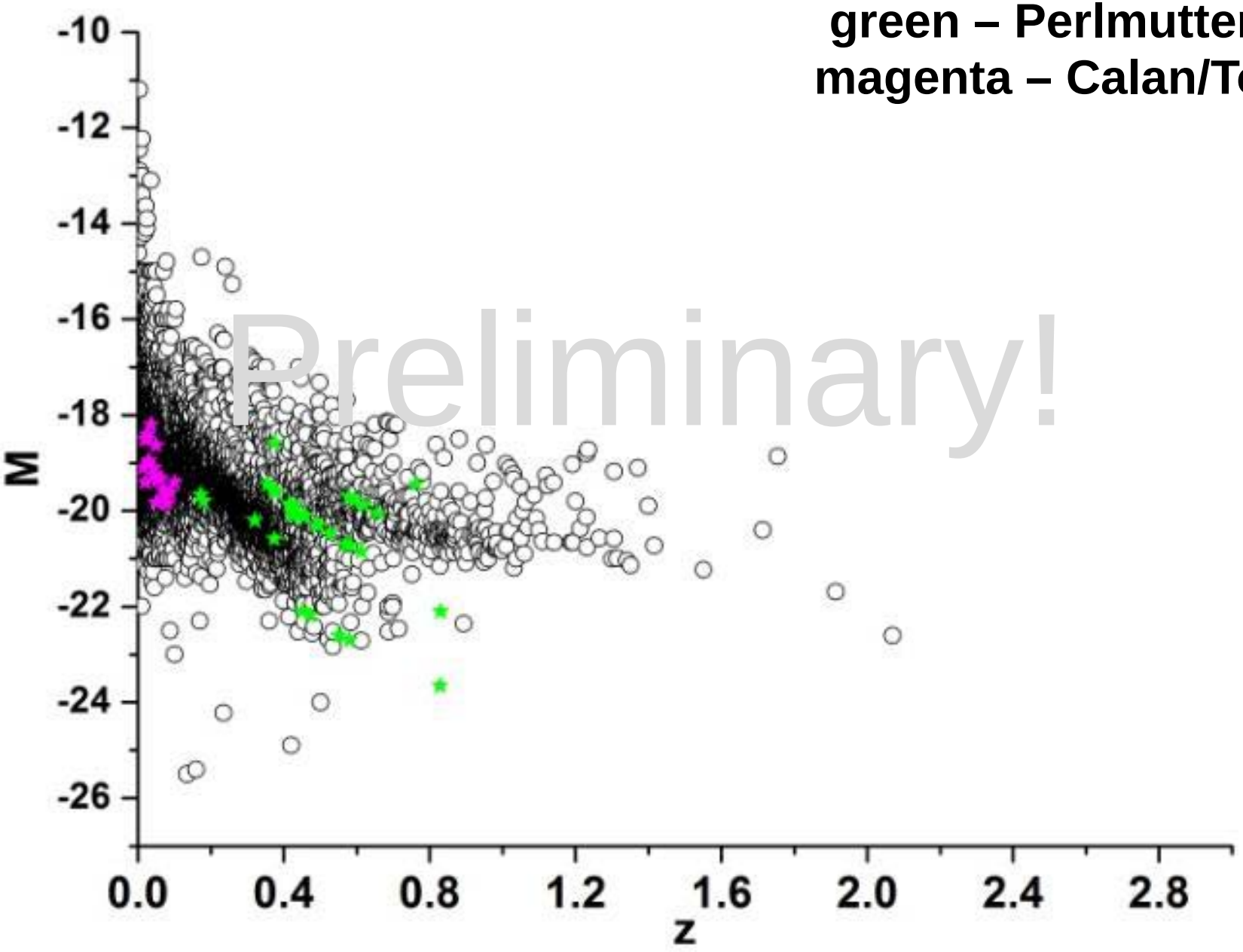
Plot of magnitude dependence on redshift (black - Open Supernova Catalog, blue - Asiago Supernova Catalog, green – Perlmutter data, magenta – Calan/Tololo)



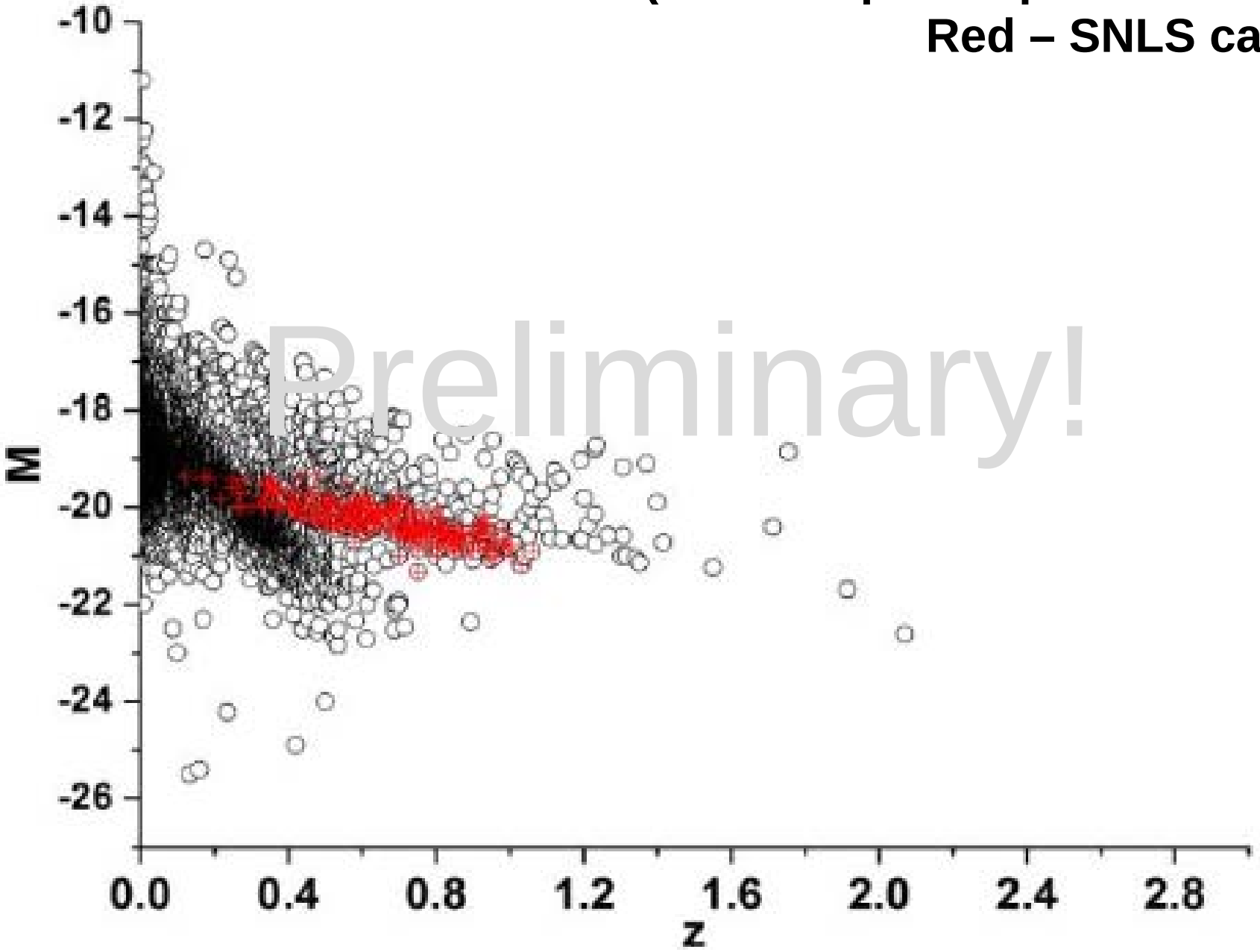
The distribution of SNIa on absolute magnitudes and redshift on data of Open Supernova catalogue



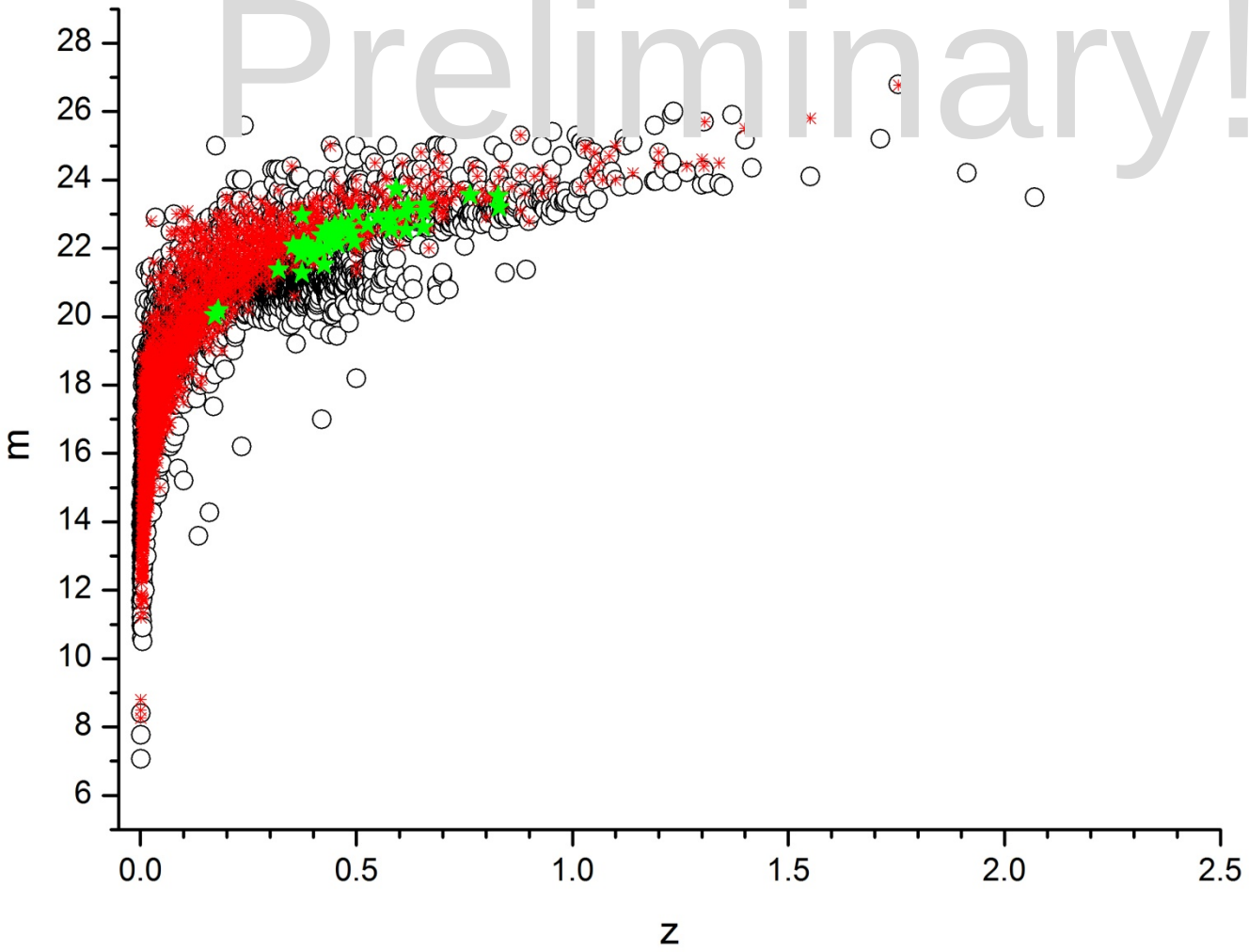
Plot of absolute magnitude dependence on redshift (black - Open Supernova Catalog, green – Perlmutter data, magenta – Calan/Tololo).



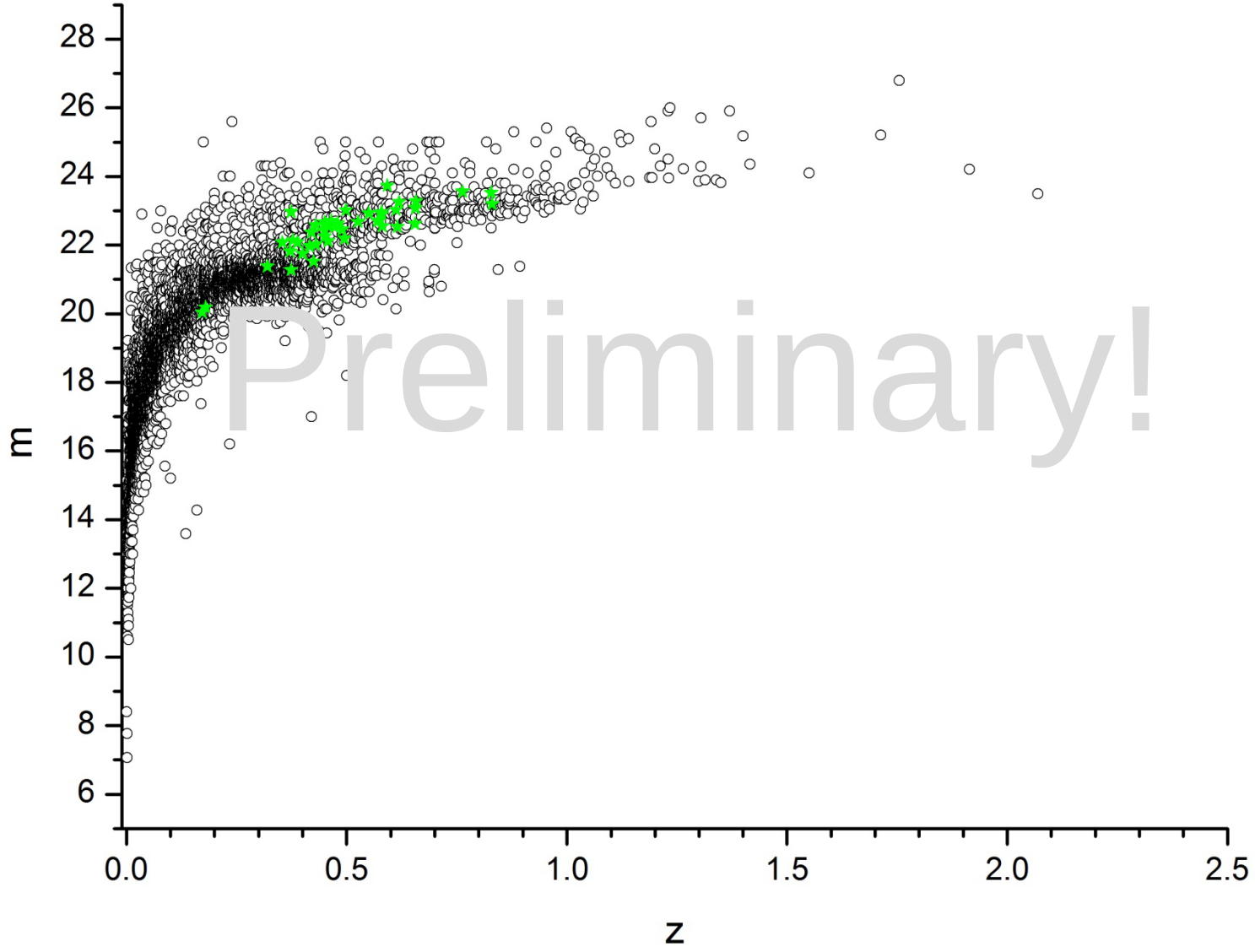
Plot of absolute magnitude dependence on redshift (black - Open Supernova Catalog, Red – SNLS catalog).



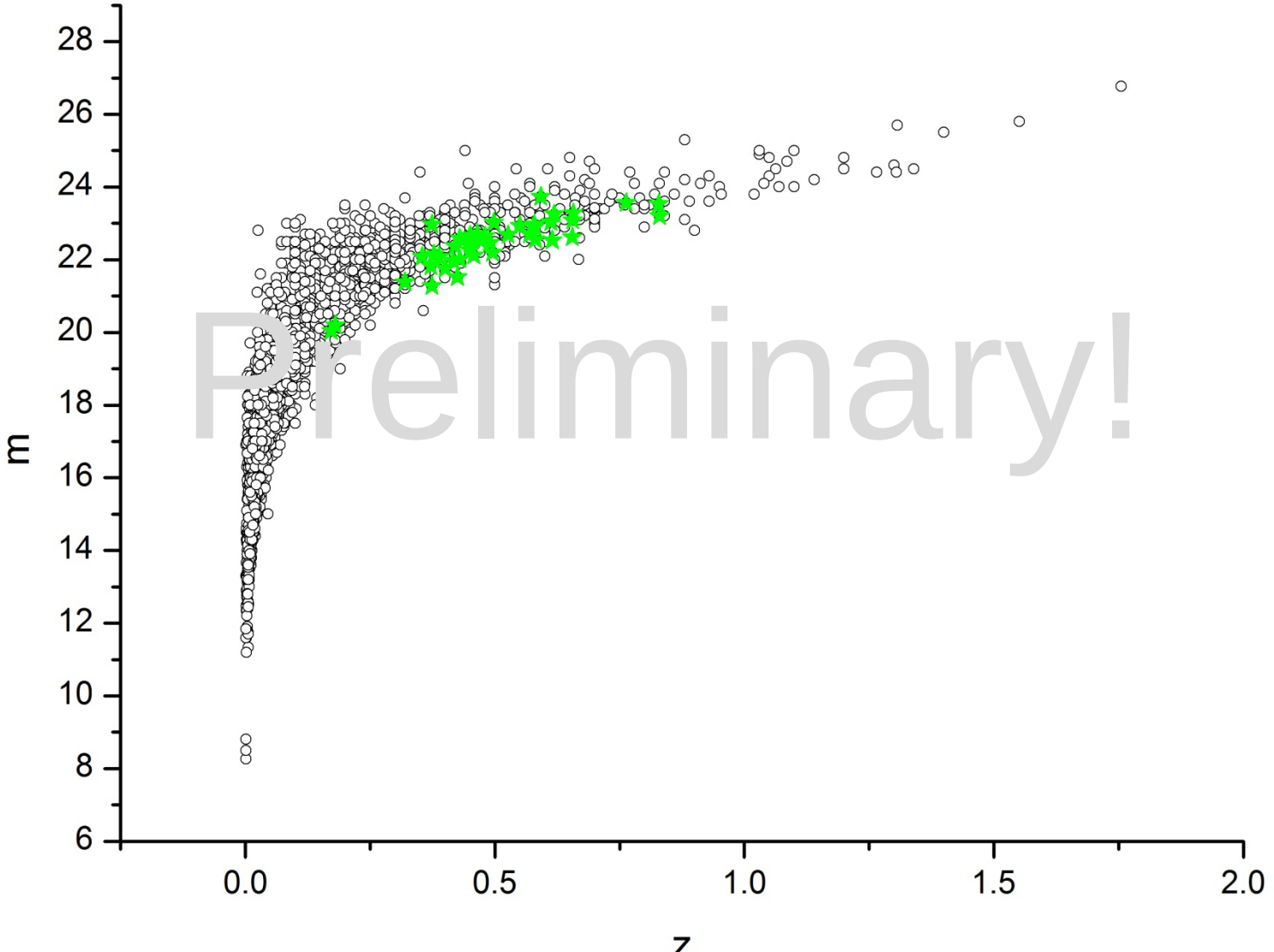
Plot of apparent magnitude dependence on redshift (black - Open Supernova Catalog, Red – Asiago, green -perl catalog).



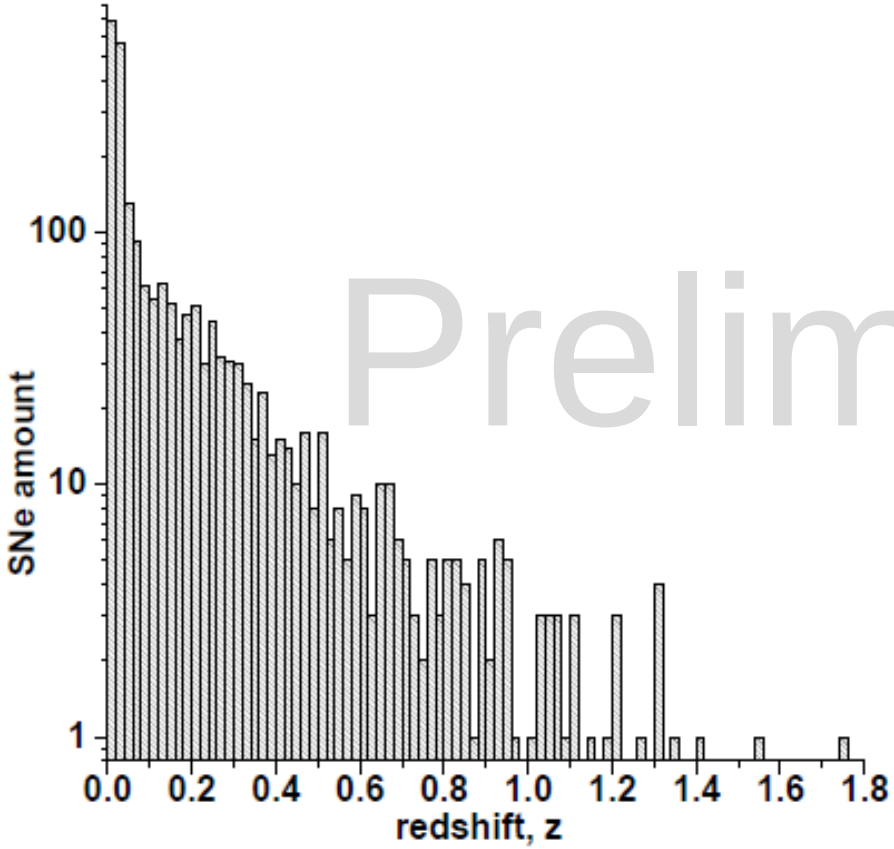
Plot of apparent magnitude dependence on redshift (black - Open Supernova Catalog, green -Perlmutter data).



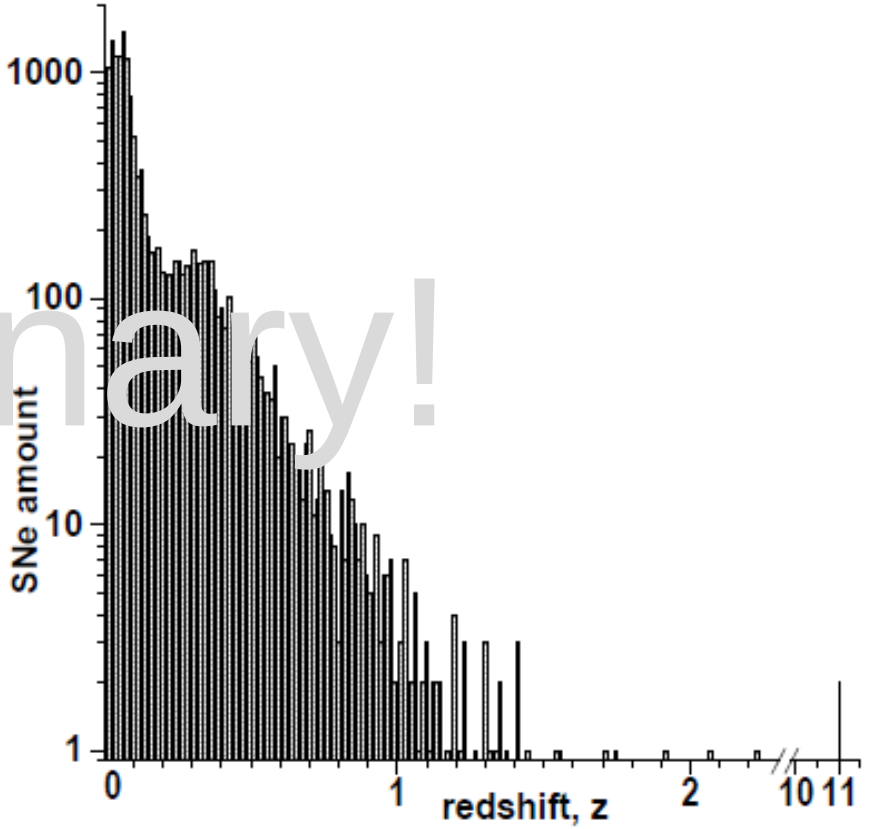
Plot of absolute magnitude dependence on redshift (black -, Asiago, green - Perlmutter data).



The distribution of SNIa amount on redshift on data of following catalogues: (a) Asiago Supernova and (b) Open Supernova.

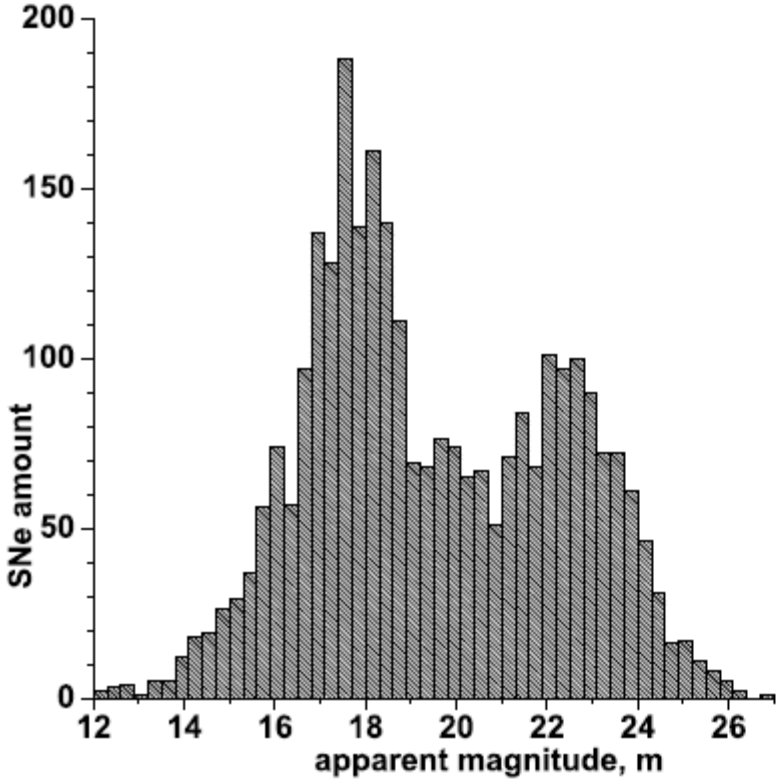


(a)

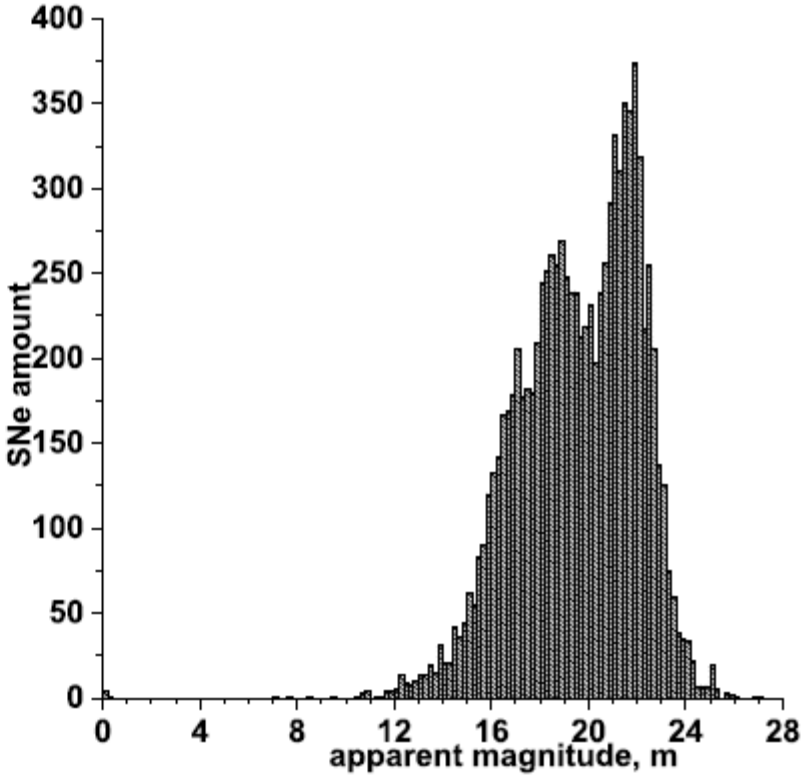


(b)

The distribution of SNIa amount on apparent magnitudes on data of following catalogues: (a) Asiago Supernova and (b) Open Supernova

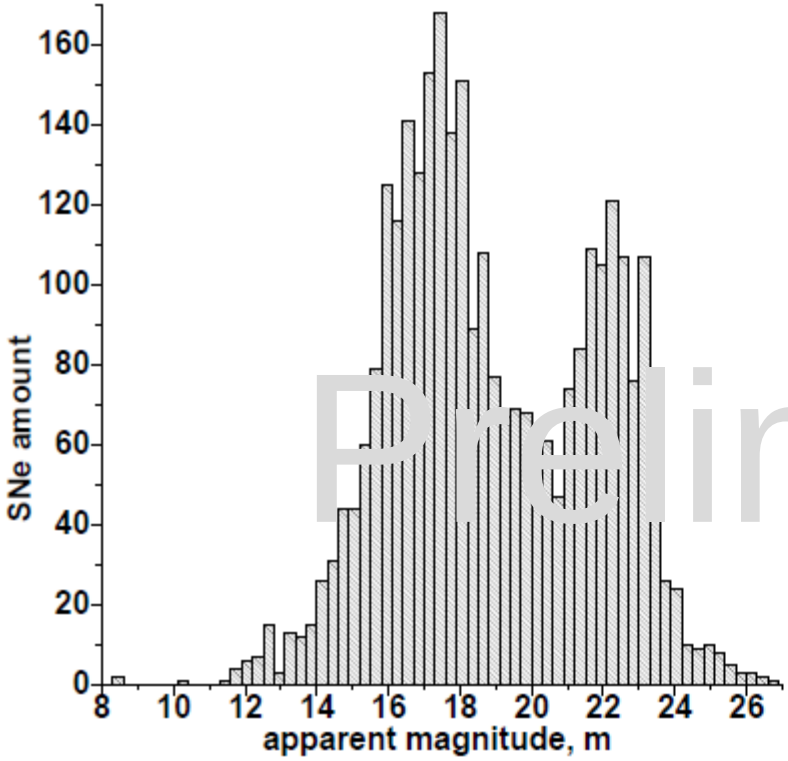


(a)

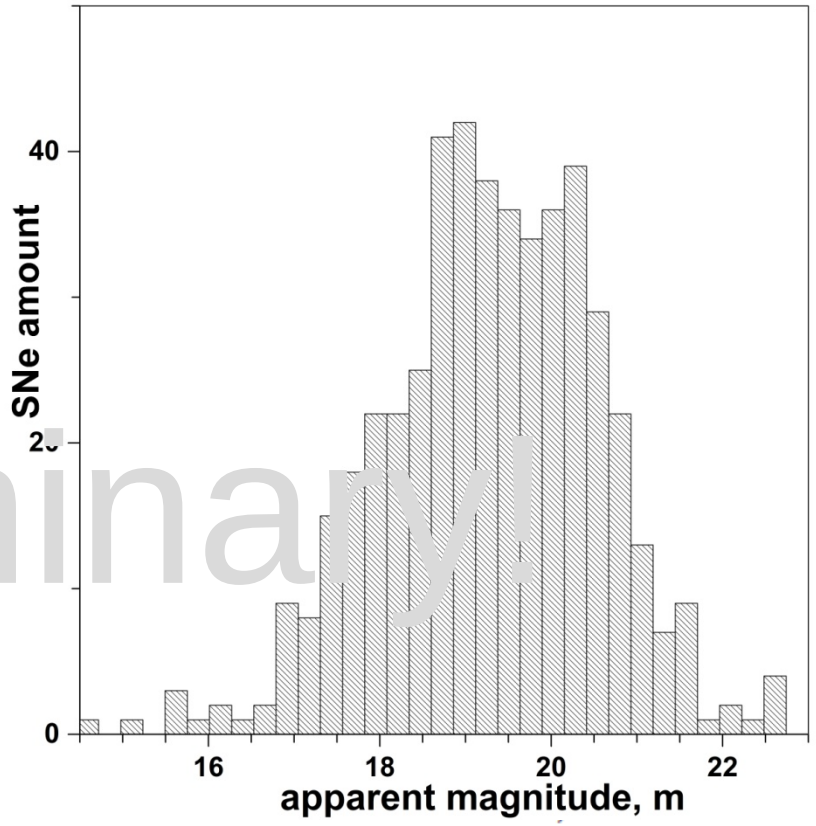


(b)

The distribution of SNIa amount on apparent magnitudes on data of: (a) Sternberg Astronomical Institute Supernova Light Curve Catalogue, (b)Pan-STARRS1 (PS1) Medium Deep Survey within Open Supernova Catalogue

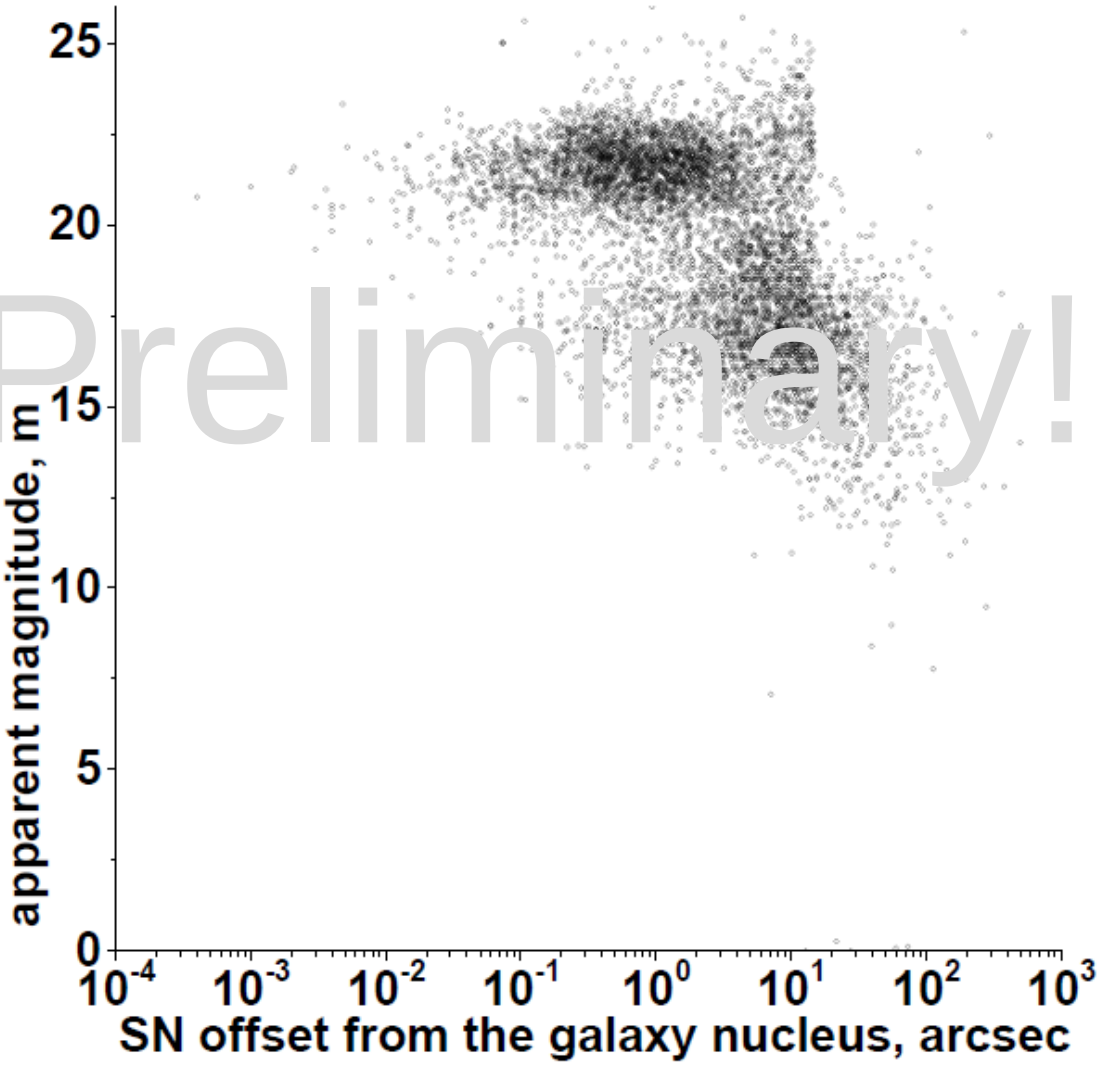


(a)

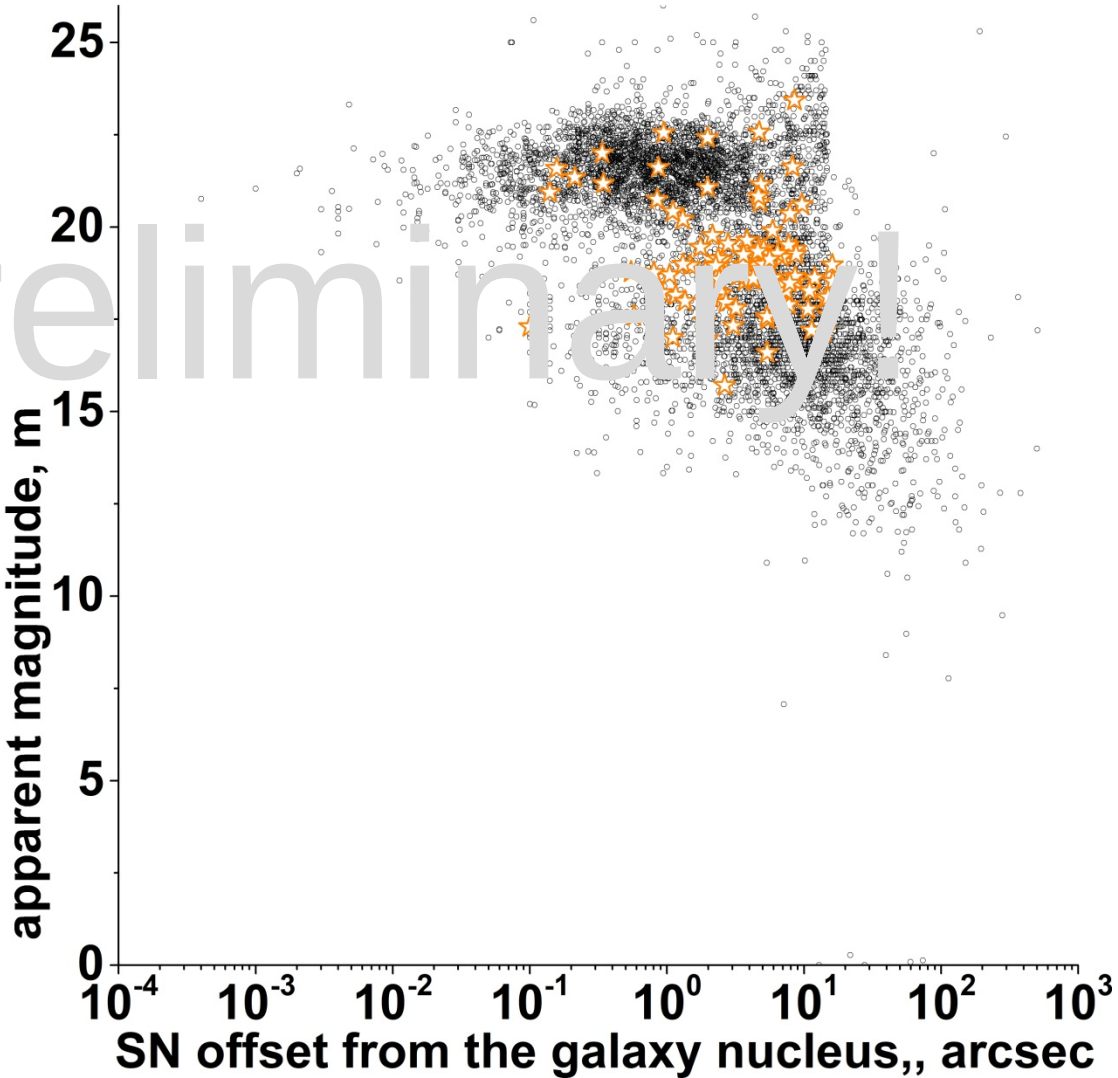


(b)

The distribution of SNIa on apparent magnitudes and SN offset from the galaxy nucleus on data of Open Supernova catalogue



The distribution of SNIa on apparent magnitudes and SN offset from the galaxy nucleus on data of Open Supernova catalogue



Preliminary analysis results have shown the presence of two subsets ($faint_m$ and $bright_m$ supernovae) at each distributions separated by $m_{fb} \sim 20$. These dual structure appear in the same distributions of catalogues composing OSC.

Let's consider two SNIa at z1 = 0.0039 and z2 = 0.0037: 1998aq and 2004W. The difference in the apparent magnitudes of these objects is ~ 6:

m1max = 12.5 (bright SNIa) and m2max = 18.5 (faint SNIa)

ome hosts contain several supernovae but its apparent magnitudes could differ for Δmonehost ~ 2.5. For example, galaxy UGC03432 withmgal = 15.51 at z=0.016667 contain two SNIa 1996bv has m1 = 15.5 and 2003kb has m2 = 18.

The examples of difference in the apparent magnitudes of SNIa at various redshifts

#	SN	redshift z	m_{max}	Δm_{max}	m_{host}
1	2004W	0.0037	18.5	~ 6	9.8
2	1993c	0.012	18.0	~ 4.4	13.3
3	2007if	0.04	20.5	~ 4.4	16.3
4	1999G	0.10	21.4	~ 3.5	18.4
5	1998aq	0.0039	12.5	~ 6	10.9
6	1999cw	0.013	14.3	~ 4.4	14.2
7	2009do	0.04	16.1	~ 4.4	16.1
8	2012X	0.10	17.9	~ 3.5	17.7

CONCLUSIONS

The preliminary results of data analysis shows that several peculiarities are presented in Ia supernovae redshift distribution

The deviation in the band $0.015 < z < 0.13$ accordingly Open Supernova Catalogue (OSC)

data contain more faint supernovae. Two peculiarities also were found in the region $0.25 < z < 0.45$ on data of this catalogue. One of it's contain more faint events, other contain more bright supernovae.

Also $faint_m$ and $bright_m$ supernovae areas could be separated by $m_{fb} \sim 20$ in distribution of object amount on apparent magnitude on both catalogues data.

The distribution of SNIa on apparent magnitudes and angular distance to host centre on OSC data also reveal two areas (faintdist and brightdist objects) and ratio between these regions populations is different for different subsamples in OSC (Pan-STARRS1 (PS1) Medium Deep Survey, ASASSN and so on)

CONCLUSIONS

The preliminary results of data analysis shows that several peculiarities are presented in Ia supernovae redshift distribution

Different scenarios of Type Ia SNe explosions (Single Degenerate, Double Degenerate)????

Absorption in the Galaxy, in host galaxies?????

Deviations that occur over redshift ranges as small as about 0.05 and as large as the full observed redshift range of about 2.3 ?????
Appearance in H_0 tension and so on????
Really changing of the parameters of our Metagalaxy???

Next: Dark Energy Survey Supernova Program data analysis…

Thank you for attention!