The influence of peculiar velocities of SNe Ia on distance measurements
THE HUBBLE CONSTANT

- SDSS + Planck $\sim 67.91 \frac{\text{km/s}}{\text{Mpc}}$ (arXiv:2007.08991)

- SNe Ia observations $\sim 73.24 \frac{\text{km/s}}{\text{Mpc}}$ (Riess et al., 2019)

- luminosity distance - redshift relation

- SNe Ia standardisation method improvements, for example, taking into account the environmental parameter

$\Omega_{\text{DE}} \approx 0.73$
\[ \mu = 5 \log d_L - 5 \quad \text{— distance modulus} \]

\[ d_L = \left(1 + z\right) \frac{c}{H_0} \int_0^z \frac{dz'}{\sqrt{\Omega_m (1 + z')^3 + \Omega_\Lambda}} \]

\[ (1 + z_{\text{obs}}) = (1 + z_{\text{cosmolog}})(1 + z_{\text{peculiar}}) \]

\[ z_{\text{obs}} \simeq z_{\text{cosmolog}} + z_{\text{peculiar}} \]

The radial peculiar velocity contributes to redshift value.

We consider peculiar velocities of SNe host galaxies as a next step of the decreasing the spread on the Hubble diagram.
PANTHEON SAMPLE

- Pantheon Sample is the latest cosmological sample with 1048 SNe Ia
- Two nearby clusters of galaxies show the velocity dispersion value $> 1000 \text{ km/s}$
- Intrinsic dispersion value for the Pantheon

$$\sigma_m = \frac{5\sigma_V}{cz \ln 10}$$ — mag dispersion calculated by the peculiar velocity dispersion $\sigma_V$
As a cosmological sample we chose the Pantheon sample and added some SNe from the JLA.

To determine the galaxies’ clusters we chose catalogs:


We found 34 SNe in clusters of galaxies in the nearby Universe i.e. $z_{\text{cluster}} < 0.2$.

Differences in redshift values between host galaxy and its cluster are $0.0001 \div 0.02$.  

PRELIMINARY RESULTS
11 SNe Ia from the Nearby Supernova Factory were found in the clusters of galaxies (Leget et al., 2018)

The galaxy cluster redshift was used instead of the host galaxy redshift to construct the Hubble diagram

Significant dispersion decreasing around the Hubble diagram

Leget et al., 2018
FUTURE PLANS

- Calculate the cosmological redshift $z_{\text{cluster}}$ for all clusters of galaxies using redshifts of their members.
- Take into account the difference between $z_{SN}$ and $z_{\text{cluster}}$.
- Plot the Hubble diagram with the improvement values of redshifts and estimate the dispersion.

Thank you for your attention!