

# Annual Report 2013

Jaan Einasto

## 1 Research

I participated in the comparison of the structure of groups of galaxies of the Sloan Digital Sky Survey seventh data release (SDSS DR7) galaxy and galaxy group catalogues and groups found for the Millennium N-body simulation by Nurmi et al. (2013). We analysed the group luminosities, group richnesses, virial radii, sizes of groups and their rms velocities for four volume-limited samples from observations and simulations. Our results showed that the spatial densities of groups agree within one order of magnitude in all samples with a rather good agreement between the mock catalogues and observations.

I participated in the search for shell-like structures in the distribution of nearby rich clusters of galaxies drawn from the SDSS DR8, initiated by Maret Einasto (Einasto et al., 2013b). We find the maxima in the distribution of distances from rich galaxy clusters to other groups and clusters at distance of about  $120 h^{-1}$  Mpc suggesting a density enhancement at these distances from rich clusters, and possible indication of shell-like structures. The rich cluster A1795, the central cluster of the Bootes supercluster, has the highest maximum in the distance distribution of other groups and clusters around them at distance of about  $120 h^{-1}$  Mpc among our rich cluster sample, and another maximum at a distance of about  $240 h^{-1}$  Mpc. However, the radius of the possible shell is larger than expected for a BAO shell ( $\approx 109 h^{-1}$  Mpc).

Together with Maret Einasto and collaborators I studied the morphology and galaxy content of SDSS DR8 superclusters (Einasto et al., 2013a). We found that the fraction of red, early type, low star formation rate (SFR) galaxies in superclusters is higher than among galaxies in low density global environment. In all environments the fraction of blue, low stellar mass and high star formation rate galaxies in poor groups is larger than in rich groups. The fraction of red, early type, low SFR galaxies in superclusters of filament type is higher than in superclusters of spider type. In superclusters of spider morphology red, high SFR galaxies have higher stellar masses than in filament type superclusters. Groups of equal richness host galaxies with larger stellar masses, and they have larger fraction of early type and red galaxies, and higher fraction of low SFR galaxies, if they are located in superclusters of filament morphology. The peculiar velocities of the main galaxies in groups from superclusters of filament morphology are larger than in those of spider morphology. Groups with larger peculiar velocities of their main galaxies in filament type superclusters are located in higher density environment than those with small peculiar velocities. There are significant differences between galaxy populations of individual richest superclusters.

I continued the work on book “Dark Matter and Cosmic Web Story” (Einasto, 2013b), a personal recollection of the story of the discovery of dark matter and the large scale structure of the Universe, as seen from our viewpoint. Most of the year 2013 was spent to the editing and polishing of the book and the accompanying website. The book is now printed by World Scientific Publishing Co. The official presentation of the book in Tartu University shall be on December 2.

My talk on Texas Meeting in 2012 is published (Einasto, 2013a).

## 2 Lectures, conferences

- February 06, Interview to the Estonian Radio on current problems in astronomy;
- April 12, lecture in the AHHA Science Center “Astronomy in Estonia”;
- April 25, lecture in the Tartu University Keila campus “The development of the understanding of the structure of the Universe”;
- May 03, lecture at the TEDx in Tallinn “The Universe and its content”;
- May 29, talk in the Turku University “Dark Matter and the Structure of the Universe”;
- June 20, talk on the signing ceremony of the “Jaan Einasto Foundation”;
- August 10, talk in the Estonian Astronomical Society Annual Meeting “The evolution of the Universe”;
- September 02, talk on the conference in honour of Prof. G. Kangro “Remembering Gunnar Kangro as Teacher”;
- September 12, talk in the Tartu-Tuorla seminar “Formation of the Cosmic Web”;
- September 27, talk in the Kunda Museum on Science Night “Encounters with Ernst Öpik”;
- September 30, discussion in the Estonian Television “Music and Science”;
- November 07, talk in the Buddha Society in Tallinn “Understanding the Structure of the Universe”;
- November 17, talk in the Society of Theatre Producers in Tallinn “The Structure and Evolution of the Universe”;
- December 02, presentation of the book “Dark Matter and Cosmic Web Story” in the Tartu University.

## 3 Visits

- May 28 – June 02, Turku University to receive the Doctor Honoris Causa Award;
- July 07 – July 13, Turku University, European Week of Astronomy and Space Science..

## 4 Scientific organisations, awards

I am member of the International Astronomical Union (1961), Estonian Academy of Sciences (1981), American Astronomical Society (1981), European Astronomical Society (1990), Academia Europaea (1990), Royal Astronomical Society (1994).

I have Estonian Science Prizes (1982, 1998, 2003, 2007), The Estonian Order of the National Coat of Arms (1998), Marcel Grossmann Award (2009), honorary Doctor of Tartu University (2010), Viktor Ambartsumian International Prize (2012).

On May 31 I was given the Doctor Honoris Causa degree of the Turku University.

On June 20 the representatives of Tartu University and I signed the document to create “Jaan Einasto Foundation” to support young scientists in astronomy and cosmic physics. I donated to the Foundation 50,000 US dollars.

## References

Einasto, J. 2013a, *Dark Matter*, Brazilian Journal of Physics

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November 19, 2013