

Einasto Jaan

Position: Adjunct Professor of the ICRANet Faculty
Period covered: 01 January – 31 December 2010



I. Scientific Work

Together with E. Tago, E. Saar and other members of the Tartu Observatory cosmology group I participated in the compilation of a catalogue of groups of galaxies for the Sloan Digital Sky Survey (SDSS) using all 7 data releases (Tago et al. 2010a, 2010b). The catalogue is prepared in two versions, using all galaxies up to observational limit (flux-limited catalogue), and a series of volume-limited catalogues.

In collaboration Tartu with and Potsdam astronomers I made several series of numerical simulations of structure evolution of the universe. These simulations have several goals: to investigate the influence of density perturbations of different scale to structure formation and evolution, the role of phases to the formation of systems of galaxies of various scale, the absence of galaxies in voids etc. Simulations were made for several cube sizes: 64, 100, 256, 500, 768, 1000 Mpc/h. For most models simulations were performed with full power spectrum, and with truncated spectrum, where long-wave perturbations are cut. Initial conditions (random numbers used to generate initial positions and velocities of particles) were identical in models of various cut, this allows to identify particles in systems (halos), and to follow the behavior of halos in varying conditions. The analysis of models shows that voids appear in regions of space where large-scale density perturbations have similar phases of low-density sections of perturbations, and superclusters form in regions where large-scale perturbations have similar phases in high-density sections. Two papers based of this series of models are almost completed and ready to send to the publisher ("Wavelet analysis of the formation of the cosmic web" by J. Einasto G. Hütsi, E. Saar, I. Suhhonenko, L. J. Liivamägi, M. Einasto, V. Müller, A. A. Starobinsky, E. Tago, and E. Tempel and "The cosmic web for various scale density perturbations" by Suhhonenko, J. Einasto, L. J. Liivamägi, E. Saar, M. Einasto, S. Gottlöber, G. Hütsi, V. Müller, E. Tago, and E. Tempel).

I participated in the analyze of rich clusters of galaxies in the Sloan Great Wall (Einasto et al. 2010), and in the study of the environment of nearby quasars (Lietzen et al. 2010).

II. Conferences and educational activities

II a. Conferences and Other External Scientific Works

Series of 5 lectures in January 2010 in Nice Observatory on Large-scale Structure of the Universe. Invited talk "Large Scale Structure of the Universe - a powerful probe for fundamental physics" in the 2nd Galileo-Xu Guangqi Meeting in July 12 - 18 in Ventimiglia.

Lectures in the IRAP PhD Erasmus Mundus School, 6 - 10 September in Nice: 1. Large Scale Structure of the Universe I. Introduction; 2. Large Scale Structure of the Universe II. Quantitative Analysis; 3. Large Scale Structure of the Universe III. Dark Matter; 4. Large Scale Structure of the Universe IV. Cosmological Parameters and Dark Energy; 5. Large Scale Structure of the Universe V. Formation and Evolution.

II b. Other Teaching Duties

Lecturing in Tartu and Baltimore Universities and Estonian Schools

March 17 - lecture "The Structure of the Universe" in Paldiski High-School, Estonia.

March 19 - lecture "The Structure and Evolution of the Universe" in Ala High-School, Estonia.

April 19 - seminar talk in Baltimore University "Large Scale Structure studies in Tartu".

May 25 - Tartu University seminar talk "Professor Taavet Rootsmäe 125 Jubilee".

May 27 - Tartu Observatory seminar talk "Remarks on the History of Tartu Observatory".

September 24 - Lecture in Tartu University "The Structure and Evolution of the Universe".

October 29 - Lecture "Large Scale Structure of the Universe - current problems" in Virtual Institute of Astroparticle Physics, Paris via internet.

III. Service activities

III a. Within ICRANet

participation of the preparation of Erasmus Mundus program

III b. Outside ICRANet

Member of the Scientific Organizing Committee of the Conference devoted to the 200 Anniversary of Tartu Observatory, to be held in April 2011.

IV. Visits:

January 17 - February 21: Pescara, ICRANet;

01 April 01 - May 01: Baltimore, Astronomy Department of Johns Hopkins University;

July 11 - September 12: Nice, Ventimiglia;

September 27 - November 27 - Astrophysics Institute Potsdam.

2010 List of Publications:

Einasto, J. 2009, *Dark Matter*, arXiv0901.0632E (revised)

Einasto, J. 2010, *Two hundred years of galactic studies in Tartu Observatory*, ArXiv e-prints

Einasto, M., Tago, E., Saar, E., Nurmi, P., Enkvist, I., Einasto, P., Heinamaki, P., Liivamagi, L. J., Tempel, E., Einasto, J., Martinez, V. J., Vennik, J., & Pihajoki, P. 2010, *The Sloan Great Wall. Rich clusters*, ArXiv e-prints
Lietzen, H., Heinamaki, P., Nurmi, P., Liivamagi, L. J., Saar, E., Tago, E., Tempel, E., Einasto, M., Einasto, J., Gramann, M., & Takalo, L. O. 2010, *Large Scale Environments of Nearby Quasars*, in American Institute of Physics Conference Series, Vol. 1240, American Institute of Physics Conference Series, ed. V. P. Debattista & C. C. Popescu, 249

Tago, E., Saar, E., Tempel, E., Einasto, J., Einasto, M., Nurmi, P., & Heinamaki, P. 2010a, *Groups of galaxies in the SDSS Data Release 7. Flux- and volume-limited samples*, A&A, 514, A102+

Tago, E., Saar, E., Tempel, E., Einasto, J., Einasto, M., Nurmi, P., & Heinamaki, P. 2010b, *Groups of galaxies in the SDSS Data Release 7. Flux- and volume-limited samples.*, VizieR Online Data Catalog, 351, 49102