

# Jasjeet Singh Bagla

## Research Summary:

The distribution of galaxies can be described in a statistical manner using a hierarchy of correlation functions. This full hierarchy is often difficult to compute and represent and reduced moments of the distribution are often used to describe its key features. The initial density perturbations are Gaussian and all the moments can be expressed in terms of the second moment. The late time distribution of galaxies is highly non-Gaussian and the values of reduced moments are very sensitive to the form of the high density non-Gaussian tail. We studied the non-Gaussian tail of the probability distribution function of density in cosmological N-Body simulations for a variety of initial conditions. Further, we studied the differences between the distribution in real space and redshift space. The form of the distribution function in redshift space is of great significance as galaxy surveys probe this and not the real space analogue predicted using theoretical models. We have shown that redshift space distortions in the non-linear regime dominate over signatures of initial conditions or the cosmological background. We find that at scales smaller than the scale of non-linearity the differences in Skewness, etc. for different models are very small compared to the corresponding differences in real space. We show that bias also leads to smaller values of higher moments, but the redshift space distortions are typically the dominant effect. In particular, we are able to explain the observations of reduced moments from galaxy surveys and also the differences between these and the predictions for reduced moments in real space. This work was done with Suryadeep Ray.

## Publications:

1. Bagla J. S. and Prasad Jayanti, *Effects of the size of cosmological N-Body simulations on physical quantities — I: Mass Function*, MNRAS **370**, 993 (2006)

## Preprints:

1. Bagla J. S. and Ray Suryadeep, *Gravitational Clustering in Redshift Space: Non-Gaussian Tail of the Cosmological Density Distribution Function*, astro-ph/0604598.

## **Conference/Workshops Attended:**

1. *Emerging Trends in Physics 2006*, SGTB Khalsa College, Delhi, India, September, 2006.
2. *IUCAA Reference Centre Workshop on Advanced Topics in Data Analysis in Cosmology and Gravitational Wave Astronomy*, University of Delhi, Delhi, India, October, 2006.
3. *Study of Hot Diffuse Gas with ASTROSAT*, Bangalore, India, December, 2006.
4. *24th meeting of the Indian Association for General Relativity and Gravitation (IAGRG)*, Jamia-Millia Islamia University, Delhi, India, February, 2007.
5. *25th meeting of the Astronomical Society of India*, Osmania University, Hyderabad, India, February, 2007.
6. *IUCAA-MPA workshop*, Pune, India, March, 2007.

## **Visits to other Institutes:**

1. IUCAA, Pune, India, July, 2006.
2. TIFR, Mumbai, India, September, 2006.
3. Raman Research Institute, Bangalore, India, February, 2007.
4. IUCAA, Pune, India, March, 2007.

## **Invited Lectures/Seminars:**

1. *Simulating the Universe*, Emerging Trends in Physics 2006, SGTB Khalsa College, Delhi, September 2006.
2. *Large Scale Structures in the Universe*, IUCAA Reference Centre Workshop on Advanced Topics in Data Analysis in Cosmology and Gravitational Wave Astronomy, University of Delhi, Delhi, October 2006.
3. *From Tides to Colliding Galaxies*, Quanta 2006, CMS Lucknow, November 2006.
4. *Cosmology with X-Ray observations*, Study of Hot Diffuse Gas with ASTROSAT, Bangalore, India, December 2006.

5. *Large Scale Structure and Redshift Surveys*, 24th meeting of the Indian Association for General Relativity and Gravitation (IAGRG), Jamia-Millia Islamia University, Delhi, India, February 2007.
6. *Recent Results on Galaxy Clustering from the SDSS and other surveys*, 25th meeting of the Astronomical Society of India, Osmania University, Hyderabad, India, February 2007.
7. *Does Size Matter: Effects of finite box size in cosmological N-Body simulations*, Astrophysics Seminar, Raman Research Institute, Bangalore, February 2007.
8. *Possibilities for collaboration in computational cosmology*, IUCAA-MPA workshop, Pune, India, March 2007.

### **Other Activities:**

- Two students did summer project with me in May-July, 2006.
- Two students did industrial training with me in May-July, 2006 during which they worked on some aspects of cluster computing.
- I co-organised a school for high school students from the Allahabad and neighbouring areas. Hindi was the medium of instruction in this school. This school was held during May 22-26, 2006. I also gave two lectures in this school.
- A new Linux cluster for high performance scientific computing was added to the cluster facilities. This cluster has 35 dual processor computers and a high performance interconnect. The theoretical peak performance of this cluster is 1.6 TeraFlops and it is expected that scientific applications can perform at up to 1.1 TeraFlops. I designed the configuration for this cluster and am taking care of installation and system administration. Several other facilities have also been added to the cluster facilities during the last year.