

STRUCTURE FORMATION IN THE UNIVERSE

19 July to 17 December 1999

Report from the Organisers

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This programme was extremely timely. A number of observational results had just come out, or came out during the programme, including supernovae redshift surveys, cosmic microwave sky maps and dark matter surveys. On the theoretical side there were also a number of new developments and challenges, particularly in the ideas of 'brane worlds'. There was also a need for intense discussion and debate of longstanding theoretical puzzles, such as the quantum mechanics of inflation, for which it was very useful to have the main proponents present for an extended period. The comments of participants were uniformly positive and all reported valuable discussions and new collaborations. The support of the staff at the INI was uniformly excellent and was absolutely essential to the smooth running of the programme.

The programme began with a very intense burst of schools and workshops, which had a major international impact.

The NATO school on Structure Formation in the Universe was a high quality school reviewing the subject and all the main areas of interest and importance.

The workshop on The Statistical Analysis of Cosmological Data Sets was a success, with some of the most exciting experimental results of the day (the BOOMERANG measurement of the cosmic microwave sky) being revealed for the first time.

The EC School on Connecting Fundamental Physics and Cosmology turned out to be the most exciting event of the summer internationally in the field of theoretical cosmology, as there is a lot of interest in the cosmology of M theory and in particular in large extra dimensions. We heard state-of-the-art talks from the leaders in this field and there were a large number of experts here to add comments and criticisms. A very large number of collaborative projects resulted from the workshop, involving UK participants with many of the overseas speakers. We were told by a number of distinguished physicists that this was one of the best meetings they have ever been to. Again the INI handled all the organisational details beautifully, showing considerable diplomatic skills even when faced with a set of physicists almost totally oblivious to normal rules of etiquette (skipping lunch ticket queues etc!).

Following the intensive summer, from October on, the main activity was seminars, an average of two a week. Two colloquia, by Rubakov on Baryogenesis and by Prof C Frenk on Galaxy Formation, were held which attracted reasonable audiences.

The Spitalfields Day involved 3 INI speakers (Guth, Crittenden, Turok) and one from Oxford (Lucas). There was an audience in excess of 80 and the meeting was a success.

Turok organised a small one-day meeting called Futuristic Detectors for Cosmology which brought experimentalists and theorists to the INI on 11 November 1999. The number of participants was small, around 40, but the discussion was very stimulating and useful in terms of establishing links between researchers across the UK working to detect cosmic backgrounds: photons, neutrinos, gravitons, and dark matter.

The final workshop of the programme, in the first week of December, turned out to be excellent, with review talks by a number of speakers (Moore, Bond, March-Russell, Turok)

setting the scene for each day, followed by contributed talks. The audience was in excess of 80 for much of the workshop.

In general terms, the programme was an international event of high significance for the field. UK scientists benefited strongly through establishing new contacts and collaborations. There was continuous strong pedagogical content, and many students attended from across the UK. Significant work was carried out during the programme on the following topics:

- New models of dark matter stimulated by the latest discoveries that cold dark matter fails to reproduce the observed structure of galaxies.
- Brane worlds and gravity in such scenarios.
- Particle physics implications of brane worlds.
- Quantum cosmology and inflation.
- Gravitational clustering and statistical descriptions.
- Cosmic microwave anisotropies and statistical descriptions.
- Models of quintessence and the cosmological constant.

This last work was reported in an article in the New York Times in February 2000.

Our only real problem with the programme was that it was surprisingly much easier to get overseas visitors to come for extended periods than it was for UK academic staff. Many of the US participants (eg Guth, Steinhardt) made several transatlantic trips to spend a week or two at the INI. It seems harder to persuade UK academics to make a similar effort, probably due to their above-average teaching and administrative load as compared to their overseas counterparts. For the future I recommend the INI consider how to fund 'lecturer fellowships', or persuade funding councils to fund them, or other similar arrangements to free UK researchers from their University duties in order to attend INI programmes.

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