PROCEEDINGS OF SCIENCE

Round Table Discussion: UK Future Plans

Walter K. Gear
(Deputy-chair, PPARC Science Committee)
Cardiff University
School of Physics and Astronomy
5, The Parade
Cardiff CF24 3YB, UK

E-mail: gear@astro.cf.ac.uk

1. Introduction

The UK particle Physics and Astronomy Research Council (PPARC) is responsible for funding UK research on Early Universe physics and CMB research. In order to coordinate its portfolio of research facilities, exploitation activity, theory development and future technology R&D PPARC has appointed a 'Science Commitee' as its highest-level peer review body to advise the council on both current funding and future development requirements to ensure that UK remains at the forefront of these two closely-related areas of science.

The Science Comittee is advised by 4 panels in the areas of Astrophysics, Particle Physics, Solar System and Particle Astrophysics, with the last of these covering CMB science. With the advice of these panels a 'Roadmap' is laid out which highlights the top-level priorities for PPARC Science and then goes into detail regarding currently funded and potential future projects. The Roadmap may be found on the web at http://www.pparc.ac.uk/roadmap/rmhome.aspx

CMB and Physics of the Early Universe – International Conference
Ischia, Italy
April 20 – 22, 200

The Roadmap is built around the following 9 key science questions

- What is the universe made of and how does it evolve?
- What is the origin of mass?
- Are we alone in the universe?
- Why is there more matter than antimatter?
- How do galaxies, stars and planets form and evolve?
- Is there a unified theory of all particle interactions?
- What are the laws of physics in extreme conditions?
- How does the Sun affect the Earth?
- What are the origins and properties of the energetic particles reaching the Earth?

Of these 9 the 6 highlighted in red and underlined are clearly all of relevance to the subject of this conference. The PPARC Science Commitee attempts to direct funds towards answering these 9 questions, including looking to fund strategic R&D for potential future projects, but within of course the reality of funding limits. The presence of a future project in the Roadmap does not guarantee funding, but does indicate its potential place in the programe. Proposers of major projects submit letters of intent, and if subsequently invited, a full proposal, which is then peer-reviewed. The UK aims to take a significant or leading role where possible and fund projects fully or not at all rather than spreading funds too thinly with small roles in many projects.

2: Current CMB experiments

The major operating CMB projects presently funded in the UK are the Very small Array (VSA) (see http://www.mrao.cam.ac.uk/telescopes/vsa/index.html), which has been operating in Tenerife for several years and published significant results on the CMB power spectrum at small angular scales (e.g. Rajguru et al 2005); the Arcminute Microkelvin Imager (AMI) (see http://www.mrao.cam.ac.uk/telescopes/ami/index.html) which is a UK-based and recently-comissioned Sunyaev-Zeldovich survey experiment (see Barker et al 2006), and QUaD (http://www.astro.cf.ac.uk/groups/instrumentation/projects/quad/) which is a bolometric polarization sensitive experiment currently operational at the South Pole and which will report its first season measurements in the next couple of months.

3: Projects under Construction

3.1: Planck

The UK has taken a very significant role in Planck, especially in the high-frequency instrument (HFI), both on the hardware side and the data analysis. Extensive details on

Planck, both HFI and the low-frequency instrument, LFI can be found at e.g. www.planck.fr/ for HFI and www.tesre.bo.cnr.it/Research/planck.php/ for LFI.

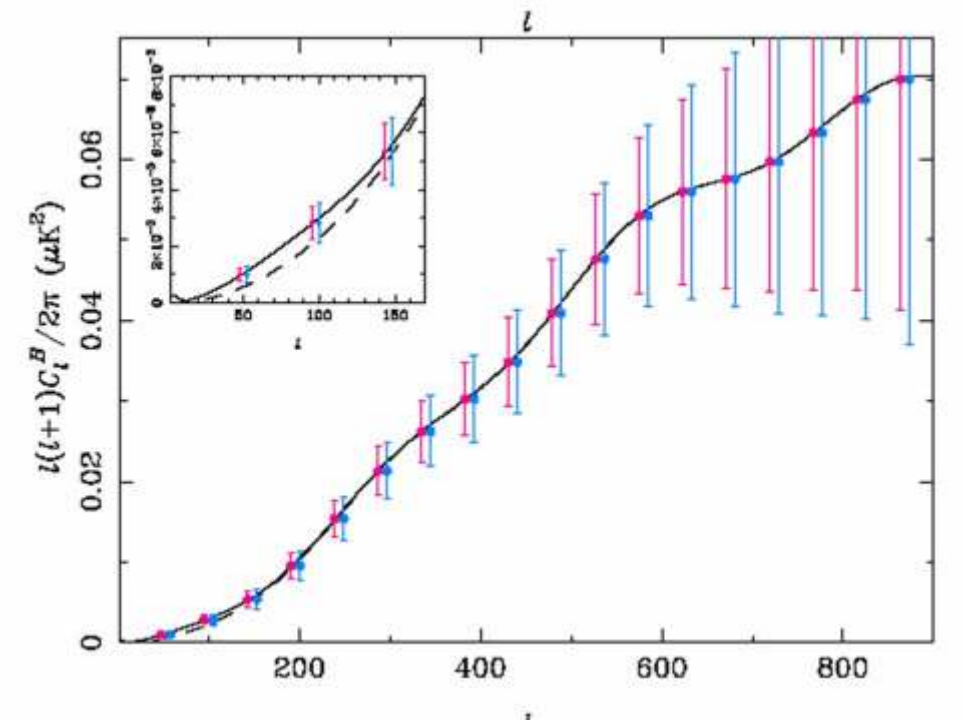

Figure One: Predicted Clover measurement of the B-mode power spectrum for a scalar-to-tensor ratio of 0.01. The blue error bars are an exact Fisher matrix calculation whereas the magenta are an approximation that ignores E-B mixing due to finite survey area. Figure courtesy Anthony Challinor.

3.2: C*l*over

Clover is an experiment to measure the B-mode signal in the CMB polarisation, which is a signature of primordial gravity-waves created at the time of inflation. This is very much a UK-led project, involving the Universities of Cardiff, Cambridge and Oxford and will be the leading next-generation ground-based CMB experiment. Clover is designed to:

- Characterise *B*-mode polarization on angular scales $20 < l < \sim 1000$ with sufficient thermal sensitivity to be limited by sample variance of lensing signal for $l < 200$
- Detect gravitational waves if $r > 0.01$ (c.f. current 68% limit of 0.384) hence measure energy scale of inflation
- Place tight constraints on dynamics of inflation
- Secondary science –lensing & exotic physics

Clover will operate at 3 frequencies around 100, 150 and 220 GHz, and will be sited in the high Atacama desert in Chile.

4: The Future

The UK has indicated a likely involvement in CMB experiments beyond Planck and Clover, however the nature of this involvement is note yet decided and will depend on scientific priorities as they become clearer over the next few years and how the UK experimental and theoretical groups are positioned to take advantage of opportunities.

A UK role in a future 'B-mode satellite' is indicated in the roadmap referred to above however that does not guarantee funding ! If however such a mission does come to fruition, either through ESA, NASA or some combination of these or other agencies and the UK was playing a significant role then it would expect to fund participation at a level similar to that for its involvement in Planck.

References

[1] Rajguru, N. et al 2005 MNRAS 363,1125
[2] Barker, R. et al 2006, MNRAS, 369,L1.