

Preface

The concept that fundamental physical constants can change over time dates back to the late 1930s and has been a very fertile idea in several branches of theoretical physics so far. More recently it also evolved into a branch of observational astronomy. At present the detection of the smallest variations of coupling constants throughout the universal space-time is seen as an effective way to reveal the presence of light scalar fields foreseen in many cosmological and elementary particle theories.

The JENAM symposium entitled *From Varying Couplings to Fundamental Physics*, convened in Lisbon on the 6th and 7th September 2010, was the second JENAM symposium on this topic. Both symposia were held in Portugal. The first took place in Porto in 2002, and was one of the first in this field of research. To our knowledge the very first one was the discussion meeting on *The constants of physics* held on 25 and 26 May 1983 at the Royal Society and organized by William Hunter McCrea, Martin Rees, and Steven Weinberg.

Most of the presentations in those early days were theoretical, though in the 2002 JENAM first indications for α variation were presented by J.K. Webb and collaborators. At JENAM 2010 the majority of the talks were observational, reflecting the evolution of the field which also developed an active experimental character.

Actually, the JENAM 2010 symposium occurred at a particularly exciting time, only a few weeks after the first announcement on arXiv of the claim for a cosmological spatial dipole in the value of the fine-structure constant α . This prompted a press release and the symposium was the first forum for the formal presentation of these results. If confirmed, these observations will have dramatic implications for cosmology and fundamental physics. They were very lively debated at the meeting. In contrast, a number of astrophysical and atomic clocks measurements yield null results for variations of alpha and other constants. With an entirely different approach, evidence for a tiny variation of the electron-to-proton mass ratio in the Galaxy at the level of few parts per billion was also claimed. This could be the smoking gun of the presence of a chameleon scalar field.

The next few years bear the promise of being particularly exciting. While several groups will certainly use new and improved data to challenge the above claims, a quest for redundancy will also be undertaken, looking for new astrophysical techniques that may allow independent measurements. The prospects for

future European facilities for this research area are particularly bright with several new spectrographs at ESO and other major observatories being built which will allow significant advances in the observational sensitivity leading eventually to a systematic mapping of the behaviour of the couplings throughout the cosmic history.

In our view the meeting was extremely successful, with plenty of opportunities for cross-disciplinary conversation. We wish to thank all participants for their presentations of unique quality and for sharing with us their most recent results. The more than one hundred registered participants from 32 countries revealed the great interest among the community, which goes far beyond the specialists of the sector.

We are pleased to acknowledge financial support from JENAM itself, the European Astronomical Society, Centro de Astrofísica da Universidade do Porto and Fundação para a Ciência e a Tecnologia. We wish to warmly thank the Scientific Organizing Committee for their advice in preparing the scientific program and the JENAM local organizing committee for the assistance and for making the meeting very enjoyable.

Porto and Trieste
November 2010

Carlos Martins
Paolo Molaro