

was found to be equivalent, though somewhat windier, and at the time less accessible. It gives confidence that some 25 years later those two mountains remained at the top in a new survey of possible sites. There are some indications that climate change begins to affect the Pacific, though not necessarily for the worse at Paranal/Armazones. While the quality of the atmospheric turbulence in Antarctica seems to be superior (especially at dome A), the sky coverage would be limited and the access difficult and extremely expensive. So it could only be considered for certain niche projects with relatively small telescopes, but not for projects like the VLT or E-ELT.

The Future

Are we going to build ever-larger telescopes? Plans for the next generation of radio, optical, infrared and X-ray telescopes are in advanced stages or on the way to realization with price tags in the range of 1-5 billion Euros well above those for the previous generation. Will there be the interest and the capacity in Society to continue providing such – or even larger – sums? For a long time in the European, and even more in the American, mindset there has remained a brilliant future on the horizon with vistas of scientific discovery, technological development and economic growth. Characteristic was the influential 1945 report by Vannevar Bush to the U.S. President “Science: The Endless Frontier”. But will scientific development really be endless? An early warning sign may have been the fate of the big particle collider in the U.S., abandoned after several billion dollars had been spent. And at NASA the JWST originally budgeted at less than 1,000 MUS\$ has now reached the 5,000 MUS\$, while having been reduced somewhat in diameter. Of course, the result was that a number of other projects could not be executed. Hence the title of a recent article in *Nature*: “*The telescope that ate astronomy*”. At ESO the 100-m OWL planned in 2000 was wisely downsized to 42 m without much change in budget. So, prudence is called for not to overreach and lose one’s credibility.

But even apart from issues of affordability, the question may be asked if every next step in our instruments will be equally productive? Will the future developments have as large an impact on our image of the world as those of an earlier generation? We may doubt it. The beginning of quantum mechanics was so exciting because it fundamentally changed not just a specialized part of physics but also much of science, including chemistry, astronomy and biology. Similar situations in the future seem rather unlikely. As science becomes more and more narrowly specialized, it may remain very interesting to its practitioners but a disconnect to Society at large seems possible. In that case the way is open to many forms of obscurantism. Education may be helpful in this respect, and it is perhaps there that astronomy has special opportunities.

How Society at large views science has a major influence on the rewards of a scientific career. If the view is positive, the brighter minds are inclined to favor such a career. If not, they will study other subjects. But is not an ageing society likely

to be much less inclined to worry about science – except perhaps for antiaging pharmaceuticals? So while I see a bright future for astronomy in the next half-century or even somewhat beyond that, I believe that thereafter we may well look back to a past golden age, irremediably lost. If so, it might be well if we would plan for a less favorable situation. Of course one may argue about the precise time scale on which future events will unfold. However, it seems difficult to avoid the suspicion that science may not be an infinite frontier after all.

Lodewijk Woltjer

SYMPOSIUM I: FROM VARYING COUPLINGS TO FUNDAMENTAL PHYSICS

Nature is characterized by a number of physical laws and fundamental dimensionless couplings. These determine the properties of our physical universe, from the size of atoms, cells and mountains to the ultimate fate of the universe itself. It is remarkable how little we know about them. The study of the behavior of these quantities throughout the history of the universe is an effective way to probe fundamental physics and search for evidence of a fifth force and light scalar fields.

The symposium ‘From Varying Constants to Fundamental Physics’ was held on the 6th and 7th September 2010. This was the second JENAM symposium on this topic; the first took place in Porto in 2002. There were 117 participants from 32 countries, and 21 oral presentations took place.

The symposium occurred at a particularly exciting time, shortly after the announcement (in an arXiv preprint) of a claim for a cosmological spatial dipole in the value of the fine-structure constant “alpha” which, if true, will have dramatic implications for cosmology and fundamental physics. This prompted a JENAM press release and the symposium was the first forum for the formal presentation of these results [Webb, Flambaum], which were debated very lively.

Various astrophysical measurements yielding null results were also presented [Gutierrez, Petitjean, Thompson, Wendt], as were the constraints at high redshift [Galli] and very sensitive laboratory measurements by means of atomic clocks [Bize, Peik]. The comparison between measurements is often not easy, with different theories such as strings [Zagermann], quintessence [Nunes] or varying speed of light [Magueijo] to complicate things further.

Evidence was also presented [Levshakov] for a tiny variation in the Galaxy of the electron-to-proton mass ratio, which could be a further smoking gun for a scalar field. Finally, the good prospects for future European facilities relevant for this area were illustrated [Molaro]. The spectrographs ESPRESSO, under construction at the combined focus of the 4 units of the VLT, and CODEX proposed for the E-ELT, will allow major advances in this field.

The coming years bear the promise of being particularly exciting. Several groups will use new and improved data to challenge the above claims, and a ‘quest for redundancy’ will also be undertaken, looking for new astrophysical techniques that may allow independent measurements of these couplings, leading to a systematic mapping of their behavior throughout space-time.

In addition to the JENAM 2010 LOC and the EAS, the symposium was supported financially by CAUP and FCT. For those who wish to obtain more information, the slides of most talks are available at <http://www.astro.up.pt/vfc2010>

Carlos Martins (CAUP, Portugal)
Paolo Molaro (INAF-Trieste, Italy)

SYMPOSIUM 2: GALAXY FORMATION AND ENVIRONMENT: 30 YEARS LATER

The effect of environment on the properties of galaxies constitutes a key observable to understand the baryon physics that transforms the primaeval distribution of gas into the galaxies we see today. The year 2010 marks the 30th anniversary of a seminal paper – by Prof. Dressler - on the connection between galaxy formation and environment. The symposium consisted of four main sections, addressing observations of environmental imprints on galaxies at low redshift, high redshift, cluster regions, and theories to model those effects.

The opening talk by Prof. Dressler (Carnegie) gave an overview of the morphology-density relation, including a description of the field in the years up to the discovery of this correlation. The main conclusion was that environmental effects could indeed be a reflection of the more «local» properties of galaxies, in the sense that more massive galaxies end up most likely in high-density environments. Dr. Weinmann (Leiden) reported on the Yang et al. SDSS groups catalogue and its role in discriminating between local and environmental properties. Prof. Aragon-Salamanca (Nottingham) presented the work of the EDisCS and STAGES teams on the effect of cluster environments on the transformation from gas rich spirals into lenticulars.

The modeling session was opened by a review by Dr. De Lucia (Trieste) on the way of incorporating environmental effects in semi-analytical models of galaxy formation. The recipes related to the suppression of gas condensation and gas stripping are still rather simple and need more physical insight. Prof. Kenney (Yale) gave an overview of observational evidence of ram-pressure stripping in galaxy disks. Dr. Khochfar (MPE) presented his work on gravitational heating as an efficient method to suppress gas cooling in clusters today and at early times in the most massive halos, introducing a mass-dependent environmental effect, difficult to separate from more intrinsic mechanisms.

The final discussion session was led by Prof. van den Bosch (Yale) with an interesting number of open questions, the most

important being the need for a proper indicator of environment (with central/satellite classification being a tentative candidate). The impact of environment on morphology is not a solved problem. We still need to pinpoint the essential mechanism to model environment, with a tentative option being strangulation. The discussion had very active participation by the audience, reflecting the state of the field.

The programme of the symposium, including PDF files of the talks, can be found at <http://www.mssl.ucl.ac.uk/~ipf/J10/Programme.html>

Anna Pasquali
(ARI, University of Heidelberg)
Ignacio Ferreras
(MSSL, University College London)

SYMPOSIUM 3: DWARF GALAXIES: KEYS TO GALAXY FORMATION AND EVOLUTION

The JENAM symposium “Dwarf Galaxies: Keys to Galaxy Formation and Evolution” took place on the 9th and 10th September 2010. Its six sessions of 90 minutes each were all extremely well attended, with a vivid participation and a large number of high-quality contributions, including four reviews and several invited and contributed talks. Additionally, poster presentations were given before each evening session.

Evan Skillman who gave a review on outstanding questions and future perspectives of dwarf galaxy research opened the first session. Carme Gallart reported on new results from the “Local Cosmology from Isolated Dwarfs” (LCID) project, that suggests that reionization alone was not able to stop star formation in dwarf galaxies, as had been expected. Janice Lee closed the session with a discussion on the consistency between star formation rates (SFRs) inferred for late-type dwarf galaxies from their H α and far ultraviolet non-ionizing continuum emission. She pointed out that UV yields a higher SFR than H α by factors of two to more than ten, and that possible explanations for this discrepancy include a non-universal stellar initial mass function.

The second session was devoted to star-forming dwarf galaxies (SFDGs) beyond the Local Group both in galaxy clusters and in the field. It was opened by Nils Bergvall who provided us with an overview of the structural, chemical and environmental properties of SFDGs, laying special emphasis on the question of evolutionary links between dwarf irregulars (dIs) and Blue Compact Dwarf (BCD) galaxies, and the role of starburst activity on dwarf galaxy evolution. Jorge Iglesias-Paramo addressed the impact of the cluster environment on the star-forming activity of SFDGs as traced by their H α morphology. An impressive example of the interaction of a SFDG with the intracluster medium (ICM) was presented by Jeffrey Kenney: GALEX UV and WIYN optical images reveal in the Virgo dI IC3418 a spectacular “head-tail” morphology