The Physics that was Unlocked by Albert Einstein

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Beyond Einstein – Physics for the 21st Century, the 13th General Conference of the EPS was the scientific finale of the centenary celebrations of the annus mirabilis in Bern.

At preparatory meetings for the 'World Year of Physics' people often commented that the Einstein Centenary Celebrations in Bern might become one of the high points, if not *the* high point of WYP2005. And, indeed, they were! 'Forum Einstein 2005 Bern', an association of institutions of education and science, had made plans for a sequence of public events taking place in the months leading up to July 2005. These comprised a discussion forum on "The Culture of Innovation from Science to Product", a one-day seminar about Einstein's relationship to music, and talks and debates by historians of science on Einstein's discoveries[1]. Upon an International Celebration Day, on Saturday 9 July, consisting of a Symposium on "Perspectives for Physics in Einstein's Tradition"[2] and an Official Ceremony under the auspices of Mr. Samuel Schmid, President of the Swiss Confederation, followed the 13th General Conference of EPS, EPS13, which dovetailed into the Annual Congress of the Swiss Academy of Science and an Open Day organised jointly by the Academy, EPS, the Swiss Physical Society and others.

The official celebration of 9 July 2005 took place in the late afternoon, following a morning of talks to an overflow audience by Anton Zeilinger (A), the Nobel Laureate Claude Cohen-Tannoudji (F) and Alan Guth (USA). The President of the Swiss Confederation, Samuel Schmid, opened the Celebration in the concert hall of the Bern 'Kulturcasino', where well over a thousand guests from politics, science and industry as well as from the public at large had gathered. President Schmid considered that the prime reasons for Einstein's becoming an idol were his civil courage and humanity. The scientist Einstein was convinced that care of human beings must be the main aim of all technical efforts. Einstein, as a human being, also lived 'the liberty of being allowed to be different, and had the will to think beyond the point, where others stopped.' This liberty, Schmid said, may have been underlying current of the development of Einstein's outstanding abilities.

The Director General of UNESCO – the organisation that had declared the 'World Year of Physics 2005' – spoke next, and expressed his hope that the World Year would bring more young people to physics and, in general, would result in a better understanding of the qualities of this central scientific discipline.

Anders Bárány, of the Nobel Museum, then gave an account of the developments that had led to Einstein's Nobel Prize. Apparently, Einstein's main relief after the award was that he didn't have to hear the enquiry "Why don't you receive the Nobel Prize?" Einstein, it is now agreed, did contribute more to the prestige of the Prize than *vice-versa*.

Iris Zschokke-Gränacher, a Swiss physicist who had helped guide Swiss science policy in many honorary functions, mentioned numerous applications that had come out of Swiss institutions performing basic research in physics and are taken for granted today. She drew urgent attention to the need for proper funding of basic research. She also stated that the potential European Research Council, must add to, not replace, national science funding.

The 'father of Quarks', Nobel Laureate Murray Gell-Mann, then received the 'Bern Einstein Medal' in recognition of his achievements in a life of science. In his speech, he illustrated creative thinking that jumps over borderlines – and also sometimes can go wrong in real life ('why not' in the case of Enron, for example!) – to a highly appreciative audience.

Brief musical interludes, among them a performance of 'Five Madrigal Stanzas' for violin and piano that by Bohuslav MartinÛ had composed for the violinist Albert Einstein, were nicely interspersed between the various speeches.

As stated at the outset, the EPS13 Conference was the scientific finale of the celebrations. It was devoted to the professional physicist, and started on Monday morning, 11 July 2005 with three welcome addresses by the Rector of the University of Bern, Christoph Schäublin, the Swiss Secretary of State for Education and Science, Charles Kleiber, and the EPS President. The latter reminded the audience that physics and closely related sciences in Europe are blossoming, as evidenced by many major physics facilities being constructed in Europe, such as the LHC and ITER and fine facilities run by ESA and ESO – in space and in Chile. Nevertheless, there was still a net brain drain out of central and eastern, but also western Europe. Thus, better career prospects for physicists must be provided in Europe, and EPS will have to continue working on assuring that physics as a profession fares better in Europe.

Three magnificent plenary talks on '100 Years of Relativity', 'Attosecond Lasers', and 'Brownian Motion and Later Develop-

▲ Fig. 1: In the 'Green Room' before the official celebration: the President of the Swiss Confederation, Samuel Schmid, speaking with the Director General of UNESCO, Prof. Koïchiro Matsuura. In the background the Vice-Director of the Nobel Museum, Stockholm, Anders Bárány, who later spoke about the prolonged developments in the Nobel Physics Committee that led to the award of the Nobel Prize to Albert Einstein. (Photo: Eidg. Dept. f. Verteidigung, Bevölkerungsschutz und Sport, VBS)

[1] The talks and debates by historians of science on Einstein's discoveries have been recorded on DVD

[2] The talks by A. Zeilinger, C. Cohen-Tannoudji and A. Guth at the International Symposium on "Perspectives for Physics in Einstein's Tradition" have been recorded on DVD.

▲ Fig. 2: The main organiser of the WYP2005 event 'Physics Enlightens the World' and the EPS President frame national organisers who made particularly successful efforts in realising the event.

ments' then opened scientific part of EPS13. The speakers, respectively, Thibault Damour, Ferenc Krausz and Giorgio Parisi thus introduced the audience to the current status of the blossoming fields that had been unlocked by Einstein in 1905. Thibault Damour, who at the same time received the Cecil F. Powell Memorial Medal in recognition of his efforts towards achieving a grand unification of all fundamental forces, discussed the role of the theories of Special and General Relativity in the present framework of physics, summarised their experimental verification, and presented the motivation for further tests. Ferenc Krausz reported on the progress towards the development of laser pulses with a duration between 10^{-14} s and 10^{-18} s, i.e., an attosecond. The reproducible generation and measurement of isolated 250-attosecond extreme ultraviolet pulses and first attosecond time-resolved observations of atomic electron dynamics demonstrate that tools and techniques for studying the motion of electrons in the microcosm, i.e., at atomic and molecular length scales, are now becoming available. Giorgio Parisi demonstrated the enormous influence and potential of Einstein's paper on the Brownian motion. He explained that the paper was one of the first successful applications of statistical mechanics beyond kinetic theory of gas, and that it was extremely important in convincing scientist at the time of the existence of atoms.

During the main part of EPS13, namely the three parallel conferences with the themes: 1. "Photons, Lasers and Quantum Statistics", 2. "Relativity, Matter and Cosmology" and 3. "Brownian Motion, Complex Systems and Physics in Biology", which took place from Monday afternoon until Thursday afternoon – participants discussed in depth the state of the art of the fields that Albert Einstein had unlocked in Bern early in the 20th Century. All EPS Divisions were involved in the organisation, several of them collaborating in the three parallel conferences. Moreover, ESA, ESO and CERN had decided to hold their triennial joint Symposium together with the second Conference on 'Relativity, Matter and Cosmology'.

The interest in EPS13 among the community was therefore large: 570 physicists had registered. A fund of 65,000 € had been accumulated over the three years since EPS12, and this permitted EPS to award grants to numerous scientists. Many of these scientists were at the beginning of their career and from countries, where national funding might have permitted attendance for very few, if any! Also, thanks to the support of the Regional UNESCO Regional Office for Science in Venice, EPS-UNESCO (ROSTE), short-term fellowships could be given to a number of young scientists from South-Eastern European countries.

The EPS13 participants had several opportunities for respite from the rigours of science. A reception at the Historical Museum, where the Major Special Exhibition 'Albert Einstein (1879-1955)' could be visited, took place on Monday evening. And 'Symmetry, Music, and the Flow of Time – some thoughts about art, symmetry and science, put into words and music on two grand pianos' was the title of a cultural presentation at the 'Hochschule der Künste' scheduled on Tuesday evening. There was, of course, also a Conference Dinner, offered at two places, namely in the traditional 'Kornhauskeller' and in the recently opened 'Paul Klee Zentrum' that has been designed by the architect Renzo Piano.

Another high point, again of scientific nature, was the award of the *Europhysics-Agilent-Prize*, to David Awschalom (USA), Tomasz Dietl (Poland) and Hideo Ohno (Japan). The laureates, who have pioneered, in international collaboration, the promising area of 'spintronics' with their work on spin effects in semiconductor materials, each gave an *aperçu* of their contributions to the achievement being honoured. And, of course, there was the General Meeting, where the President, the Executive Secretary and the Secretary General reported on the state of the Society. In a further award ceremony, John Lewis received the Thomas Medal in presence of Edit Thomas, Martial Ducloy was awarded the Prize for 'Public Understanding of Physics', and further honours were bestowed on physicists who had been particularly active in their national light relays of WYP2005 – 'Physics Enlightens the World'.

On Friday, 15 July 2005, the last day of EPS13, EPS joined with CERN, EFDA/JET, ESA, ESO, the Swiss Academy of Sciences, the Swiss Physical Society and the Institute of Physics in Bern, in offering a day of the open door to the public at large. Over a thousand people took advantage of this opportunity, which – among many other attractions – featured demonstrations of the Danish Group 'Fun Physics' and also, in the afternoon, a webcast, where sites of CERN in Geneva, ESO in Chile, ESA in Noordwijk and EFDA/JET in Culham, U.K., were visited with a two-way video link, and where the audience could ask questions (in some cases even in the local Bernese dialect) about the scientific work and also the daily life of the researchers in their international environment.

The overall event of the Einstein celebrations of the 'Forum Einstein 2005 Bern' concluded with a loud, but relaxing one-hour jazz concert in the tent set up in front of the Building for Exact Sciences. Here the EPS Presidency was handed over to Ove Poulsen, and as a permanent mark of the Einstein celebrations, the 'Einsteinterrasse' was inaugurated.

After all these celebrations have become history, a visit to the city, which was Einstein's home early in the 20th Century is still worthwhile: not only the 'Einsteinterrasse', also the 'Einsteinhaus' – renovated and extended in view of the centennial of the *annus mirabilis* – and an 'Einstein Path' guiding the visitor on the vestiges of Albert's daily life, remain and are accessible to visitors. Moreover the superb exhibition "Albert Einstein (1879–1955)" in the Historical Museum Bern will remain open until 17 April 2006.

Thanks are due to many people who have helped making EPS13 a success: Martial Ducloy, the Chair of the International Programme Committee; the Conference Co-ordinator, Christophe Rossel; the Chair of the Local Organising Committee, Hans Balsiger; the Corresponding Chairs of the three parallel Conferences, namely Sandro de Silvestri, A.M. Cruise and Jean Pierre Boon; Ophélia Fornari from the EPS Conference Services, and all their helpers, all the speakers, poster presenters and general participants. ■

More pictures to be seen in a coming issue of Europhysics News