The Victor Francis Hess Society and the European Physical Society/History of Physics Group (EPS/HOP) are pleased to invite you to a first joint European Symposium on the History of Physics:

the roots of physics in Europe

The symposium is held under the auspices of the first European Centre for the History of Physics:

echophysics

Schloss 1, Pöllau Castle, 8225 Pöllau, Austria (www.echophysics.org)
May 28–29, 2010

Symposium initiator & organizer:
Schuster, Peter M. (President Victor F. Hess Society)

Free admission

Contact: info@echophysics.org or info@victorfhess.org

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Österreichisches Bundesministerium für Wissenschaft und Forschung
The Austrian Federal Ministry of Science and Research

Das Land Steiermark – Wissenschaft und Forschung
Land of Styria—Science and Research

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The First Wireless Transmission of Music

12:00–12:20: Denoth, Armin (University of Innsbruck; Austria)
The Innsbruck *Physikalische Institut*, 1906–1926: the Period of 'Atmospheric Electricity'; H. Mache, F.v. Lerch and E.v. Schweidler

12:20–12:40: Vlahakis, George N. (Hellenic Open University, Maroussi, Greece)
Tracing the Future Into the Past—the Significance of History of Physics for Physics Development

12:40–13:00: Breisky, Bill (Grandson of Victor Francis Hess; MA, USA)
A Cosmic Connection: a Grandson's Perspective on Victor Hess—how he lived in America, and how he influenced my life

13:00: Lunch Break

echophysics Grand Opening Programme

At the occasion of the Grand Opening Ceremonies to jointly inaugurate

- the first European Centre for the History of Physics: echophysics
- its 2010 exhibition on the European History of Physics: Radiation and Mankind
- the Victor F. Hess Centre of Research and Commemoration

at Schloss Pöllau on May 29, from 16:00, a dedicated public session of three plenary lectures will be held thereafter in the 'Großer Freskensaal' at Schloss Pöllau, from 18:00

Saturday Afternoon, May 29, 2010

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Univ.-Prof. Dr. Günther Hasinger, Direktor Max-Planck-Institut für Plasmaphysik, Garching: *Von der Sonne auf die Erde: Die Energie der Zukunft*

Univ. Prof. Dr. Wolfgang Baumjohann, Direktor des Institus für Weltraumforschung der Akademie der Wissenschaften, Graz: *Was sucht Österreich im Weltraum?*

Emer. Univ.-Prof. Dr. Siegfried Bauer, Graz (ehem. Vizedirektor der Weltraumwissenschaften des NASA Goddard Space Flight Center (USA): *Victor Franz Hess: Forscher zwischen Erde und Kosmos*

20:00: Dinner buffet, Refectorium Hall at Schloss Pöllau

Sunday Morning, May 30, 2010

8:30–9:00: Performance by Johann Winkler, Salzburg
In Homage to Christian Doppler
from: *The Creation Week, Day One* by Peter Maria Schuster;
(in German, with handouts in English)

List of Abstracts

Besser, Bruno P.

Space Research Institute of the Austrian Academy of Sciences; Graz, Austria

History of the Spectroscopy of Planetary Atmospheres

The Dutch astronomer Anton Pannekoek first published in 1904 a theoretical paper about the effects a planetary atmosphere will have on the light of a distant star if it is occulted by the planet. This gave new impetus for star occultation studies of planets and their moons.

But it took several more years until Rupert Wildt of the University of Göttingen, Germany, studied the spectra of the outer planets and could thereby identify several gases including ammonium in Jupiter's atmosphere in the 1930s.

The development of (high-altitude) rockets during World War II and their subsequent scientific use after the war at Alamogordo, USA, opened the way for spectrographs to be flown above the Earth's atmosphere. The first one was flown on a V-2 rocket in October 1948 and was used for solar physics studies. The Sun was the only target for several years due to the accuracy of the pointing devices.

The first Infra-Red Interferometer Spectrometer (IRIS) to measure atmospheric temperature, water vapour, and ozone in the vertical was flown on the Nimbus-3 satellite in 1969.

During the 1970s and 1980s several spacecraft (to the inner and outer planets) carried spectrometers as payload and the knowledge about the atmospheres of our neighbouring worlds increased dramatically. The next step was to investigate exo-planetary stars and planets (and their atmospheres) with these high-sophisticated measurement techniques.

Blondel, Christine

CRHST/Centre Alexandre-Koyré; Paris, France

The Replication of Historical Experiments and the Ampère Website

In recent times the replication of historical experiments has brought new insight into the history of physics. Besides the Ampère correspondence, publications and manuscripts, and a sequence in history of electricity, the Ampère website will present and discuss a series of replications of electrical experiments (`http://www.ampere.cnrs.fr/labo/index.php`). These replications such as the Coulomb balance, the Ampère 'induction' experiment or some electrostatic puzzles concern education as well as the history of physics.

Breisky, Bill

Grandson of Victor Francis Hess; MA, USA

A Cosmic Connection: a Grandson's Perspective on Victor Hess—how he lived in America, and how he influenced my life

Davis, Edward Arthur

University of Cambridge; UK

Lord Rayleigh—His Works and Laboratories

Lord Rayleigh (John William Strutt)—one of the great Victorian British physicists—worked in private laboratories at Terling Place, the family home in rural Essex, where he studied electromagnetic phenomena, sound, mechanics, hydrodynamics, optics, vibrations and indeed everything we now call classical physics. A famous paper in 1871 on the scattering of light by small particles provided an explanation for the blue colour of the sky. Two books, titled *The Theory of Sound*, which he wrote in 1877 and 1878, became classics and are still consulted today by acoustic engineers. His research into diffraction gratings led to the Rayleigh criterion in optics and to the production of the first Fresnel zone plate.

As Cavendish Professor of Physics at Cambridge, he undertook seminal work on electrical standards and invented the Rayleigh disc for measuring the intensity of sound waves. By the turn of the century he had derived the well-known

Rayleigh-Jeans law describing the spectrum of black body radiation at long wavelengths.

Lord Rayleigh's crowning achievement was the discovery of argon for which he received the Nobel Prize in 1904. The balance, which he used to weigh gases to determine their atomic weights, rests undisturbed in his still extant laboratories.

Denoth, Armin

University of Innsbruck; Austria

The Innsbruck *Physikalische Institut*, 1906–1926: the Period of 'Atmospheric Electricity'; H. Mache, F.v. Lerch and E.v. Schweidler

In 1906, Paul Czermak, head of the *Physikalische Institut* had fallen seriously ill and was excused from his duties. From 1906 up to 1908, the teaching business and management was taken over by Heinrich Mache, and Friedrich Edler von Lerch stood in for Czermak up to 1910, the year, Czermak was forced to retire.

In 1911, Egon Ritter von Schweidler was offered the chair of the *Physikalische Institut* and, with the appointment of F. Lerch in 1914 as 'professor extraordinarius', another second chair was de facto created. Mache, Lerch and Schweidler initiated and intensified in Innsbruck a new field of research of topical relevance in those times: 'radioactivity' and 'atmospheric electricity;' and so they created an excellent basis for the upcoming research of the so-called *Ultrastrahlen*.

Through the hard time of WWI and the following years, the *Physikalische Institut* was cleverly managed by the duo Schweidler and Lerch: experimental research had to be reduced to a minimum, but Schweidler intensified his theoretical work, and Lerch focused his efforts in the field of teaching and in the improvement of lecture room experimental equipment, especially in the new field of radio techniques.

In 1926, Schweidler was offered the chair of the *1. Physikalische Institut* of the University of Vienna, as the successor to Ernst Lecher, the second chair of the *Physikalische Institut* in Innsbruck was cancelled, and Friedrich v. Lerch was appointed as head of the *Physikalische Institut*.

Draxler, Sonja and Lippitsch, Max E.

Karl Franzens University of Graz; Austria

The Reckoning of Time—Calendars Across the Centuries

That humans use astronomy for structuring time seems quite natural, since at least in temperate climates the periodicity of days and seasons is obvious. In many civilizations highly sophisticated methods for translating astronomical observations into civil calendars have been developed. The mutual fertilization between scientific achievements and societal development in no other field is more easily demonstrated, and time-reckoning provides the most intimate relationship between physical sciences and every day culture.

Faustmann, Cornelia

University of Vienna; Austria

The Roots of Modern Physics Teaching at the University of Graz—the Merits of Leopold Gottlieb Biwald

Leopold Gottlieb Biwald SJ (1731–1805) is primarily known for his physics textbook *Physica Generalis* and *Physica Particularis*, published in Graz in 1767–1768, and officially designated for use at the universities and lyceums of the Habsburg monarchy by an imperial decree. Biwald taught physics in Graz for more than 40 years and contributed significantly to the conception of a modern physics teaching system at his educational institution. In this lecture the information about Biwald's achievements provided by primary sources such as records and contemporary reports will be discussed. Furthermore, characteristic features of the *Physica Generalis* and *Physica Particularis*, which led to modern physics teaching, will be analysed.

Ford, Peter
University of Bath and IOP/History Group; UK

History of the Liquefaction of Gases

The history of the liquefaction of gases stretches over a period of nearly 120 years and has a strong European flavour. It begins in the 1790s when the Dutch Scientist van Marum liquefied ammonia at room temperature and ends in 1908 when another Dutch scientist Kamerlingh Onnes first liquefied helium. The lecture describes the important work of Faraday who realized the importance of high pressures and low temperatures in order to liquefy a gas. The liquefaction of nitrogen and oxygen are both described as also the events leading to the liquefaction of hydrogen by Dewar and his race with Onnes to liquefy helium. The physics involved in liquefying gases will be discussed as also the spin off of some of these achievements.

Grandin, Karl
Royal Swedish Academy of Sciences; Stockholm, Sweden

The Nobel Prize to Victor Franz Hess in 1936: a Look into the Nobel Archives

Victor Hess was awarded the 1936 Nobel Prize in physics together with the discoverer of the positron the American Carl D. Anderson. This paper will address how Hess' candidacy was seen and evaluated by the Nobel committee.

In the will of Alfred Nobel it is said that the Prizes should be awarded to: *"those who, during the preceding year, shall have conferred the greatest benefit on mankind."* Since Hess' discovery had been made in 1911–12, i.e. not the preceding year, the nominators and the Nobel committee had to address this issue. The argument was that the most recent work on cosmic radiation had proven Hess' discovery and shown it fruitful for a whole new field of research. The sharing of the 1936 Prize between Hess and Anderson must be understood in this context. Other physicists in this area discussed by the committee were Bothe and Kolhörster (but they had not been nominated and subsequently couldn't be considered for the Prize) regarding the corpuscular nature of the radiation as well as the earth magnetic field's influence on the cosmic radiation. Also J. Clay (nominated in

1936) whose latitude effect was said to have successfully contributed to the interpretation of the radiation was discussed. Anderson's discovery of the positron finally was "intimately" connected to cosmic ray research.

Other members of the Academy's physics class were anxious for a Nobel Prize for the diffraction of electrons by crystals to C.J. Davisson, H.L. Germer and G.P. Thomson but gave their consent since they thought that Hess' and Anderson's discoveries were "genetically" connected.

Hess was nominated in 1931 (by Pohl), in 1933 (by Plotnikov) and in 1936 (by Clay and Compton).

The talk will thus not only tell the story of how Hess work was considered by the Nobel committee, but also give a general insight in the workings of the Nobel system.

Granitzer, Petra

Karl Franzens University of Graz; Austria

A Bloom of the Graz Institute of Physics During the Second Half of the 19th Century

Hohenester, Adi

Karl Franzens University of Graz; Austria

August Musger, Inventor of a *Time-Machine*

Holmberg, Peter

University of Helsinki; Finland

Early Radioactivity and Nuclear Physics in Finland

The discovery of radioactivity resulted in a boom of exploration. Compared to the international efforts, the interest in radioactivity during the first years was growing slowly in Finland. The basic knowledge of α-, β- and γ-rays spread among academic staff and students of physics, but the practical work came later. In an early handwritten pro gradu thesis from 1906 Kaarlo Aaltio describes the discovery of radioactivity and he also presents a method for determining the 'strengths' of radioactive materials with the aid of a well-isolated leave-electrometer. To demonstrate the method Aaltio measured the radioactivity of soil from different places around Helsinki.

In the 1910s, Yrjö Tuomikoski and Lars William Öholm visited Manchester taking a course in laboratory techniques in the field of radioactivity. Öholm then also purchased some laboratory equipment for the University of Helsinki. There is a work by Gunnar Nordström from the same period concerning the radioactivity of water from 27 natural wells. The radioactivity ranged from 0,4 (Kuopio) to 106 (Pernå) Mache-units. Some early pro gradu works can be found in the Library of the Department, revealing the general academic interest in radioactivity.

Jäger, Helmut
Graz University of Technology; Austria

The First Wireless Transmission of Music

In 1904, Otto Nussbaumer, an assistant professor at the Institute of Physics and Electrical Engineering of the *Technische Hochschule Graz*, dealt with problems in the field of wireless telegraphy. In the course of his experiments, he connected a so-called whistling electric arc with a Braun spark transmitter. Doing this he could hear in the headphone of a simple Marconi receiving set the same tone as it was emitted from the arc. To be able to receive the acoustic frequencies, he also had to develop a special coherer. In the next step he replaced the whistling arc components by a grain coal microphone in the primary circuit of the induction coil. Now, he could hear the characteristic sounds of music instruments played near the microphone in the headphone of the receiver. Nussbaumer was the first to publish a technique of wireless transmission of music. The results of his experiments were very surprising. According to the opinion of experts as to the use of a spark transmitter such a wireless transmission should on principle not be possible. Its mechanism was not quite clear for 100 years. Only recently it was found out how the Nussbaumer transmission works.

Jurdana-Šepić, Rajka

University of Rijeka; Croatia

Educational Aspects of the History of Physics in Classroom and Environment

We will show the experiences of the Croatian educational system concerning the History of Physics from primary-school to the university level. The younger generation is taught the History of Physics through an extracurricular interdisciplinary and often artistic way of learning (exhibitions, museums, artistic expression, popularization events) and are usually connected with people and discoveries from the National History of Physics. Physics teachers lead History of Physics sections (as an extra-curricular activity) for a somewhat older generation in primary and secondary schools. At the University of Rijeka, the History of Physics course resulted in creating an educational content on the History of Physics for a wide educational purpose. A hypermedia e-learning WWW application or Web courseware The History of Physics (available at `http://ahyco.ffri.hr/povijestfizike/`), developed (in Croatian language) by senior students (at the Physics and Computer Science undergraduate program, will be presented. At first developed as an educational material to support e-learning of the course 'The History of Physics' at the University of Rijeka, later transformed into a courseware by its content and methodological and design interventions, into an educational material intended for a wide group of users, students, and teachers at primary and secondary levels of education. It can serve as an e-textbook for students and a sort of e-manual for teachers, as well as an additional source of knowledge on the historical development of physics. Due to its online form and the usage of multimedia, the courseware enables a more dynamic approach to its content, to which young people can easily relate to, and even manage it better than classic printed sources of knowledge. In this way, the courseware is also intended for the general public, for all those interested to pass through the virtual space, which maybe don't strive towards understanding physics itself, but are rather interested in finding out more about the discoveries in physics and their historical surroundings. In this way the courseware attributes to the popularisation of physics. Its value is evident also in the need for hypermedia courseware to be organized in smaller non-English speaking countries in one's own native language.

Kamisheva, Ganka

Institute of Solid State Physics—BAS; Sofia, Bulgaria

The Roots of Theoretical Physics in Bulgaria

Theoretical Physics has young roots in Bulgaria. The papers of professors for Physics and Mathematics show new ideas grow up in the Sofia University. Demetrius Mutieff is the first Bulgarian scientist, who worked theoretically. He obtained his PhD in Physics at the University of Berlin in 1842. Sofia University professors chose to specialize abroad in Theoretical Physics mainly. Some of them obtained a PhD degree in Physics (Kiril Popov, Nikola Bonev). Returned to Bulgaria they worked in Theoretical Physics during the first half of the 20th century. They have had new ideas in meteorology (Stayko Staykov), analytical mechanics (Ivan Tsenov), ballistics (Kiril Popov), classical dynamics (Georgi Manev), astronomy (Nikola Bonev) and physical chemistry (Ivan Stranski).

Kivilšienė, Rasa

University of Vilnius; Lithuania

Physics in Lithuania from the 16th to the 21st Century—a Short Review

The paper by Mrs. Kivilšienė is given by:
Rancova, Olga, from the same Institute of Vilnius University

Roots of physics in Lithuania are closely intertwined with the history of Vilnius University. Physics at Vilnius University from its establishment in 1579 up to essential reforms in 1773 was taught as a natural philosophy based on Aristotle teachings. Professor Tomas Žebrauskas (Żebrowski, 1714–1758) established the first *Physics Laboratory* in 1752 and *Astronomical Observatory* in 1753. Professor Juozapas Mickevičius (Mickiewicz, 1744–1817) in 1775 took care of the physics laboratory and lectured an *independent* physics course. From 1832 onwards, the University remained closed for ninety years.

The traditions of physics were continued in the independent Republic of Lithuania from 1922 when the university was restored in a provisional capital at Kaunas. In 1956, when Lithuania was under USSR, the Institute of Mathematics and Physics was established. The main areas of physics research were defined under the directorship of Povilas Brazdžiūnas (Experimental Physics) and Adolfas Jucys (Theoretical Physics). In 1963, the Lithuanian Society of Physicists was founded. It publishes a research journal *Lithuanian Journal of Physics* (from 1961) and its annex *News of Physicists*.

In nowadays independent Lithuania, applied physics research is most prominent in laser and semiconductor physics. A widely recognized and employed Vilnius astrophotometrical system is created by Lithuanian astronomers. Lithuanian physicists gained 845 PhD degrees during the period of 1945–2006. The number of women with PhD makes about 11% of the total number.

Kluza, Maciej

Jagiellonian University Museum; Cracow, Poland

Liquefaction of Air—a Success with Controversy

In 1790, van Marum accidentally obtaining liquid ammonia initiated the research on liquid gases. In the second half of the 19th century, several scientists aspired to obtain liquid oxygen and nitrogen. In December 1877, Raoul Pictet (1846–1929) and Louis Cailletet (1832–1913) announced obtaining liquid oxygen in a dynamic state, meaning that they could observe droplets of liquid oxygen.

In Cracow in 1883, Karol Olszewski (1846–1915) and Zygmunt Wróblewski (1845–1888) observed for the first time the meniscus of liquid oxygen and nitrogen in a stable state. They used a Cailletet apparatus, which they had modified by themselves. This was the cause of an argument between Polish and French scientists concerning the claim who should be recognized as the actual originator of this achievement.

Kragh, Helge

University of Århus; Denmark

Heavenly Radiation: Research on the aurora borealis in the Early 20th Century

Auroral research, meaning attempts to understand the aurora borealis in scientific terms, developed greatly since the end of the 19th century. Although the magnificent displays had attracted scientific interest since the days of Halley and Mairan, a realistic understanding of the origin and nature of the displays only became pos sible with the emergence of spectroscopy and cathode-rays

physics. Among the problems investigated by physicists, meteorologists and other auroral researchers were: What is the height and distributions of the aurorae? By what physical mechanisms are they caused? What is the nature of the upper-atmospheric substances
responsible for the colours of aurorae?

The favoured view in the early part of the 20th century was that the aurorae had their origin in cathode rays emitted by the sun, a view that received support from laboratory simulations. (An alternative hypothesis assumed solar alpha rays to be the cause.) The identification of the characteristic auroral spectrum turned out to be a more difficult problem. It was only solved in the 1920s, primarily because of advances in both theoretical and experimental spectroscopy.

In this talk an outline of some of the major progress in auroral physics in the period from about 1880 to 1930 is presented. Particular attention is paid to problems related to auroral spectroscopy.

Krehl, Peter

Ernst Mach Institute of the Fraunhofer Society; Freiburg, Germany

Shock Wave and Detonation Physics: a Stimulus for the Evolution of Numerous New Branches in Science and Technology

Shock Waves are mechanical waves characterized by a surface or sheet of discontinuity in which, within a narrow region, the particle velocity and all thermodynamic quantities (such as the pressure, density, temperature, and entropy) change abruptly. Compared to acoustic waves, which are waves of very small (almost infinitesimal) amplitude, shock waves are waves of "finite amplitude". Because shock waves move faster than the speed of sound, the medium ahead of the shock cannot respond until the shock strikes, and so the shock wave falling upon the initially quiescent particles is a supersonic "hydrodynamic surprise" Also detonation phenomena produce shock waves.

Shock wave physics – until the end of WWII mostly confined to high-speed aerodynamics and military technology (such as ballistics, impact physics, and chemical explosions) – quickly developed into a large interdisciplinary field of research. Basic knowledge, hitherto gained in classic shock and detonation physics, is now increasingly used also in other branches of science and engineering. Examples encompass computational fluid dynamics, dynamic materials

research, fracture mechanics, shock synthesis of new materials, microdetonics, chemical reaction kinetics, magnetohydrodynamics, hypersonic flight and reentry, hypervelocity impact physics, laser fusion, nano shock physics, microbiology, medical therapy, seismology, volcanology, planetology, astrogeology, cosmic gas dynamics, solar physics, astrophysics, cosmology, and cosmogony. Thus, shock wave phenomena are now studied within enormous dimensions, ranging from microscopic to macroscopic, even to cosmic dimensions.

Krenn, Heinz

Karl Franzens University of Graz; Austria

Boltzmann's *Bicycle*—a Mechanical Analogue of Coupled Electric Circuits

Hermann Helmholtz introduced the term "cyclic motion" for stationary phenomena in mechanics by what the state of the system is meant to be retained and observed as unchanged in spite of moving particles insofar as they are permanently replaced (like in a constantly flowing fluid). This cyclic condition is perfectly fulfilled in electric conductors: current is flowing without any visual effects to the outside world. Starting with the Helmholtz monocycle, Ludwig Boltzmann extended this cyclicity to the "bicyle", a mechanical apparatus with two monocycles coupled together. This is a perfect analogue to coupled electric circuits. By means of the bicycle, Boltzmann—commonly not respected as a famous experimentalist—could "simulate in advance" the today well known phenomena of lumped electric circuits, which act as basic filter circuits in modern electronics. Nowadays, there is some renaissance of coupled mechanic-electric phenomena like piezoelectricity, SAW filters and others, taking advantage of the outstanding high Q-factor of mechanical oscillators.

Kutschera, Walter

University of Vienna, Austria

Ludwig Boltzmann's Encounter with America in 1905

In 1905, Ludwig Boltzmann was invited to give a series of lectures at the University of California in Berkeley. Boltzmann published a humorous report on this travel, which he called *Reise eines deutschen Professors ins Eldorado*, in his book

Populäre Schriften (published by: Verlag J.A. Barth, Leipzig, 1905). During his stay at Argonne National Laboratory in Chicago the author of this contribution translated Bolzmann's essay out of curiosity [1]. Shortly thereafter an abridged translation was also published in Physics Today [2]. As the author learned later, another English translation had been published earlier [3]. Boltzmann's description of his visit to Berkeley is a very personal record of his impressions and feelings during the trip. This talk will attempt to present the flavour of this unique travel report at the beginning of the 20th century.

[1] W. Kutschera (trans.), *Transport Theory and Statistical Physics* **20** (1991) 499–523.
[2] B. Schwarzschild (trans.), *Physic Today*, (January 1992) 44–51.
[3] M. Malt (trans.), *Annals of Nuclear Energy* **4** (1977) 145–159.

Lippitsch, Max E. and Draxler, Sonja
Karl Franzens University of Graz; Austria

Digging the Roots—Ancient History Behind Modern Concepts

Today's concepts in physics by non-experts often are seen as exceedingly abstract and counterintuitive, typical for a highly sophisticated scientific culture. Earlier civilizations are believed to have followed much simpler and naïve paths of thinking, shaped by everyday experience. Unfortunately, this impression is wrong. The expanding cosmos, multiple universes, cosmic radiation, uncertainty, string theory: All these modern concepts have been created long ago, and have a long-standing history, patently or subconsciously influencing their development and acceptance by the scientific community.

Peruzzi, Giulio
University of Padua, Italy

Notes on Italian Physics Between the Two World Wars

The talk will present some fundamental aspects of the activity of the two physicists who promoted, in the 1930s, nuclear and subnuclear physics in Italy: Enrico Fermi and Bruno Rossi. The first was the leader of the Rome school, mainly devoted to theoretical and experimental nuclear physics, and the latter was the founder of the Italian cosmic-ray school. 1938, the year of the infamous fascist racial laws, marks the beginning of the dispersion when, as it is well known, the roads of many Italian physicists diverged: some, like Amaldi and Bernardini, stayed in Italy to keep the research alive; others, like Rossi and Fermi themselves, Occhialini, Rasetti and many others emigrated.

Pichler, Franz Rupert
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The Contributuion by Robert von Lieben to the Development of Electronic Amplification

The Austrian scientist and inventor Robert von Lieben (1878–1913) got in 1906 his patent *Das Kathodenstrahlenrelais* where he described a vacuum-tube with heated cathode for electronic amplification of electrical signals. Although the construction as stated in the patent never worked, the continuing work by Robert von Lieben and his co-workers Eugen Reisz and Siegmund Strauss was successful. In 1911, they discovered how the tube could be controlled electrostatic by a grid and they applied it for electronic amplification of speech signals. As a result the production of the *Liebenröhre*, the LRS-relais, was started by Telefunken and AEG in Germany by 1913. The *Liebenröhre* found practical application in different kind of WWI-equipment. In the U.S.A. the research departments of Western Electric (Arnold) and General Electric (Langmuir) improved by 1914 the *Audion* of the inventor and physicist Lee De Forest by creating the high-vacuum triode tube which could be applied for amplification in long distance telephony and for modulation of radio-transmitters. Both research results, the *Liebenröhre* and the high vacuum triode tube of Arnold and Langmuir paved the way to the era of electronics in which we are until today.

Rossel, Christophe
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One Hundred Years of Swiss Physical Society—the Link Between Tradition and Innovation

The Swiss Physical Society (SPS) was created in 1908, three years after the *annus mirabilis* of Einstein, as a section of the Swiss Natural Science Society—today the Swiss Academy of Science—itself founded in 1815. During these hundred years, Switzerland evolved between tradition and progress thanks to an efficient education system and a well established spirit of innovation and entrepreneurship. Indeed great pioneers paved the way of its industrial development with the production of textiles, the construction of machines, the fabrication of watches, food products, chemicals and pharmaceuticals. Such achievements would have been impossible without the professional support of physicists and scientists from universities and other research organizations. Over its 100 years of existence the SPS has grown into a society with more than 1200 members. Its membership registers include such famous names as Charles-Edouard Guillaume, Albert Einstein, Wolfgang Pauli, Felix Bloch, Peter Debye, Paul Scherrer, Karl-Alex Müller or Heinrich Rohrer. To link the glorious history of Swiss science to the great challenges of the future, it was decided recently to create a new section on history of physics within the SPS. A brief overview of these different developments will be presented here.

Rumpf, Klemens
Karl Franzens University of Graz; Austria

Development and Highlights of Physics at the University of Graz During the Last 425 Years

Salcher, Günther
Karl Franzens University of Graz; Austria

Peter Salcher—His Life and Works

Peter Salcher was born on August 10, 1848, in the modest teacher dwelling apartment in a small village called Kreuzen in Carinthia. He spent his childhood in Kreuzen and for the first school years he was his father's pupil. After finishing primary school he continued his high school education at the K. K. Gymnasium in Klagenfurt from 1861 to 1868, where he graduated. Then he enrolled into the Faculty of Philosophy at the Graz University where he passed with flying colours and obtained his PHD in philosophy after "rigorous exams" on May 31, 1872. He started being employed for a probationary period for a half year at the K. K. *Staatsgymnasium* in Graz , then passed two years of teaching at the K.K. *Staatsoberrealschule* in Trieste and eventually was appointed Professor for Physics and Mechanics at the K.K. Marine Academy in Fiume (Riijeka). There he taught successfully until he retired on November 1, 1909. From 1880 onwards, he was also in charge of the meteorological station. Peter Salcher died in Susak (Rijeka) on October 4, 1928, and was buried in the family tomb at the cemetery of Kozala in Rijeka.

Peter Salcher was the first to make sharp photos of a flying bullet with induced shock waves. Experiments have been extended in the field of compressed air jet in supercritical flow conditions, showing the reflected shock waves for the first time. One wave structure was also called "Salcher's lyre" while looking same as the ancient music instrument (later this phenomenon is known as planar shock wave or Mach's disc). His experiments marked the beginning of supersonic aerodynamics. Shock waves, ballistics, supersonic jets and high-speed wind tunnels were soon to follow.

Schuster, Peter Maria
Victor F. Hess Society and echophysics; Pöllau, Austria

Conference opening and welcome address.

Why is a European Centre for the History of Physics to be? Still, why is it to be in Austria in the first place?

Šebesta, Juraj
Comenius University of Bratislava, Slovakia

History of Physics in Slovakia (1990–2010)

After the 'velvet revolution' in November 1989, great changes have started in Czechoslovakia. In scientific research, we had the opportunity to inform about physicists who were prohibited for many years (for example, Philipp Lenard). In education, courses on humanities were included in the training of future physicists and future physics teachers at Slovak universities. At Comenius University new courses were organized: on the History of Physics in Slovakia, on the Epistemology of Physics and on using of the History of Physics in physics education. For that purpose a monograph in two volumes on the History of Physics was published. Diploma works and PhD theses on the History of Physics and on using of the History of Physics in physics teaching were written. In 1992, we joined the IGHP headed by Fabio Bevilaqua, and in 1996, we organized conference of IGHP.

Some activities had continued, for example a seminar on the History of Physics at Comenius University had been practiced each Thursday during university semesters.

When Czechoslovakia was divided in 1993, a Slovak national committee for the History of Science and Technology was established. We regularly took part in congresses of IUHPS/DHST. All mentioned facts, events and activities will be discussed in detail.

Soukup, Rudolf Werner
Vienna University of Technology, Austria

Some New Insights into the Scientific Network of Robert W. Bunsen

When Robert Wilhelm Bunsen died in 1899, all the books, special editions, articles, and notebooks from Bunsen's private library in Heidelberg were offered for sale. The well known chemist Dr. Carl Auer von Welsbach, who had been Bunsen's student, acquired the library. The printed works were transported to Treibach in Carinthia where they were stored in the attic of the research institute on the factory grounds of Treibach Chemical Works. For nearly 100 years, the library was more or less forgotten and remained largely untouched in the packing cases.

Since Bunsen's correspondence during his years in Heidelberg appears to be largely destroyed, his private library (now in the Auer Welsbach-Museum in Althofen) opens up a new chance of researching Bunsen's unexpectedly comprehensive network of teachers, colleagues, and fellow scientists. The main subjects of the nearly 10.000 specimens in this library are: inorganic and organic chemistry, spectroscopy, astronomy, geology, mineralogy, physiology, and, last but not least, geography and glaciology. Hitherto not so well known but well documented by many books is the perpetual interest of Bunsen in mountaineering and alpinism.

Bunsen's various topics of research (such as the gas analysis of volcanic gases, the photometric measurements of solar intensity, his syntheses of arsenic compounds, his geological, and mineralogical studies), can be seen in the context of research done by physicists and alpine travellers at the end of the 17th century like Horace-Bénédict de Saussure. Many colleagues and students of Bunsen were mountaineers. Tyndall, Kirchhoff, Helmholtz, Roscoe and Frankland wrote papers about physical observations they made during their climbing. The physiological study of Bunsen's student Adolph Fick during an ascent of Faulhorn in Switzerland in 1865 was the first of many investigations of scientifically oriented physiologists like Julius Geppert and Adolf Weil, who had studied in Bunsen's laboratory. Of course, geologists are also present in that circle of scholars, who were—like Bunsen and Kirchhoff—members of the Heidelberg section of the Alpenverein: Achilles Andreae and Oskar Zeise are two of them.

The impact Robert W. Bunsen had on the development of science throughout Europe was enormous. This can be shown by the importance of Bunsen's students for the development of chemistry in Austria, Hungary, and Russia.

Strohmaier, Brigitte

University of Vienna, Austria

The Vienna Radium Institute and Its Collection of Historical Instruments

The *Institut für Radiumforschung der Kaiserlichen Akademie der Wissenschaften* (Institute for Radium Research of the Imperial Academy of Sciences) in Vienna was opened on October 28, 1910. It was built and equipped with the money of a private donation, and it was the first research institution in the world dedicated to the exploration of the physical properties of the radioactive element radium which had been discovered in 1898. After its example the Radium Institutes in Prague, Paris and St. Petersburg were fashioned several years later.

Already in the first decade of its existence, the scientists who conducted research at the Vienna Radium Institute achieved considerable success in the fields of atmospheric electricity, radiochemistry, atomic-weight determination and other radioactivity research. Two of these discoveries were even honoured with the Nobel Prize later on. After World War I, when Austria was reduced in size and impoverished, the institute nevertheless attracted scientists from within the country and abroad, with a high percentage of both women and foreigners among the doctoral students and graduates. The emphasis of the work shifted to artificial nuclear reactions, the beginnings of nuclear physics. Several important methods of detection of particles originating in such reactions were developed at the Vienna Radium Institute.

After Austria's annexation to Germany in 1938, the Institute lost a large portion of its staff due to the anti-Semitic politics of the Nazi regime. The research concentrated on nuclear fission as well as the search for new elements, and again yielded remarkable results.

The time after World War II was shaped by extreme scarcity, but by and by a neutron generator together with the appropriate detectors for the study of neutron-induced reactions, and an apparatus for dating of organic objects by means of the radiocarbon method were set up, as well as a bureau for import and distribution of radioactive preparations in times when no legal regulations of radiation protection existed. From 1955 on, 'Nuclear Physics' was part of the Institute's name.

The Vienna Radium Institute lost the status of an Institute of the Austrian Academy of Sciences in 1987, it gave up the original objective of radium research as part of the name of the remaining university institute which was re-named Institute for Isotope Research and Nuclear Physics in 2000, and finally had to move out of the historical building in *Boltzmanngasse* at the end of 2004.

A collection of instruments, some of which date back as far as 1910, was preserved at the Institute until recently. It was transferred to Pöllau earlier this year and forms part of the inventory of the Museum at the first European Centre for the History of Physics—founded on patronage of the Victor F. Hess Society. The present contribution gives a survey of the history of the Vienna Radium Institute, relating its scientific work to the existing apparatus.

Talas, Sofia

University of Padua, Italy

Cosmic-Ray Physics in Italy from the End of World War II to the G-Stack: the Rebirth of Italian Physics

"A disaster." This is how Italian scientists described the condition of Italian physics at the end of World War II: many physicists had left, many physics institutes had been severely damaged and scientific activity had almost completely stopped in most Universities. Italian physics emerged from this tragic situation in the ten years following the end of the War. The present paper will show how cosmic-ray researches played a crucial role within this "rebirth" process.

Thim, Hartwig

Johannes Kepler University of Linz, Austria

The U2 Anisotropy Experiment of Smoot Had Confirmed an Aether Drift

Smoot *et al.* [1], [2] have observed, that radiation coming from the direction of constellation LEO is blue shifted, whereas radiation coming from the opposite direction is red shifted. Putting the measured shifts into the Doppler shift equation yielded the absolute motion of our solar system to be equal to about 370 km/s

in the direction of constellation LEO. Hence, light propagation is anisotropic in our solar system. Smoot *et al.* have called their experimental results in [1] “The New Aether Drift”. This frame of reference seems to be identical with Maxwell’s Aether or, in other words, “with a fundamental frame of reference from which our Universe looks most simple” according to Smoot *et al.* [1]. It also seems to be obvious that Newton had this frame of reference in mind [3] when he wrote his famous Principia. Interestingly, Maxwell had stated that his equations are valid only in the Aether. This could easily be put into another simple principle, namely, that light speed is isotropic only in the (New) Aether. If one measures light speed in the Aether he should obtain the value $c = 1/\sqrt{\varepsilon_0 \mu_0}$ in all directions. If one measures the speed of light travelling on earth in the direction of constellation LEO he should obtain $c - u$ with $u = 370$ km/s, and $c + u$ in the opposite direction. Thus light speed turns out to be anisotropic on earth.

If one accepts this view he then has to give up the Lorentz Transformation equations. It will be shown that the Lorentz Transformation equations yield paradoxical results for a spherical wave emitted in K, and measured in K'. The question then arises which transformation equations would be more realistic and should, hence, be used. The Galilei Transformations would certainly be a good choice. They would explain the anisotropic light propagation phenomenon very well. And, as far as the Doppler Effect is concerned, the classical Doppler shift equations turn out to be compatible with the Galilei Transformation equations. This had already been shown in the Appendix of ref. [4] where the Michelson-Morley null result has also been explained using the Galilei Transformation equations.

[1] G. F. Smoot, M. V. Gorenstein and R. A. Muller, “Detection of anisotropy in the cosmic blackbody radiation”, *Phys. Rev. Letters*, vol. 39, no. 14, pp. 898–901, 1977
[2] G. F. Smoot, Lawrence Berkeley Laboratory and NASA, “U2 Anisotropy Experiment”
[3] I. Newton, Principia, `http://de.wikipedia.org/wiki/Isaac_Newton#Der_newtonsche_Zeit-_und_Raumbegriff`
[4] H. W. Thim, “The Long History of the Mass-Energy Relation”, *56. Jahrestagung der ÖPG in Graz*, 18.–21. September 2006, Abstract booklet, p. 51, and *Proceedings of the History of Physics Group of the European Physical Society*, pp. 117–121

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Tracing the Future Into the Past—the Significance of History of Physics for Physics Development

History of Physics has undoubtedly been an interesting independent field, which has seen a remarkable development since the early twentieth century.

In the present paper our aim is to give some evidence supporting the argument that history of physics may play a significant role for the progress of physics.

The basic idea is that modern physics can successfully use some alternative models other than that of logical positivism to push forward the scientific thought for the explanation of the natural phenomena.

Weaire, Denis
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Philomorphic Pursuits in Science, Art, Architecture, History ...

The admiration of form is common to science and art. Following some personal heroes—Kepler, Plateau, Kelvin, Smith—we will trace some of their preoccupations with the structures of materials, and especially that of a soap froth. The path leads to the Beijing Olympics (and a casino in Macao).

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