



# ESI NEWS

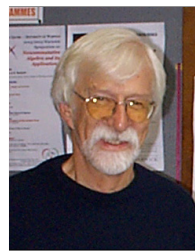
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## Editorial

Klaus Schmidt



In terms of scientific activities, the year 2008 set a new record for the ESI. The Institute spent more than €810.000 on its scientific activities while keeping its infrastructure costs around €400.000 (as in previous years). The number of visiting scientists also set a new record: more than 700 mathematicians and physicists worked at the ESI in 2008, more than 10% of whom worked at the Institute for at least 4 weeks. The ESI organized 4 major thematic programmes and a total of 11 workshops. Several of these workshops were specifically aimed at supporting the *ESI Junior Research Fellows (ESI JRF) Programme*, and most of them were at least partially supported by external sources.

In its *Senior Research Fellows Programme* the ESI offered five lecture courses for graduate students and postdocs in 2008, and the *JRF Programme* attracted 23 postdocs and PhD students during that year.

Last, but not least in this brief account of scientific events and activities in 2008, I should mention the *ESI Lectures in Mathematics and Physics*, a lecture note series edited by the Institute's Scientific Directors Joachim Schwermer and Jakob Yngvason and published by the European Mathematical Society. Three further volumes appeared in 2008: *The Cauchy Problem in General Relativity* by Hans Ringstroem, *Boltzmann's Legacy*, edited by Giovanni Gallavotti, Wolfgang L. Reiter and Jakob Yngvason, and *Recent Developments in Pseudo-Riemannian Geometry* by Dmitry V. Alekseevsky and Helga Baum.

Unfortunately the current economic crisis is casting a shadow over the activities of the ESI. A hoped for increase in the

scientific budget of the ESI is not expected to materialise in the near future, forcing us to introduce some cuts to the programme budgets for 2010. The *JRF Programme*, which is funded by the Austrian Ministry of Science and Research and allows PhD students and postdocs to spend up to six months at the ESI to engage in research and participate in the scientific activities of the Institute, may not be continued beyond 2010.

The JRF Programme has been remarkably successful in terms of numbers and quality of applications, as well as in the very positive feedback the programme has received from the scientific community world wide. Let me quote a few lines from the final report on the ESI PROGRAMME ON NUMBER THEORY AND PHYSICS, organized by Alan Carey (ANU, Canberra), Harald Grosse (University of Vienna), Sylvie Paycha (Université Blaise Pascal, Clermont-Ferrant) and Steven Rosenberg (Boston University) to illustrate this point: *... the programs [at the ESI] extend over a longer period than is usual at other research institutes. This is particularly valuable for junior researchers at the beginning of their careers ... We also find that the medium size of the ESI's programs works very well, as opposed to the more standard model of large conferences, which junior researchers can find intimidating. ... [The ESI] provides efficiently run programs that both train the next generation of researchers and host leading senior researchers. We hope ESI will continue its valuable activities for years to come.*

The threatened discontinuation of the *ESI JRF Programme* would be particularly disappointing in view of the press release after the visit of the Austrian Minister for Science and Research, Dr. Johannes Hahn, to the ESI on March 30, 2009: *The promotion and support of young scientists is absolutely central to science and research in Austria. Especially in the area of Mathematics with its applications in many areas of life it is important for Austria to 'stay on the ball', the Minister said, and I could not agree more!*

## Visit Dr. Johannes Hahn, Federal Minister for Science and Research

March 30, 2009



**Jakob Yngvason**, scientific director of the ESI, **Johannes Hahn**, Federal Minister for Science and Research, **Heinz Engl**, vice rector for research, University of Vienna, **Joachim Schwermer**, scientific director of the ESI and **Klaus Schmidt**, president of the ESI – from left to right, in front of the longest blackboard worldwide.

### Press Release

*Austrian Federal Ministry of Science and Research*

*Press Release of the Austrian Federal Ministry of Science and Research on the Occasion of the Visit by the Federal Minister for Science and Research, Dr. Johannes Hahn on 30 March, 2009 (OTS0184 5 CI 0255 MWF0002 II Mo, 30. März 2009)*

### Johannes Hahn: Reger Austausch von Forschern stärkt Forschungsstandort Österreich

Wissenschaftsminister Dr. Johannes Hahn hat heute das Erwin-Schrödinger-Institut in der Wiener Boltzmannngasse besucht. **„Das Erwin-Schrödinger-Institut zählt zu den weltweit führenden Forschungsinstituten im Bereich der mathematischen Physik und Mathematik und wurde zu einer internationalen Begegnungsstätte für führende Wissenschaftler und Forscher“**, so der Minister.

Besonders erfreut zeigte sich der Minister über die hohe Zahl der Gastwissenschaftlerinnen und Gastwissenschaftler: Jährlich kommen mehr als

500 Wissenschaftler aus der ganzen Welt nach Wien, um zu forschen. So waren bisher insgesamt rund 5.000 Gastforscherinnen und Gastforscher aus 64 Ländern zu Gast. Aus der erfolgreichen internationalen Zusammenarbeit gingen bisher rund 1.500 wissenschaftliche Arbeiten hervor, die in renommierten Fachzeitschriften publiziert wurden. **„Der rege Austausch bereichert die Arbeit der Forscherinnen und Forscher, wirkt sich sehr positiv auf die Forschungsergebnisse aus und stärkt den Forschungsstandort Österreich“**, betont Hahn.

Am Erwin-Schrödinger-Institut wird auch besonderen Wert gelegt auf die **Förderung der Nachwuchsforscherinnen und -forscher**. Dazu wurde u.a. im Jahr 2004 das vom Bundesministerium für Wissenschaft und Forschung (BMWF) geförderte **„Junior Research Fellows“ – Programm** aus der Taufe gehoben. Jungen Doktoranden und Postdocs wird auf diesem Weg ermöglicht, für ein Semester an das Erwin-Schrödinger-Institut zu kommen und zu forschen. **„Die Förderung des wissenschaftlichen Nachwuchses ist für den Wissenschafts- und Forschungsstandort Österreich zentral“**, so der Minister. Gerade im Bereich der Mathematik, die mit ihren Anwendungen zahlreiche Lebensbereiche beeinflusst, erachtet es der Minister für wichtig, dass Österreich **„am Ball bleibt“**.

## A Summer of the Bandol-Ellmau Free Institute of Mathematics and Mathematical Physics

Masamichi Takesaki

In this short essay, I would like to describe the life, in the summer of 1977, of a private research group of mathematicians and mathematical physicists, the heart of which was Daniel Kastler. This research group was born of and led by Daniel Kastler with the dedicated assistance of his wife, Lisl Sander Kastler.



What follows is my personal account of this distinguished research group with a focus on that special summer of '77. In an effort to avoid a boring, businesslike list of events, I have chosen to relate a possibly unbalanced selection of episodes with which I am personally most familiar. I apologize in advance to those people who might be offended by my unintentional omission of their significant contributions to the research group.



Daniel Kastler is the son of Physics Nobel laureate Alfred Kastler, and he is best known for his work on algebraic quantum field theory done in a longtime collaboration with Rudolf Haag – one of the founders of mathematical physics. Rudolf Haag once owned a condo near the Kastler's home in Bandol. Daniel has the firm conviction that mathematical advances should be accomplished via free inquiry, freely communicated: free from any social, racial, ethnic, nationalistic, geographical, philosophical or religious restrictions or prejudices. When it comes to practical matters, Daniel often needs the help of others.

Two people in particular played key roles in this regard: Lisl, his devoted wife; and M. Mebkhout, nicknamed Momo, Daniel's student-colleague and a dean of Physical Sciences at the University of Marseille-Aix-Luminy. Lisl took care of the daily life of visitors, finding accommodations, suggesting activities for the young, connecting children who have fallen sick with proper care. Momo provided visitors with financial support and adroitly handled bureaucratic matters with a maximum of flexibility. Lisl is a descendant of a Tyrolean hero, Andreas Hofer, who fought Napoleon's troops successfully up until the surrender of the central government in Vienna.

Each summer throughout the two and a half decades starting in the early 60s, academic friends of the Kastler family came to Bandol, a small lovely Mediterranean seaside town with less than 8 thousand inhabitants growing to more than 20 thousand residents from July 14th through the end of August. Bandol is situated 54 km east of Marseille and 20 km west of Toulon, along the Mediterranean coast.



Among these visitors, in random order, were Rudolf Haag, Hans Borchers, Richard V. Kadison, Nico M. Hugenholtz, Huzihiro Araki, Derek W. Robinson, Marinus Winnink, Robert T. Powers, Erling Størmer, Sergio Doplicher, John Roberts, Marc Rieffel, Gert K. Pedersen, Dorte Olsen, Ola Bratteli, Alain Connes, Vaughn F. R. Jones, and many others. They came to Bandol as soon as their universities entered summer vacation. Most of them came with their families to enjoy the Mediterranean seaside. Year after year Lisl skilfully and artfully arranged accommodations for these many visitors during the popular summer tourist season along the Mediterranean coast.

Daniel and Lisl live in a hillside house with a large living room, and a large garden where many exciting academic (and non academic) discussions have taken place. There is a beautiful view of Bandol Bay from both the Kastler's living room and garden. Some lucky visitors got to stay nearby in the Katikias apartment complex, overlooking Bandol, in which the Kastler family also owns a flat. Beginning July 14, the first day of the month long French summer vacation period, the crush of tourists in Bandol becomes frantic.

To avoid the frenzy, some of Kastler's visitors moved to Lisl's ancestral family farm house in the small village of Ellmau, an Austrian town in Tyrol with a population of about 2,500 located near St. Johann and Kitzbühel – known for World Cup skiing. Ellmau is located about 60 km east of Innsbruck and 60 km southwest of Salzburg. It is known for its picturesque environment, with the Wilder Kaiser Mountain range on the north and many gentle alpine meadows on the south.

Although Ellmau is a quiet, small mountain-side village in Tyrol, it still attracts quite a few holiday vacationers, mainly from Austria and Germany, who love family hikes in the mountains. Ellmau attracts tourists with its Tyrolean evening festivals, which include barbecues, beer, wine, and Tyrolean dance. Thus, in advance of their arrival, Lisl had to work hard to find suitable accommodations for each family. Imbued with a relaxing and tranquil atmo-

sphere, Ellmau's crisp air and alpine meadows provided an ideal environment for the academic research activities of Kastler's friends.



The Bandol-Ellmau Free Institute (BEFI) was unusually busy in the summer of 1977. That summer a conference on operator algebras and algebraic quantum field theory, with an emphasis on the theory of duality, was held at the newly born Luminy Mathematical Research Institute. This conference attracted many specialists in duality theory, many of whom went on to Bandol thereafter, and then on to Ellmau, 1000 km east of Bandol. Some came directly to Ellmau, skipping the Marseille conference. The Doplicher-Haag-Roberts theory of superselection sectors had just appeared for the first time. Other current mathematical developments of the period included the Enock-Schwartz theory of Kac algebras, the classification of approximately finite dimensional (AFD) factors by Connes, Connes' extension of the Atiyah-Singer index theory to foliations, the chemical potential theory of Araki-Haag-Kastler-Takesaki wherein Tannaka's duality theorem played a fundamental role.

After learning that the focal point of the conference was duality theory, the author proposed to Daniel that he invite the duality specialist Nobuhiko Tatsuuma via phone – no email in those days. Tatsuuma accepted Daniel's hasty invitation and flew to Marseille from Osaka, Japan. I drove a rental car with my family and Tatsuuma from Bandol to Innsbruck, where Tatsuuma stayed a couple days to explore the capital of Tyrol. Tatsuuma then came to Ellmau with Daniel and Lisl.

Lisl's aging parents, then well over 90 years old, lived in Innsbruck, so Lisl and Daniel visited them for a few days before coming down to Ellmau. This was the Kastler's routine every summer for many years, repeated during the Christmas season as well. Lisl's family farm house, typical for the area, was located on the western edge of the village, surrounded by a small meadow. A local farm family served as caretakers. All other participants stayed in various extended-stay accommodations previously arranged by Lisl.

As the sun set, the sweet meadow air was full of dew, in contrast to the dry air of day. As night approached thousands of birds returned to their nests, and we all settled into Lisl's garden to enjoy a fine barbecue. The participants became part of the Kastler's extended family, forming strong bonds that remain. The caretakers too were included in this informal gathering, proudly displaying photos of their son and his

medals won in ski racing.

Each day started with a morning of shopping at the village market. Many of the participants had cooking facilities, and thus they took advantage of fresh bread delivered to their rooms each morning. The research participants gathered in the seminar room about 10 am to discuss their work, while other family members went hiking in the nearby hills or visited points of interest such as Salzburg, Kitzbühel or St. Johann.

Among the participants were two distinguished mathematicians in particular, each unique characters in their own way: Tatsuuma and Connes. Tatsuuma was not a professional mathematician in the usual sense; he did not hold an academic position at a university or institute. Instead, he was the vice president of a famous Sake brewery, Hakutaka, in charge of sake production. Sake is wine produced from rice in two stages: the starch of cooked rice must be changed to sugar via first stage fermentation; then the sugar is changed to alcohol via second stage fermentation. Tatsuuma graduated from Kyoto University with a bachelors degree in chemical engineering, and he then went to work in his family's sake business. He does mathematics two days a week. This would not be much for, say, a young mathematician; but it would be quite sufficient for a full professor with many university duties. It seems apparent to me that his life-time mathematical research accomplishments are greater than that of an average mathematician. His sake business, Hakutaka, is perhaps equivalent in fame to a well-known wine chateaux in Bordeaux. Indeed, the Nada region in Japan is to sake what Bordeaux is to wine; and Hakutaka is one of the best sake producers in Nada. Thus Tatsuuma takes the business of sake production very seriously. Tatsuuma is quite a talented man, running a first rate sake firm for his profession, doing mathematics as a hobby – much like the mathematicians of the 18th century or earlier.



At any rate, Tatsuuma decided to join the BEFI and bring his family: three daughters, Masako, 13 years old; Teiko, 11 years old; Reiko, 7 years old; and his wife, Kiyoko. The family flew into Munich from Osaka, while Nobuhiko arrived in Marseille a week earlier. In order to pick up the family of Tatsuuma the author drove to Munich International Airport from Ellmau via Kufstein through heavy rain, without noticing the severity of the storm. In fact, the storm was so strong that a mother and child were killed in their car by a flash flood in a gorge adjacent to the one the author drove. Although the water level in the river was quite high, we were lucky enough to avoid even being aware of the nearby tragedy; and we safely arrived at our accommodations

in Ellmau early that evening. Tatsuuma's family, however, did not spend a pleasant night. First, their accommodation was located on the north side of the valley. Until morning they were unknowingly isolated by flood waters from the main group of the BEFI, who were staying on the south side of the valley. During the night, the second eldest daughter, Teiko, injured her head when she fell from her bed.

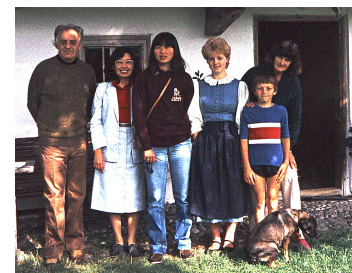
It was Teiko's first time sleeping in a raised bed, rather than on a futon on the floor, as is Japanese custom. Poor Tatsuuma had to wait until late in the morning for the flood waters to recede under the day's warm sun before he could rush via bicycle to get help for his daughter's injury. The author's wife, Kyoko, drove a small car to St. Johann with 5 passengers beside her: Tatsuuma's three daughters; their mother, Kiyoko; and the author's daughter, Yuki, who was the only person in the car who could speak German. Fortunately, Teiko's injury was not serious; she was treated quickly and released from the hospital in St. Johann – thus ending the dramatic first phase of the Tatsuuma family's trip outside Japan. Though the storm retreated into nice weather, the village was damaged quite a bit by the flood. The villagers quickly and smoothly repaired those damages, however; impressing all the visitors. The vacationers pondered as to whether the teamwork exhibited by the villagers was built into their culture as a survival mechanism, a result of thousands of years of harsh mountain living. In any event, after the storm and flood had passed all went well for the villagers, participants and their families.

Prior to the summer of 1977, Daniel negotiated with the principal of the elementary school of Ellmau to secure a room for the workshop. The school was located near the church of the small village. The principal of the school was happy to host the workshop. The only problem was the size of the chairs and desks, which were obviously a bit small for most of the adult participants. But spirits were high enough to overcome these difficulties; nobody complained about the uncomfortable chairs. The participants at the Ellmau gathering were: J. Bellissard, A. Connes, S. Doplicher, M. Enock, N. Tatsuuma, Y. Nakagami, N. M. Hugenholtz, R. V. Kadison, H. Narnhofer, J. Roberts, J-M. Schwartz, G. Skandalis, D. Testard and yours truly, M. Takesaki. The BEFI brought satisfaction to the participants. Their families enjoyed hiking and vacationing in the Ellmau Alps.

One day, the Nakagami couple and my family took a circular walk to the foot of Ellmau Tor, a majestic, rocky mountain pass. Far away an attractive, Tyrolean girl danced down a steep, cliff-like path, wearing a Tyrolean green skirt – she impressed us all. As we approached closer we realized that the girl was none other than our colleague, Heide Narnhofer. We greeted each other warmly. She then took off down the mountain, as if she could fly.

At the gathering Tatsuuma discussed his research on the unitary which plays a key role in the entire duality theory. It was then further

developed into the theory of multiplicative unitaries of Baaj-Skandalis, satisfying the pentagon relation. Alain Connes emphasized the importance of studying the K-theory of the irrational rotation  $C^*$ -algebra,  $A_\theta$ . He mentioned that his noncommutative geometry heavily depended on the fact that the  $K_0$  group of  $A_\theta$  was generated by the trivial projection and the Powers-Rieffel projection. It was as if he was anticipating the result proved by Pimsner and Voiculescu on the K-theory of the crossed product of a  $C^*$ -algebra by a single automorphism. It was indeed the dawn of noncommutative geometry. Connes then extended the Thom isomorphism theorem to  $C^*$ -algebras and then established noncommutative geometry – the theory of cyclic cohomology. Although there were no prophets among the participants of the BEFI, it was clear to everybody that some big advances were coming soon. Everybody was thrilled to be part of this historic development.



Senior participants and R. V. Kadison started to discuss and plan an American Mathematical Society summer school on operator algebras. Ten years had elapsed since the famous Baton Rouge International Conference on Operator Algebras and Applications. Despite his age of 30 years, Alain Connes was already considered a leader of the field and was naturally an active participant in these discussions. With the combined force of the young and experienced leaders, the three-week long Kingston Summer School of 1980 became a reality, and a big success.

As with any wonderful vacation, the BEFI summer of 1977 came too quickly to an end. The days became shorter, vacationers were leaving the village. The participants had to leave for home as well, with exciting memories. Recently the author met one of Tatsuuma's daughters, Masako, who runs a high-class restaurant in Kyoto. Masako told me that she had lasting good memories of Ellmau and her good times with Yuki.

Although the Bandol - Ellmau Free Institute ended its operation more than 15 years ago, when Kastler retired from the university, the members of the extended Kastler family came back to celebrate their academic success from time to time. The author also visited Bandol in the early summer of 2005. The academic seeds of the Kastler couple are now blooming in many places.

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## A Philatelic Introduction to Statistical Physics

Simo Puntanen and George P. H. Styan

The Nobel laureate Ernest Rutherford, 1st Baron Rutherford of Nelson (1871–1937) said: “All science is either physics or stamp collecting” [1, p. 108] and the mathematics educator William Leonard Schaaf (1898–1992) in his 1978 book [10, p. xiii] entitled *Mathematics and Science: An Adventure in Postage Stamps* found that “The postage stamps of the world are, in effect, a mirror of civilization and that multitudes of stamps reflect the impact of mathematics and science on society.” We agree with Schaaf and in this article we present a philatelic introduction to statistical mechanics, in particular to “Fermi–Dirac, Maxwell–Boltzmann, and Bose–Einstein Statistics”, a main entry [9] in the *Encyclopedia of Statistical Sciences* [4]. The six scholars are

Enrico Fermi (1901–1954),  
Paul Adrien Maurice Dirac (1902–1984),  
James Clerk Maxwell (1831–1879),  
Ludwig Boltzmann (1844–1906),  
Satyendra Nath Bose (1894–1974),  
Albert Einstein (1879–1955),

and three (Fermi, Dirac and Einstein) have won Nobel Prizes in Physics.

All six of these scholars have been honoured with a postage stamp, with nine for Enrico Fermi:

1. 1967 Italy, *Scott* 976,
2. 1996 Tanzania, *Scott* 1480h,
3. 2000 Romania, *Scott* 4380,
4. 2001 Cambodia, *Scott* 2056,
5. 2001 Guinea, *Scott* 2130a,
6. 2001 Italy, *Scott* 2424,
7. 2001 Monaco, *Scott* 2222,
8. 2001 USA, *Scott* 3533,
9. 2008 Guinea.

Scott catalogue numbers are as given in the *Scott Standard Postage Stamp Catalogue* [11]; we have not yet found a *Scott* number for the 2008 stamp from Guinea. We have found images of eight of these nine stamps and present images of four on this page (Romania 2000, Cambodia 2001, Italy 2001, Monaco 2001); we would be pleased to find (an image of) the Fermi-stamp from Tanzania 1996. Five of the nine stamps for Fermi were issued in 2001, the year of Fermi’s birth centenary. The 2008 stamp from Guinea (shown on the next page) also depicts the Chinese-born American physicist Tsung-Dao Lee (b. 1926), who won the Nobel Prize in Physics together with Chen-Ning Yang (b. 1922).

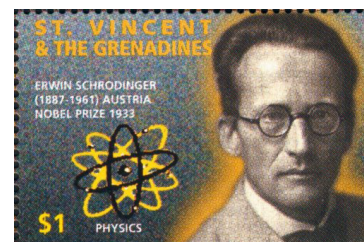


The Italian–American physicist Enrico Fermi was noted for his work on the development of the first nuclear reactor, and for his contributions to statistical mechanics. He was awarded the Nobel Prize in Physics in 1938 for his research on induced radioactivity.

Paul Adrien Maurice Dirac, OM, FRS, was a British theoretical physicist, who made fundamental contributions to the early development of both quantum mechanics and quantum electrodynamics. He shared the Nobel Prize in physics for 1933 with Erwin Schrödinger, “for the discovery of new productive forms of atomic theory.” We have found just two stamps for Paul Dirac: Sweden 1982, *Scott* 1428 and Guyana 1995, *Scott* 3012g.



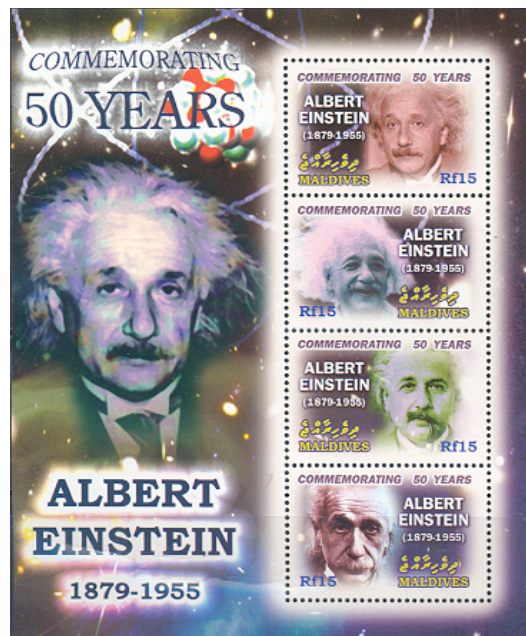
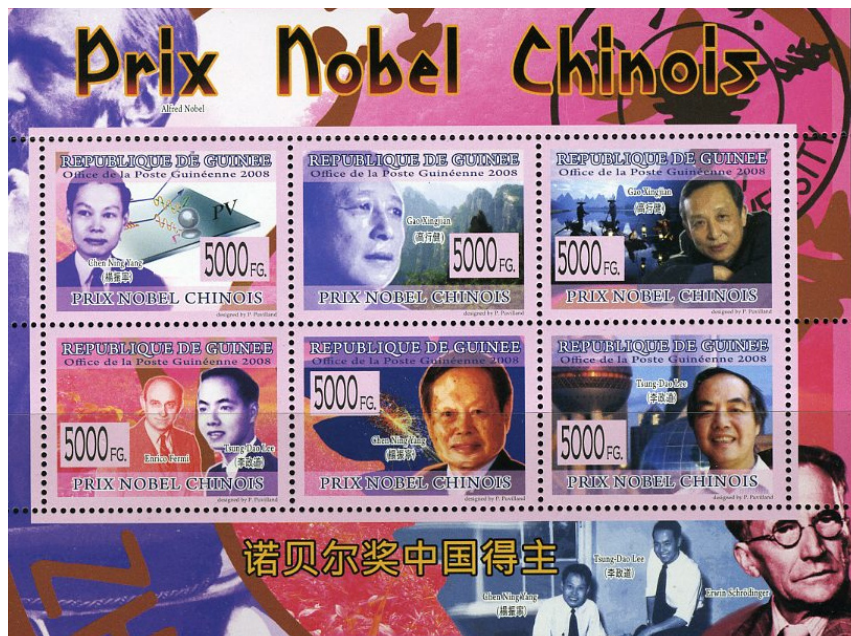
The 1982 stamp from Sweden [15, p. 89] was one of a set of five depicting various atomic models associated with Nobel Prize winners in physics (quantum mechanics), while the 1995 stamp from Guyana was issued in celebration of the 100th anniversary of the first Nobel Prize.



We have found three stamps which honour Erwin Rudolf Josef Alexander Schrödinger (1887–1961): Sweden 1982, *Scott* 1426, Austria 1987, *Scott* 1404, and St. Vincent & the Grenadines 1995, *Scott* 2217l.

The Schrödinger stamp from Sweden [15, p. 89] was one (*Scott* 1426) of the same set of five which also included the stamp for Dirac; the other 3 stamps were for Nobel laureates Niels Henrik David Bohr (1885–1962), Louis-Victor-Pierre-Raymond, 7th duc de Broglie, FRS (1892–1987) and Werner Heisenberg (1901–1976). The stamp from St. Vincent & the Grenadines was one of twelve stamps in a souvenir sheet issued in celebration of the 100th anniversary of the Nobel Prize.

Heilbronner & Miller in *A Philatelic Ramble through Chemistry* [2, item #120, p. 228] display a first-day cover with the stamp from Austria 1987 and the time-dependent Schrödinger equation given in the postmark; this equation (in abbreviated form) is also shown on a 1987 postcard from Hungary [2, item #158, p. 137].



Erwin Schrödinger is also depicted in the selvaige (bottom right-hand corner) of a souvenir sheet of six stamps issued by Guinea in 2008 [6] featuring three Chinese Nobel Prize winners: Chen-Ning Yang (upper-left and lower-centre), Gao Xingjian (upper-centre and upper-right), and Tsung-Dao Lee (lower-right and lower-left, with Enrico Fermi).

Chen-Ning Yang (b. 1922) is a Chinese-born American physicist who worked on statistical mechanics and particle physics. Together with Tsung-Dao Lee (b. 1926), Chen-Ning Yang received the 1957 Nobel prize in physics for their work on parity nonconservation of weak interaction. Gao Xingjian (b. 1940) is a Chinese-born novelist, who won the 2000 Nobel Prize in Literature.

Statistical mechanics is the application of probability theory to the motion of particles or objects when subjected to a force. In statistical

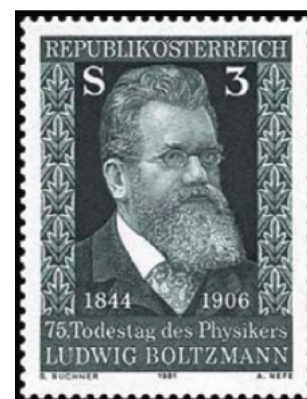
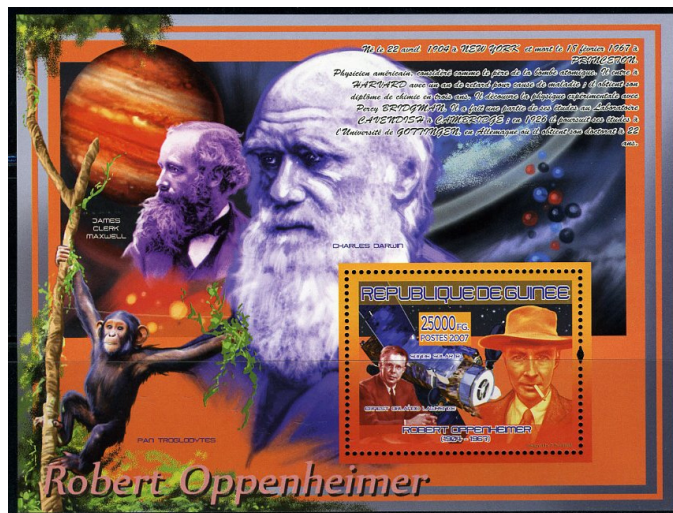
mechanics, Fermi–Dirac statistics determine the statistical distribution of fermions over the energy states for a system in thermal equilibrium. In particle physics, fermions are particles with half-integer spin, such as protons and electrons.

James Clerk Maxwell (1831–1879) was a Scottish mathematician and theoretical physicist, whose most significant achievement was aggregating a set of equations in electricity, magnetism and inductance eponymously named Maxwell's equations. He also developed the Maxwell distribution, a statistical means to describe aspects of the kinetic theory of gases.

We have found three stamps for James Clerk Maxwell: 1967 Mexico 1967, *Scott* C332, 1971 Nicaragua 1971, *Scott* 881, and 1991 San Marino 1991, *Scott* 1242.

The 1967 stamp from Mexico features portraits of James Clerk Maxwell (on the right-hand side) with Heinrich Rudolf Hertz (1857–

1894) on the left. It was issued for the Second International Telecommunications Planning Conference, October 30–November 15, 1967. Heinrich Rudolf Hertz was the German physicist for whom the unit “hertz” is named; the hertz (symbol: Hz) is the standard unit of frequency: one hertz means one per second. The 1991 stamp from San Marino was issued to celebrate 100 years of radio. We have also found a 2007 souvenir sheet from Guinea [6] with James Clerk Maxwell and Charles Darwin depicted in the selvaige and featuring J. Robert Oppenheimer and Ernest Orlando Lawrence on the stamp. J. Robert Oppenheimer (1904–1967) was an American theoretical physicist, who is best known for his role as the scientific director of the Manhattan Project: the World War II effort to develop the first nuclear weapons at the secret Los Alamos National Laboratory in New Mexico.



Many Nobel Prize winners in physics participated in the Manhattan Project [12]. Oppenheimer worked closely with Ernest Orlando Lawrence (1901–1958), who was awarded the Nobel Prize in Physics for his work on the

cyclotron and its applications. Charles Darwin (1809–1882) was an English naturalist, who realised and presented compelling evidence that all species of life have evolved over time from common ancestors, through the process he

called natural selection.

Ludwig Eduard Boltzmann (1844–1906) was an Austrian physicist famous for his founding contributions in the fields of statistical mechanics and statistical thermodynamics. He

was one of the most important advocates for atomic theory when that scientific model was still highly controversial. In statistical mechanics, Maxwell–Boltzmann statistics describe the statistical distribution of material particles over various energy states in thermal equilibrium.

We have found only two stamps for Ludwig Eduard Boltzmann: Nicaragua 1971, *Scott* C763 and Austria 1981, *Scott* 1184.

Satyendra Nath Bose (1894–1974) was an Indian physicist, specializing in mathematical physics. He is probably best known for his work on quantum mechanics in the early 1920s, providing the foundation for what are now known as Bose–Einstein statistics.

In statistical mechanics, Bose–Einstein statistics determine the statistical distribution of identical indistinguishable bosons over the energy states in thermal equilibrium; in particle physics, bosons are force carrier particles, such as the photon. They are distinguished from fermions (matter particles) by their integer spin.



We have found just one stamp for Satyendra Nath Bose: issued by India in 1994 (*Scott* 1475) to celebrate the 100th anniversary of his birthyear.

Albert Einstein (1879–1955) is probably best known for his theory of relativity and mass-energy equivalence,  $E = mc^2$ . He received the 1921 Nobel Prize in Physics “for his services to Theoretical Physics, and especially for his discovery of the law of the photoelectric effect.”

Einstein’s many contributions include solving some classical problems of statistical mechanics as well as providing an explanation of the Brownian movement of molecules and atomic transition probabilities. In 1999 Einstein was named *Time* magazine’s “Person of the Century”, and a poll of prominent physicists named him the greatest physicist of all time.



There are over 200 stamps for Einstein: we particularly like the set of four stamps in a souvenir sheet [6] from the Maldives, issued in 2005 (*Scott* 2867). We also like the 1971 stamp from Nicaragua for “Einstein’s Law” (*Scott* 879) issued in a set of 10 stamps one for each of “10 mathematical equations which changed the face of the earth” [13, p. 44], which also feature the laws of Maxwell (*Scott* 881) and Boltzmann (*Scott* C763).

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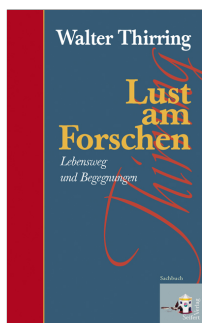
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## ESI News

### Walter Thirring: *Autobiography*

Walter Thirring, founding father and Honorary President of the ESI, has written his autobiography. The book is already on the market.

**Walter Thirring, Lust am Forschen – Lebensweg und Begegnungen.** Wien: Seifert Verlag 2008.



### New Members of the ESI Society 2009:

**Adrian Constantin** (Faculty of Mathematics, University of Vienna)

**Herwig Hauser** (Faculty of Mathematics, University of Vienna)

**Christian Krattenthaler** (Faculty of Mathematics, University of Vienna)

**Maximilian Kreuzer** (Faculty of Physics, Vienna University of Technology)

**Anton Rebhahn** (Faculty of Physics, Vienna University of Technology)

**Walter Schachermayer** (Faculty of Mathematics, University of Vienna)

### New Activity in Physics and Philosophy of Science in Collaboration with the University of Vienna:

As a joint initiative of philosophers of science and physicist of the University of Vienna a interdisciplinary symposium on the topic **(Un)Conceived Alternatives. The Assessment of the Underdetermination of Scientific Theory building and its Role in Scientific Reasoning** will be held in December 2009 at the ESI.

The symposium aims to bring physicists and philosophers of science into discussion about their perspectives on the question of underdetermination.

Invited speakers:

#### *Physics:*

Markus Arndt (Vienna), on Quantum Nanophysics, Markus Aspelmeyer (Vienna), on Foundations of Quantum Physics, Daniel Grumiller (Vienna), on Quantum Cosmology, Karl Landsteiner (Madrid), on String Theory, Gerard Milburn (Brisbane, to be confirmed), on Quantum Computing, Jakob Yngvason (Vienna), on Mathematical Physics

#### *Philosophy of Science:*

Richard Dawid (Vienna), Brigitte Falkenburg (Dortmund), Paul Hoyningen-Huene (Hannover, to be confirmed), Elisabeth Nemeth (Vienna), Miklos Redei (Budapest and London), Kyle Stanford (Irvine), John Worrall (London).

The activity is supported by the University of Vienna.

### New ESI Lectures in Mathematics and Physics

Hans Ringström

#### The Cauchy Problem in General Relativity

Zürich: European Mathematical Society Publishing House 2009.

The book presents complete proofs of several classical results that play a central role in mathematical relativity but are not easily accessible to those wishing to enter the subject. Prerequisites are a good knowledge of basic measure and integration theory as well as the fundamentals of Lorentz geometry. The necessary background from the theory of partial differential equations and Lorentz geometry is included.

### News from the Scientific Community

**Ludwig Faddeev** (Director of the Euler International Mathematical Institute, Steklov Institute of Mathematics, St. Petersburg), a long standing member of the *International Scientific Advisory Board* of the ESI, is **Shaw Laureate 2008 in the Mathematical Sciences** together with **Wladimir Arnold** (Chief Scientist of Steklov Mathematical Institute, Moscow).

The closing conference of the *Initiativkolleg Sciences in Historical Contexty*, a Ph.D.- Programme of the University of Vienna, will be held at the *Schrödinger Lecture Hall* on 27 and 28 November, 2009.



## Current and Future Activities of the ESI

### Thematic Programmes 2009

**Representation theory of reductive groups — local and global aspects**, January 2 – February 28, 2009

**Organizers:** G. Henniart, G. Muic and J. Schwermer

**Mathematics at the Turn of the 20th Century: Explorations and Beyond**, January 7 - 12, 2009

**Organizers:** D.D Fenster, J. Schwermer

**Number theory and physics**, March 1 - April 18, 2009

**Organizers:** A. Carey, H. Grosse, D. Kreimer, S. Paycha, S. Rosenberg and N. Yui

**Gravity in Three Dimensions**, April 14 - 24, 2009

**Organizers:** H. Grosse, D. Grumiller, R. Jackiw, D. Vassilevich

**Selected topics in spectral theory**, May 4 – July 25, 2009

**Organizers:** B. Helffer, T. Hoffmann-Ostenhof and A. Laptev

**Catalysis from First Principles**, May 25 - 30, 2009

**Organizers:** J. Hafner, J. Norskov, M. Scheffler

**Large cardinals and descriptive set theory**, 2 weeks in June – July 2009

**Organizers:** S. Friedman, M. Goldstern, R. Jensen, A. Kechris and W.H. Woodin

**Entanglement and correlations in many-body quantum mechanics**, August 18 – October 17, 2009

**Organizers:** B. Nachtergaele, F. Verstraete and R. Werner

**The dbar-Neumann problem: analysis, geometry and potential theory**, October 27 - December 24, 2009

**Organizers:** F. Haslinger, B. Lamel, E. Straube

### Thematic Programmes 2010

**Quantitative Studies of Nonlinear Wave Phenomena**, January 7 - February 28, 2010

**Organizers:** P.C. Aichelburg, P. Bizon, W. Schlag

**Quantum field theory on curved space-times and curved target-spaces**, March 1 - April 30, 2010

**Organizers:** M. Gaberdiel, S. Hollands, V. Schomerus, J. Yngvason

**Matter and radiation**, May 3 - July 30, 2010

**Organizers:** V. Bach, J. Fröhlich, J. Yngvason

**Topological String Theory, Modularity and Non-Perturbative Physics**, June 7 - August 15, 2010

**Organizers:** L. Katzarkov, A. Klemm, M. Kreuzer, D. Zagier

**Anti - de Sitter holography and the quark-gluon plasma: analytical and numerical aspects**, August 2 - October 29, 2010

**Organizers:** A. Rebhan, K. Landsteiner, S. Husa

**Higher Structures in Mathematics and Physics**, August 15 - November 15, 2010

**Organizers:** A. Alekseev, H. Bursztyn, T. Strobl

### Thematic Programmes 2011

**Bialgebras in free Probability**, February 1 - April 22, 2011

**Organizers:** M. Aguiar, F. Lehner, R. Speicher, D. Voiculescu

**Nonlinear Waves**, April 4 - June 30, 2011

**Organizers:** A. Constantin, J. Escher, D. Lannes, W. Strauss

**Dynamics of General Relativity: Numerical and Analytical Approaches**, July 4 - September 2, 2011

**Organizers:** L. Andersson, R. Beig, M. Heinzle, S. Husa

**Combinatorics, Number theory, and Dynamical Systems**, October 17 - December 17, 2011

**Organizers:** M. Einsiedler, P. Grabner, C. Krattenthaler, T. Ziegler

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**Other Scientific Activities in 2009**

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**Architecture and Evolution of Genetic Systems**, July 20 – July 25, 2009

**Organizers:** R. Bürger, A. G. Jones, S. J. Arnold

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**Entanglement and Correlations in Many-Body Quantum Mechanics**, August 10 – October 17, 2009

**Organizers:** B. Nachtergaele, F. Verstraete, R. Werner

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**Classical and Quantum Aspects of Cosmology**, September 28 – October 2, 2009

**Organizers:** P. C. Aichelburg, H. Rumpf

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**Recent Advances in Integrable Systems of Hydrodynamic Type**, October 12 – October 23, 2009

**Organizers:** A. Constantin, J. Escher

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**6th Vienna Central European Seminar on Particle Physics and Quantum Field Theory**, November 27 – November 29, 2009.

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The topic of the Seminar is "**Effective Field Theories**".

This Seminar, organized by the Faculty of Physics, University of Vienna, is supported by the ESI.

**Organizer:** H. Hüffel

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**Symposium "Quanta and Geometry"**, October 8 and 9, 2009

On the occasion of **Harald Grosses** retirement from his position at the University of Vienna a Symposium will take place at the ESI on October 8 and 9, 2009 under the heading *Quanta and Geometry*.

The Symposium starts in the afternoon of Thursday, October 8 with an Erwin Schrödinger Lecture by **Vincent Rivasseau**, followed by a reception at the ESI.

On October 9 there will be further lectures by **Fritz Gesztesy**, **Dorothea Bahns**, **Krzysztof Gawedzki** and **Volker Schomerus**.

**Organizer:** Alan Carey, Joachim Schwermer, Jakob Yngvason

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**dbar-Neumann Problem: Analysis, Geometry and Potential Theory**, October 27 – December 23, 2009

**Organizers:** R. Bürger, A. G. Jones, S. J. Arnold

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## Erwin Schrödinger Lectures

Spring Term 2009

The Erwin Schrödinger Lectures are directed towards a general audience of mathematicians and physicists. In particular it is an intention of these lectures to inform non-specialists and graduate students about recent developments and results in some area of mathematics or mathematical physics.

These lectures take place in the Boltzmann Lecture Room of the ESI.

Each lecture will be followed by an informal reception at the Common Room of the ESI.

**James W. Cogdell** (Ohio State University, Columbus): *On sums of three squares*. January 22, 2009

## Jean-Pierre Serre at the ESI

Jean-Pierre Serre (College de France, Paris)

gave a lecture on *Variation with  $p$  of the number of solutions (mod  $p$ ) of polynomial equations* at the Boltzmann Lecture Hall on December 11, 2008.



Some pictures from Serre's lecture



SERRE

AUDIENCE AT THE BOLTZMANN LECTURE HALL

Organizer: J. Schwermer

## Senior Research Fellows Lecture Courses

Spring and Fall Term 2009

To stimulate the interaction with the local scientific community, the ESI offers lecture courses on an advanced graduate level. These courses are taught by Senior Fellows of the ESI, whose stays in Vienna are financed by the University of Vienna, the Vienna University of Technology, and the Austrian Federal Ministry for Education, Science and Culture.

These courses take place in the Erwin-Schrödinger Lecture Room of the ESI.

**Raimar Wolkenhaar** (Münster)

*Spektraltripel in der nichtkommutativen Geometrie und Quantenfeldtheorie*, March 1 - June 15, 2009

**Michael Loss** (Georgia Institute of Technology, Atlanta)

*Spectral Inequalities and their Applications to Variational Problems and Evolution Equations*, April 21 - June 30, 2009

**Jeff McNeal** (Ohio State University, Columbus)

*$L^2$  - Methods in Complex Analysis*, October 26 - November 2009, December 6 - December 19, 2009

In this course I'll discuss how to use Hilbert space techniques to solve the Cauchy-Riemann equations on domains in  $C^n$  and on complex manifolds. These techniques are quite flexible and we will explore the variety of  $L^2$  estimates on the Cauchy-Riemann operator that are known

to exist, including the relatively recent "twisted" estimates. I'll also give many applications of these estimates throughout the course. Some of the directions we'll apply the estimates to are: the boundary behavior of the Bergman kernel, extension theorems of Ohsawa-Takegoshi type, compactness of the  $\bar{\partial}$ -Neumann operator, and the boundary behavior of biholomorphic mappings between domains in  $C^n$ .

**Peter West** (King's College, London)

*Supergravity Theories*, September 29 - October 30, 2009

In these lectures I will give an introduction to supergravity theories. I will begin with the four dimensional  $N = 1$  supergravity explaining its construction and properties and then present the supergravity theories in ten and eleven dimensions. I will then discuss the  $E_n$  symmetries that arise in the maximal supergravity theories. The relevance of these results for string theory will be explained.

## Mathematics at the Turn of the 20th Century: Explorations and Beyond

January 7 - 12, 2009



This workshop

brought together scholars from a variety of fields with a common interest in the mathematical sciences of the 19th and 20th centuries in their historical context. Special attention was given to include young participants. The programme combined lectures on recent results with ample time for informal discussions and collaborations. In commemoration of Hermann Minkowski's death on January 12, 1909, the talks given on Monday, January 12, 2009 illuminated Minkowski's work in mathematics and physics.

Among these talks are:

**Scott Walter** (Archives Henri Poincare, Nancy):  
*Hermann Minkowski and theoretical physics in Göttingen*

**Samuel J. Patterson** (Göttingen):  
*The number-theorist Hermann Minkowski*

Organizers: D. D Fenster, J. Schwermer

### Previous lectures on physical and mathematical sciences in historical context at the ESI:

#### 2005:

**Leo Corry** (The Cohn Institute for History and Philosophy of Science and Ideas, Tel-Aviv University):  
*Hilbert's Axiomatic Approach to the General Theory of Relativity: From "Grundlagen der Geometrie" to "Grundlagen der Physik"*

**Jeremy Gray** (Centre for the History of the Mathematical Sciences, Faculty of Mathematics, Open University, Milton Keynes, U.K.):  
*Poincaré and Fundamental Physics*

#### 2006:

**Catherine Goldstein** (CNRS, Paris, Institut mathématique de Jussieu):  
*Geometry and Nature according to A. N. Whitehead*

#### 2007:

**Dieter Hoffmann** (Max Planck Institut für Wissenschaftsgeschichte, Berlin):  
*Zwischen Autonomie und Anpassung. Die Deutsche Physikalische Gesellschaft im Dritten Reich.*

**Moritz Epple** (Universität Frankfurt):  
*Beyond Metaphysics and Intuition: Felix Hausdorff's View on Geometry*

#### 2008:

**Scott Walter** (Archives Henri Poincare, Nancy):  
*Hermann Minkowski and the Scandal of Spacetime*

**Jacques Bouveresse** (Collège de France, Paris):  
*Ludwig Boltzmann und das Problem der Erklärung in der Wissenschaft*

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This newsletter is available on the web at: <ftp://ftp.esi.ac.at/pub/ESI-News/ESI-News4.1.pdf>

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