



Training Activity

CONTRACT NO. 35482

01/10/2006 — 30/09/2007

We report on the first year Training and TOK activities of the *Marie Curie Research and Training Network FLAVIANet*. The Training and TOK activities have been organized, supervised and coordinated among the several nodes by the FLAVIANet Training Committee composed by M. Davier (Orsay), S. Descotes Genon (Orsay), P. Krizan (Ljubljana), P. Hernandez (Valencia), T. Mannel (Siegen), C. T. Sachrajda (Southampton) and chaired by N. Brambilla (U. Milano). In the following we report the training and TOK achievements for each of the eleven FLAVIANet nodes in the period 01/10/2006–30/09/2007.

Although the Early Stage Researchers (ESR) contracts have started at the end of the year, we have already successfully launched our training programme with all the other Ph.D. students in our nodes (with contracts funded from other sources).

As it is detailed in the several sections of the report, for each node the training and transfer of knowledge program has been articulated at the following levels:

- *Individual training*
- *Intra-Node Training*
- *Inter-Node Training*
- *Network Training*

The General Training Measures have been organized in: the Annual General Meeting held in Barcelona in November 2006 (and detailed in the FLAVIANet Research Report), the Annual European Flavour Physics School and several Research Training Workshops (detailed in the FLAVIANet Research Report). The Annual European Flavour Physics School has been organized at the INFN National Laboratories in Frascati, Italy, as the "XII LNF Spring School in Nuclear, Subnuclear and Astroparticle Physics" from 14th to 18th of May, 2007. The School has been devoted to the theoretical and experimental developments in Flavour and Hadron physics and lectures have been given by world expert in the subject coming from the network and from outside the network. The main lectures have been:

D. Bryman (Triumph): Rare pi & K decay experiments

P. Franzini (LNF): The Physics of KLOE

K. Lane (Boston): Effective Field Theories for LHC physics

W. Marciano (BNL): The Anomalous Magnetic Moment of the muon

A. Pich (Valencia): Effective Field Theories for low Energy Physics

A. Stocchi (Orsay): Recent developments in Beauty and Charm Physics

A. Vladikas (Rome-2): Flavour Physics on the Lattice

A total of 35 students from all over the world have attended with 18 students (Ph.D. and post-doc) coming from the FLAVIANet nodes.

Inside the FLAVIANet the young researchers have accessed a lively, cutting-edge scientific frame and countless concrete opportunities to interact with the best European and International experts in Flavour Physics. Besides this, we have taken the appropriate care to train our researchers in several complimentary skills, including a training in experiments and in intensive computational methods. Particular attention has been given to the training in communication and presentation skills, vital for a scientist, and to the interdisciplinary aspects of the research.

The Early Stage Researchers and the Experienced Researchers (ER) have been appointed through an open and transparent procedure following the publication of the openings on the European web servers and on several job webpages. The recruitment procedure and the subsequent arrival in the node of the selected researchers have been closely monitored by the Training Committee. For each ESR and ER a personal and individualized Career Plan has been established and realized. This is detailed in the Section “*Career Development Plan, Tutoring, Advising, Opportunities*” for any ESR and ER hired at any node during the last year. The already rich environment of the FLAVIANet nodes has been complemented with lectures, courses and seminars given by experts coming from outside the node, secondments of ESR, ER and FLAVIANet experts among the nodes as well as complimentary skills and language courses.

The recruitment process of ESR has taken more time than expected, delaying a little bit the planned schedule. Thus, in this first reporting period, we have only delivered 5.75 ESR months (31 were planned). On the other side, since one ER has started slightly before, we have delivered 0.25 ER months (none was planned). The delay should not create any problems in the global 4-year schedule. At the moment a total of 12 young researchers (3 ER and 9 ESR) are already committed for a total of 213 months (60 ER months and 153 ESR months). Eight of these contracts have started already (3 ER and 5 ESR). In addition, a general call for applications has been made recently; therefore, new contracts will be offered soon.

1 Training and TOK achievements

1.1 Node No. 1: Spain-V (Universitat de València Estudi General [UVEG])

1.1.1 OFFERED PH. D. COURSES (LOCALLY)

The Valencia node offers a complete programme of Ph.D. courses in theoretical and experimental particle and nuclear physics. The most relevant ones for the FLAVIANet topics are:

- Ph.D. Course on “Theory and Phenomenology of the Strong Interactions”, Valencia, November 2006–May 2007
- Ph.D. Course on “Electroweak Interactions”, Valencia, November 2006–May 2007
- Ph.D. Course on “Advanced Quantum Field Theory”, October 2006–January 2007
- Ph.D. Course on “Advanced General Relativity”, October 2006–January 2007
- Ph.D. Course on “Experimental Nuclear Physics”, October 2006–January 2007

- Ph.D. Course on “High-Energy Astrophysics”, October 2006–January 2007
- Ph.D. Course on “Non-perturbative Methods”, Valencia, January–May 2007
- Ph.D. Course on “High Energy Physics”, January–May 2007
- Ph.D. Course on “Advanced Phenomenology”, January–May 2007
- Ph.D. Course on “Many Body Quantum Field Theory”, January–May 2007
- Ph.D. Course on “Geometry, Topology and Physics Applications”, January–May 2007

1.1.2 OFFERED COURSES at ANY LEVEL of interest for the FLAVIANET

- Undergraduate Course on “Quantum Field Theory”, Valencia, September 2006–May 2007
- Course on “Quantum Field Theory” for Master students in theoretical physics, given by E. Pallante, Univ. Groningen, 2006-2007
- Postgraduate Course on “The Standard Model”, given by A. Pich (node 1) at the 4th CERN–CLAF School of High-Energy Physics, Viña del Mar, Valparaíso Region, Chile, 18 February – 3 March 2007

1.1.3 COURSES/TRAINING ACTIVITIES BY MEMBERS OF THE NETWORK in DIFFERENT NODES/SUBNODES

- Course on “Effective Field Theories”, given by A. Pich (node 1) at Frascati (node 5), May 2007
- Course on “The Standard Model”, given by A. Pich (node 1) at CERN (node 9), July 2007
- 3 Ph.D. students (Paola Ferrario, Martín González Alonso, Pablo Roig Garcés) took part in the *XII LNF Spring School in Nuclear, Subnuclear and Astroparticle Physics* (Frascati, Italy, 14–18 May, 2007). Two talks presented (15/5/07):
 - A. Gonzalez, “QCD condensates for the light quark V-A correlator”.
 - P. Roig, “Hadronic decays of the tau lepton into kaon modes within large N_c QCD”.
- Training stay of the Ph.D. student Pablo Roig Garcés at Università degli Studi di Milano (node 5), 12 October – 16 December, 2006
- Training stay of the Ph.D. student Pablo Roig Garcés at Università di Bari (node 5), 16–23 December, 2006
- Training stay of the Ph.D. student Vicent Mateu at MPI in Munich (node 4), 16 September – 2 December, 2007
- Training stay of the Ph.D. student Emma Torró Pastor at CERN (node 9), October–November 2006

1.1.4 VISIT of SENIOR SCIENTISTS from OUTSIDE the NETWORK

- Olga Mena (Fermilab, USA), 15-30 October 2006
- Stefano Catani (INFN Firenze, Italy), 11-15 December 2006
- Sacha Davidson (CNRS Lyon, France), 5-9 February 2007
- Margarida Rebelo (CFTP Lisbon, Portugal), 19-23 March 2007
- Simon Eidelman (Budker Institute of Nuclear Physics, Novosibirsk, Russia), 16-20 April 2007
- Geraldine Servant (CERN, Switzerland), 1-31 May 2007
- Massimiliano Grazzini (INFN Firenze, Italy), 28 May – 1 June 2007
- Durga Prasad Roy (TIFR Bombay, India), May-December 2007

1.1.5 GENERAL TRAINING

- Ph.D. Course on “Numerical and Statistical Methods”, October 2006–January 2007
- General IFIC Seminar, weekly from September to July
- IFIC Colloquium, monthly from September to July
- Specialized IFIC seminars, weekly from September to July
- Undergraduate Physics Seminar, Univ. Valencia, monthly from November to May
- “De Sitter Lecture Series in Theoretical Physics”, Univ. Groningen (aimed to provide an education at the forefront of theoretical physics for Ph.D students and early stage researchers)

1.1.6 ER HIRED (October 1, 2006 – September 30, 2007)

- David Greynat, hired in Valencia on 24 September 2007, ER one year contract.

1.1.7 ER PERSONAL CAREER DEVELOPMENT PLAN TUTORING, ADVISING, OPPORTUNITIES

- **David Greynat, ER contract, Valencia**
David Greynat has started his ER contract on 24 September 2007. His local advisor is Antonio Pich. He receives local guidance from several members of the Valencia group (Jorge Portolés, Pilar Hernández, Roberto Bonciani) and from members of other FLAVIANet nodes

(Eduardo de Rafael, Marseille). Complementary training on experimental physics is offered locally by Fernando Martínez.

Career Development Plan

The research work of David Greynat concerns the analytical study of multi-scale Feynman graph topologies, in order to obtain some higher-order corrections to the muon magnetic anomaly and K_{l3} form factors in explicit analytical form. In addition to the usual quantum field theory framework, the required technical expertise include sophisticated mathematical tools, such as multi-variable complex analysis, special functions and Hilbert (and other) transformations. Interactions with local Valencia mathematicians are already planned.

Training and collaboration

At the University of Valencia there exist a very complete programme of postgraduate courses. In addition, IFIC hosts a large number of seminars and colloquiums on many topics. Thus, David Greynat will have a wide choice of options to complement his present physics and mathematics background. Moreover, he will attend the FLAVIANet general meetings and some specialized international workshops. IFIC is a large physics institute; therefore, there are many possibilities for collaborative work.

Achievements

The FLAVIANet contract of David Greynat has just started. Nevertheless, he is already working in a common project with members of the IFIC node. Some preliminary results related with the K_{l3} form factor calculation have been already obtained.

1.2 Node No. 2: Spain-B (Univ. Autònoma de Barcelona, Univ. de Barcelona, Univ. Politècnica de Catalunya, Univ. de Granada and Univ. de Huelva)

1.2.1 OFFERED PH.D. COURSES (LOCALLY)

The different universities within the node have had Ph.D. programs for many years. This last year was a transitional period since new Master programs are beginning to develop now in our universities. Examples of courses taught are:

- "QCD and Renormalization Group Methods" taught by M. Jamin at Univ. Autònoma de Barcelona.
- "Particle Physics" within the Master "Astrophysics, Particle Physics and Cosmology" at Univ. de Barcelona and "Supercomputation and Parallel Programming" within the Master "Applied and Computational Physics" joint Master at Univ. of Barcelona and Univ. Politècnica de Catalunya, taught by Ricardo Graciani.
- "The Standard Model and its Phenomenology" within the Master "Physics" at Univ. de Granada, taught by F. Cornet and J. Prades.
- "Renormalization Group and Critical Phenomena" within the Master "Astrophysics, Particle Physics and Cosmology" at Univ. de Barcelona, taught by D. Espriu.

- "Standard Model" within the Master "Astrophysics, Particle Physics and Cosmology" at Univ. de Barcelona, taught by J. Soto.
- "Nuclear Physics at Intermediate Energies" within the program "Nuclear Physics" taught at the Univ. de Salamanca by J. Nieves and A. Ramos.
- "QCD-based Hadronic Physics" within the program "Advanced Methods and Techniques in Physics", taught by J. Nieves.

1.2.2 OFFERED COURSES at ANY LEVEL of interest for the FLAVIANET

- Course on "Phenomenology of QCD", delivered by M. Jamin, Spanish School of High Energy Physics, Jaca, Spain, March 6-18 2007.

1.2.3 ESR HIRED (October 1, 2006-September 30, 2007)

- There was an ESR position selection process in which Ying Li was chosen. Although he initially agreed to come, he changed his mind at the last moment. The position will be offered again this year.

1.3 Node No. 3: UK (Durham-Oxford-Southampton)

1.3.1 OFFERED PH.D. COURSES (LOCALLY)

The UK node offers a complete programme of Ph.D. courses in theoretical and experimental particle physics relevant to *FLAVIANet*. Those offered in Durham are:

- Ph.D Course on "Overview of Particle Physics", Durham, October 2006–May 2007
- Ph.D Course on "Introductory Field Theory", Durham, October 2006–May 2007
- Ph.D Course on "Group Theory", Durham, October 2006–May 2007
- Ph.D Course on "Standard Model", Durham, October 2006–May 2007
- Ph.D Course on "General Relativity", Durham, October 2006–May 2007
- Ph.D Course on "Quantum Electrodynamics", Durham, October 2006–May 2007
- Ph.D Course on "Quantum Field Theory", Durham, October 2006–May 2007
- Ph.D Course on "Conformal Field Theory", Durham, October 2006–May 2007
- Ph.D Course on "Supersymmetry", Durham, October 2006–May 2007
- Ph.D Course on "Anomalies", Durham, October 2006–May 2007
- Ph.D Course on "Strong Interaction Physics", Durham, October 2006–May 2007

- Ph.D Course on “Cosmology”, Durham, October 2006–May 2007
- Ph.D Course on “Superstrings and D-Branes”, Durham, October 2006–May 2007
- Ph.D Course on “Non-perturbative Physics”, Durham, October 2006–May 2007
- Ph.D Course on “Euclidean Field Theory”, Durham, October 2006–May 2007
- Ph.D Course on “Effective Field Theory”, Durham, October 2006–May 2007
- Ph.D Course on “Flavour Physics and Neutrinos”, Durham, October 2006–May 2007
- Ph.D Course on “Integrability in Quantum Theory”, Durham, October 2006–May 2007
- Ph.D Course on “Introduction to AdS/CFT”, Durham, October 2006–May 2007
- Ph.D Course on “Extra dimensions in gravity”, Durham, October 2006–May 2007
- Ph.D Course on “Computing for Physicists”, Durham, October 2006–May 2007
- Ph.D Course on “MHV-rules, recursion relations and unitarity”, Durham, October 2006–May 2007
- Ph.D Course on “Experimental techniques”, Durham, October 2006–May 2007
- Ph.D Course on “Simulations in high energy physics”, Durham, October 2006–May 2007

1.3.2 COURSES/TRAINING ACTIVITIES BY MEMBERS OF THE NETWORK in DIFFERENT NODES/SUBNODES

- A. Bharucha (Ph.D student) participated in *XII LNF Spring School in Nuclear, Subnuclear and Astroparticle Physics*, INFN 14-18 May 2007.

1.3.3 VISIT of SENIOR SCIENTISTS from OUTSIDE the NETWORK

- Kim Maltman (York U., Canada) 19/5/07-15/6/07
- Vladimir Braun (Regensburg, Germany) 15/8/07-15/10/07

1.3.4 ORGANIZED SCHOOLS

- YETI2007 Young Theorists and Experimentalists Institute, IPPP, Durham 8-10 January 2007

Flavianet Members participating: Nigel Glover (3), Sam Harper (3), Stuart Ingleby (3), Katherine Korcsak-Gorso (3), Christopher Orme (3)

Participation of others (numbers of Ph.D. students 45, number of postdocs 5, number of scientists 5).

1.3.5 GENERAL TRAINING

- Theoretical particle physics seminars in Durham, Oxford and Southampton, several times per week
- Colloquia in Durham, Oxford and Southampton, several times per month

1.4 Node No. 4: Germany–South (Universität Karlsruhe (TH))

1.4.1 OFFERED PH. D. COURSES (LOCALLY)

- PhD seminar *Baryo- and Leptogenesis*, Aachen, Oct 2006 — Feb 2007.
- PhD and student seminar *Particles, Fields, Strings*, Aachen, Apr 2007 — Jul 2007.
- Course *Quantum Field Theory I*, Aachen, Oct 2006 — Feb 2007.
- Course *Quantum Field Theory II*, Aachen, Apr 2007 — Jul 2007.
- Course *Special Topics in Field Theory*, Aachen, Oct 2006 — Feb 2007.
- Course: *Advanced Particle Physics*, Karlsruhe, Oct 2006 — Feb 2007.
- Course: *Theoretical Particle Physics II*, Karlsruhe, Oct 2006 — Feb 2007.
- Student seminar series: *Modern Particle Physics*, Karlsruhe, Oct 2006 — Feb 2007.
- Student seminar series: *Physics at KLOE and BaBar*, Karlsruhe, Oct 2006 — Feb 2007.
- Ph.D. Course on *Supersymmetry and Grand Unification*, Siegen, Oct 2006 — Sep 2007.
- Ph.D. Course on *Quantum Field Theory*, Siegen, Apr — Jul 2007.
- Course: *Theoretical Particle Physics I*, Karlsruhe, May — Jul 2007.
- Course: *Theoretical Particle Physics III*, Karlsruhe, May — Jul 2007.
- Student seminar series: *Flavour and Supersymmetry*, Karlsruhe, May — Jul 2007.

1.4.2 OFFERED COURSES at ANY LEVEL of interest for the FLAVIANET

- Ringberg Workshop on Perspectives in Heavy Flavor Physics, Oct 1–6 Oct 2007, organised by *International Max Planck Research School Munich*

1.4.3 VISIT of SENIOR SCIENTISTS from OUTSIDE the NETWORK

- Dr. Chris Quigg, *Fermilab*, Batavia, USA, to Univ. Karlsruhe in September 2006.
- Prof. Gustavo Branco, *Instituto Superior Tecnico*, Lisbon, Portugal, to TU Munich in June/July 2007.
- Prof. Frank Wilczek, *MIT*, Cambridge, USA, to Univ. Karlsruhe in July 2007.
- Prof. Julius Wess, *Univ. Hamburg*, to Univ. Karlsruhe in July 2007.

1.4.4 ORGANIZED SCHOOLS

- *Pre-SUSY07* summer school, 23-25 Jul 2007, Karlsruhe, Germany.

Flavianet Members participating (with node no.):

Altmannshofer, Wolfgang, 4; Anastasiou, Charalampos, 9; Asch, Thomas, 4; Bauer, Andreas, 4; Bekavac, Stefan, 4; Bell, Guido, 4; Beltrame, Paolo, 4; Bozzi, Giuseppe, 4; Brein, Oliver, 3; Brod, Joachim, 4; Calibbi, Lorenzo, 1; Campanario, Francisco, 4; Crivellin, Andreas, 4; Davidkov, Momchil, 4; Duling, Björn, 4; Guadagnoli, Diego, 4; Hofer, Lars, 4; Jones Perez, Joel, 1; Kaneko, Satoru, 1; Knopf, Markus, 4; Leone, Debora, 4; Marchetti, Scharar, 4; Mertens, Susanne, 4; Milnik, Michael, 4; Paradisi, Paride, 1; Passemar, Emilie, 9; Salomon, Jens, 4; Seidel, Dirk, 4; Scherer, Dominik, 4; Scherrer, Christian, 4; Schnitter, Karsten, 4; Westhoff, Susanne, 4.

Participation of others: roughly 170 other participants, mostly PhD students.

- Herbstschule Maria Laach *German School for Graduate Student on High Energy Physics*, Maria Laach, 4–14 Sep 2007.

Flavianet Members participating:

Node no. 4: Guido Bell, Wolfgang Dungen, Martin Heck, Thomas Mannel, Benjamin Pecjak, Holger von Radziewski, Susanne Westhoff

Participation of others: 51 other PhD students, 13 other postdocs and lecturers.

- CERN School of Physics (Lectures on “Flavour Physics and CP Violation”) Trest, 19 Aug – 9 Sep 2007, co-organised by Thomas Mannel.

1.4.5 GENERAL TRAINING

- Course: *Programming for Physicists*, Karlsruhe, Oct 2006 — Feb 2007 and May — July 2007
- Course: *Softskills*, Munich, 24 Nov 2006

1.4.6 ESR already selected and committed (their contract will start next year)

- Vicent Mateu, ESR contract will start Feb 2008 and end Jan 2009.

1.4.7 ER already selected and committed (their contract will start next year)

- Artyom Hovhannisyan, ER contract starts October 2007, two-year contract.

1.5 Node No. 5: Italian Institute for Nuclear Physics [INFN]

1.5.1 OFFERED PH. D. COURSES (LOCALLY)

- Ph. D. Course on "*The Standard Model*", joint course of Rome-1 and Rome-3 Universities, Winter 2007.
- Ph. D. Course on "*Experimental Particle Physics*", joint course of Rome-1 and Rome-3 Universities, Winter 2007.
- Ph. D. Course on "*Effective Field Theories*", joint course of Rome-1 and Rome-3 Universities, Spring 2007.
- Ph. D. Course on "*Effective Field Theories*", University of Naples, Spring 2007.
- Ph. D. Course on "*Heavy Flavours and CKM phenomenology*", joint course of Rome-1 and Rome-3 Universities, Spring 2007.

1.5.2 OFFERED COURSES at ANY LEVEL of interest for the FLAVIANET

- Summer Lectures on "*Flavour Physics*", held by Benjamin Grinstein at Rome-1 University, Summer 2007.

1.5.3 VISIT of SENIOR SCIENTISTS from OUTSIDE the NETWORK

- Vincenzo Cirigliano (Los Alamos, USA): 20 May - 2 June, 2007
- Sacha Davidson (U. of Lyon, France): 1 July - 15 July, 2007
- Benjamin Grinstein (San Diego, USA): 1 May - 30 June, 2007
- P.Q. Hung (U. of Virginia, USA): 12 June - 15 July, 2007

1.5.4 ORGANIZED SCHOOLS

- "XII LNF Spring School in Nuclear, Subnuclear and Astroparticle Physics" which has been chosen to be the 2007 FLAVIANet school (INFN National Laboratories in Frascati, Italy, from 14th to 18th of May, 2007).

This edition of the School has been devoted to theoretical and experimental developments on Flavour and Hadron physics in the wake of LHC commissioning.

Main Lectures:

D. Bryman (Triumph): Rare pi & K decay experiments

P. Franzini (LNF): The Physics of KLOE

K. Lane (Boston): Effective Field Theories for LHC physics

W. Marciano (BNL): The Anomalous Magnetic Moment of the muon

A. Pich (Valencia): Effective Field Theories for low Energy Physics

A. Stocchi (Orsay): Recent developments in Beauty and Charm Physics

A. Vladikas (Rome-2): Flavour Physics on the Lattice

Total number of students: 35, with 18 students (Ph.D. and post-doc) from other nodes of the Network.

1.5.5 GENERAL TRAINING

- *Programming in C++*, University of Naples, Spring 2007.
- *English Language Course*, Frascati National Laboratories, Winter/Spring 2007.

1.5.6 ESR HIRED (October 1, 2006-September 30, 2007)

- Javier Virto, hired in Rome (INFN Rome-1) with a 12 months contract started September 6, 2007 (end September 5, 2008).

1.5.7 ESR already selected and committed (their contract will start next year)

- Miguel Mesco, to be hired in Milan (INFN Milan) for 3 months starting in May 2008.
- Pablo Roig Garces, to be hired in Milan (INFN Milan) for 6 months starting in July 2008.

1.5.8 ER already selected and committed (their contract will start next year)

- Jernej Fesl Kamenik, to be hired in Frascati (INFN National Laboratories in Frascati) for 24 months starting October 2, 2008.

1.5.9 ESR PERSONAL CAREER DEVELOPMENT PLAN TUTORING, ADVISING, OPPORTUNITIES

- **Javier Virto, ESR contract, Rome-1**

J. Virto has started his 12 months ESR contact in Rome on September 6, 2007. His local advisor is Luca Silvestrini. Virto receives local guidance and mentorship in his research work both by his local advisor, by the other members of the group at the University of Rome (in particular by M. Ciuchini and E. Franco), and by G. Isidori (coordinator of the INFN node). Complimentary training in experimental physics is offered locally by the large Babar group of Rome, lead by G. Piredda and R. Faccini. At a general level, complimentary training is offered by the Department of Physics of the University Rome-1 (Rome *La Sapienza*) with a huge variety of seminars, lectures, courses and colloquia.

Career Development Plan

The research work of J. Virto inside the Flavianet concerns the study of non-leptonic B -meson decays, aimed to perform precision tests of the SM. A detailed development plan has been elaborated in collaboration with his local advisor and the training board of the Flavianet. The expertise that the fellow has to acquire include: 1) a deeper knowledge of Quantum Field Theory; 2) a deeper knowledge of heavy-meson phenomenology within and beyond the Standard Model; 3) basic elements of Bayesian statistics and Montecarlo simulations applied to data analysis. We also expect he will present the results of his research work at major international conferences, with a substantial improvement in the ability of making public presentations.

1.6 Node No. 6: Poland (University of Silesia, University of Warsaw, Inst. of Nuclear Physics (Polish Academy of Science) Cracow, Andrzej Soltan Insitute for Nuclear Studies (Polish Academy of Science) Warsaw)

1.6.1 OFFERED PH. D. COURSES (LOCALLY)

The selected courses listed below, most relevant for FLAVIANet activities, are part of much broader offer from PhD courses at Cracow, Katowice and Warsaw.

- *Group Theory in Particle Physics*, Warsaw, 2006/7
- *High Energy Physics: Computational and Experimental Methods*, Warsaw, 2006/7
- *Quantum Mechanics*, Katowice, 2006/7
- *Neutrino Physics*, Katowice, 2006/7
- *Elements of Quantum Mechanics and Relativity*, Cracow, 2006/7
- *Introduction to Monte Carlo Methods*, Cracow, 2006/7
- *Heavy Ion Collisions*, Cracow, 2006/7

- *Elementary Particle Interactions: Symmetries and Conservation Laws* , Cracow, 2006/7
- *Astrophysics of Cosmic Rays*, Cracow, 2006/7
- *General Relativity for Physicists*, Cracow, 2006/7

1.6.2 OFFERED COURSES at ANY LEVEL of interest for the FLAVIANET

- *Quantum Field Theory*, Katowice, 2006/7
- *Standard Model*, Katowice, 2006/7
- *Extensions of the Standard Model*, Katowice, 2006/7
- *Astrophysics*, Katowice, 2006/7
- *Meson spectroscopy in p-p collisions*, Katowice, 2006/7
- *Elementary Particle Physics*, Warsaw, 2006/7
- *General Relativity*, Warsaw, 2006/7
- *Particles and Relativity*, Warsaw, 2006/7

1.6.3 COURSES/TRAINING ACTIVITIES BY MEMBERS OF THE NETWORK in DIFFERENT NODES/SUBNODES

- Lecture by Janusz Gluza: "Feynman Integrals and Mellin-Barnes Representations" at School: Computer Algebra and Particle Physics 2007, 25-30 March 2007, DESY, Zeuthen
- Training/research stay of PhD student Agnieszka Wapienik at Karlsruhe (node 4): 22/11/06-22/12/06 and 07/01/07-13/02/07

1.6.4 GENERAL TRAINING

- Polish Language Course for Foreigners Planning to Study in Poland, Katowice
- Polish Courses and Introduction to Poland for Socrates-Erasmus Students, Katowice
- Polish Courses (at various levels), Warsaw
- Summer School of Polish Language, Literature and Culture, Katowice
- Statistics for Physicists, Warsaw
- Computers and Networks, Warsaw
- Parallel Data Processing, Warsaw

- Programming Languages, Katowice
- Programming in C++, Katowice
- Computer Simulations and Analysis of Physical Phenomena, Katowice

1.6.5 ESR already selected and committed (their contract will start this year)

- K. A. Kanishchev, the contract started on 17 October 2007, 1 year contract

1.7 Node No. 7: Nordic (Lund University[ULUND])

1.7.1 OFFERED PH. D. COURSES (LOCALLY)

- Ph. D. Course on “*The standard model and extensions*”, Lund, March-September 2007.
- Ph. D. Course “*Advanced Quantum Field Theory*”, Lund, January-May 2007.
- Ph. D. course on “*Relativistic Quantum Mechanics and introduction to Quantum Field Theory*”, Lund, September-December 2006.
- Advanced course on “*FYS4170 - Relativistic quantum field theory*”, Oslo, September-December 2006.
- Ph.D. course on “*QCD and hadron structure*”, Helsinki, September 2006 - December 2006

1.7.2 OFFERED COURSES at ANY LEVEL of interest for the FLAVIANET

- Master course on “*Theoretical Particle Physics*”, Lund, November 2006-January 2007.
- Master course on “*General Relativity*”, Lund, March-June 2007.
- Undergraduate course “*Theoretical particle physics*”, Helsinki, September 2006 - December 2006
- Undergraduate course “*Introduction to quantum field theory*”, Helsinki, September 2006 - November 2006

1.7.3 COURSES/TRAINING ACTIVITIES BY MEMBERS OF THE NETWORK in DIFFERENT NODES/SUBNODES

- Talk by J. Eeg in Ljubljana, 11 Jan 2007, *Low-energy aspects of heavy meson decays*
- Talk by J. Bijnens, Mainz, 17 Jan 2007, *Kaon decays and chiral perturbation theory*

1.7.4 ORGANIZED SCHOOLS

- A short school about PWA analysis in conjunction with 4th International Pion-Nucleon PWA Workshop 26-29 Jun 2007, Helsinki, Finland

1.7.5 ESR already selected and committed (their contract will start next year)

- I. Jemos, ESR contract will start October 2007, end September 2010.

1.8 Node No. 8: France (CNRS)

1.8.1 OFFERED PH. D. COURSES (LOCALLY)

Several PhD programmes are offered in Orsay, Marseille and Prague, in particle and nuclear physics, either on experimental or on theoretical aspects, among which one can highlight

- Quantum Field Theory, second year Masters course (Oct 06-Jan 07, Orsay)
- Particles and symmetries, second year Masters course (Oct 06-Jan 07, Orsay)
- Introduction to cosmology, second year Masters course (Oct 06-Jan 07, Orsay)
- High-energy astrophysics, second year Masters course (Oct 06-Jan 07, Orsay)
- Weak interaction and unification, second year Masters course (Mar 07-Jun 07, Orsay)
- Strong interaction, second year Masters course (Mar 07-Jun 07, Orsay)
- Neutrinos, second year Masters course (Mar 07-Jun 07, Orsay)
- Relativity and gravitation, second year Masters course (Mar 07-Jun 07, Orsay)
- Relativistic quantum field theory, second year Masters course (L. Lellouch, Oct 06-Jan 07, Marseille)
- Advanced quantum field theory, second year Masters course (M. Knecht, Jan-Mar 07, Marseille)
- The standard model and beyond, second year Masters course (J. Charles, Jan-Mar 07, Marseille)
- Advanced quantum mechanics, second year Masters course (Oct 06-Jan 07, Marseille)
- Particle physics, second year Masters course (Oct 06-Jan 07, Marseille)
- Introduction to astroparticle physics and cosmology, second year Masters course (Oct 06-Jan 07, Marseille)

- Experimental particle physics, second year Masters course (Jan-Mar 07, Marseille)
- Experimental astroparticle physics, second year Masters course (Jan-Mar 07, Marseille)
- General relativity, second year Masters course (Jan-Mar 07, Marseille)
- Geometry and gauge theories, second year Masters course (Jan-Mar 07, Marseille)
- Observational cosmology, second year Masters course (Jan-Mar 07, Marseille)

1.8.2 OFFERED COURSES at ANY LEVEL of interest for the FLAVIANET

- Non-perturbative methods with LHCb connections, PhD French school *Ecole de Gif*, D. Bećirević (24-28 Sep 2007, Paris, France)
- The Standard Model and beyond, 1st PhD French-Ukrainian school, S. Descotes-Genon (9-14 Jul 2007, Mukachevo, Ukraine)
- Flavour physics, 1st PhD French-Ukrainian school, M.H. Schune (9-14 Jul 2007, Mukachevo, Ukraine)
- Chiral Symmetry Breaking, Ph.D. level, Central European School in Particle Physics, M. Knecht (12-20 Sep 2007, Prague, Czech Republic)

1.8.3 COURSES/TRAINING ACTIVITIES BY MEMBERS OF THE NETWORK in DIFFERENT NODES/SUBNODES

- D. Bećirević taught courses on quantum field theory during one week in Ljubljana in May 2006 (node 9)
- 5 PhD students (Emmanuel Chang, Benjamin Haas, Justine Serrano, Joao Costa, Jaroslav Trnka) took part in the XIIth Frascati Spring School *Physics in the LHC era* (14-18 May 2007).

1.8.4 VISIT of SENIOR SCIENTISTS from OUTSIDE the NETWORK

- Ikaros Bigi (Notre-Dame-du-Lac, USA) visited Orsay the whole month of July 2007 in order to collaborate with theorists and experimentalists on semileptonic $B \rightarrow D$ transitions. An article summarising the outcome of these discussions has been submitted.
- Andreas Nyffeler (Harish-Chandra Research Institute, Allahabad, India) visited Marseille June 4-9 2007. He gave a seminar on “Little Higgs at the LHC” and discussed theoretical aspects of the hadronic contribution to $(g - 2)_\mu$.

1.8.5 ORGANIZED SCHOOLS

Members of the node 8 took part in the organisation of two schools for PhD students

- 1st French-Ukrainian school (9-14 Jul 2007, Mukachevo, Ukraine)
Flavianet ESR participating: E. Lopez (node 2), Y. Amhis, J. Béquilleux (node 8)
Flavianet ER participating: None (limited to PhD students)
Flavianet Members participating: A. Stocchi (organiser), M.H. Schune (organiser and lecturer), S. Descotes-Genon (lecturer) (node 8)
Participation of others : 30 ph. d. students, no postdocs, 10 scientists Coming from: Germany, Poland, Ukraine, Russia, France, Spain, Roumania, Georgia
- Central European School in Particle Physics (12-20 Sep 2007, Prague, Czech Republic)
Flavianet ESR participating: M. Kolesar, J. Trnka (node 8)
Flavianet ER participating: None (limited to PhD students)
Flavianet Members participating: K. Kampf (organiser), J. Novotny, M. Knecht (lecturer) (node 8)
Participation of others : 40 ph. d. students, no postdocs, 7 scientists Coming from: Germany, Hungary, Poland, Italy, Ukraine, Slovakia, Czech Republic, Spain

1.8.6 GENERAL TRAINING

- English and French language courses provided by CNRS (Orsay) and University Paris-Sud 11 (Oct 06-Jun 07)
- Access to “Formation permanente” courses offered by CNRS (Orsay, Marseille)
- Weekly seminars on particle physics from September to July in Orsay, Marseille and Prague

1.8.7 ESR HIRED (October1, 2006.September 30, 2007)

- Nils Offen, hired in Orsay 1st August 2007 for 2 years

1.8.8 ESR PERSONAL CAREER DEVELOPMENT PLAN TUTORING, ADVISING, OPPORTUNITIES

- Nils Offen, Orsay

N. Offen has started his two-year ESR contract in Orsay on Aug 1st 2007. His local advisor is Dr S. Descotes-Genon, with further local guidance and help from Drs. D. Bećirević, O.

Pène and L. Oliver, as well as from postdocs (in particular Dr. E. Kou) and Ph.D. students (E. Chang, B. Haas, B. Malaescu). Experimental aspects of flavour physics will be covered through discussions with A. Stocchi, M.H. Schune and P. Roudeau. In particular, N. Offen will take part in discussions between theorists and experimentalists that are planned at the local level concerning the physics case for Super-B factories. If needed, further background on basic physics can be easily obtained through the courses and seminars provided by the Department of Physics and the laboratories on the campus of Orsay.

Career Development Plan

The research work of N. Offen inside the Flavianet concerns sum rules on the light cone applied for B -decays at present. The career development plan elaborated together with his local advisor will provide N. Offen tools to tackle further issues on the non-perturbative aspects of heavy-quark physics (introduction to lattice methods, effective theories). More specific research objectives have also been proposed concerning the properties of light-cone distribution amplitudes and extensions of sum rules, and on a longer term properties of the B_c meson.

Training and collaboration

Since he was hired in Aug. 2007, N. Offen has kept a steady link with his home institution (Univ. of Siegen) through several stays, allowing him to pursue his collaboration with his PhD advisor and his collaborators. He has presented his current work on B form factors in Orsay in May 2007.

Achievements

Although hired very recently, N. Offen has started to get in contact with the various members of the node, and interact with them both on personal and professional levels. He has started learning French through courses provided by CNRS (9 hours per week). He has finished a joint project with his collaborators at Univ. of Siegen which is about to be published, and he is currently working with Dr S. Descotes-Genon on one of the research objectives defined in his CDP.

1.9 Node No. 9: Switzerland (Universität Bern (UBERN))

1.9.1 OFFERED PH. D. COURSES (LOCALLY)

- At the University of Bern we offer a series of “Special topic courses” with about 12 hours of lectures over four weeks for PhD students. During last year we had:

“Introduction to dispersion relations”, Jürg Gasser (Bern)

“The minimal supersymmetric standard model” Christopher Smith (Bern)

“The standard model”, Massimo Passera (Padua)

- At the University of Zurich:

“Flavour Physics (theoretical and experimental aspects)”, Tobias Hurth (CERN-Zurich) and Urs Langenegger (ETH-PSI)

1.9.2 GENERAL TRAINING

- The University of Berne, Lausanne and Zurich have a wide offer of language courses, like German for foreigners at various levels and Scientific writing in English.
- Moreover they offer courses about different aspects of management for people working in the academic/scientific world.

1.9.3 ESR HIRED (October 1, 2006. September 30, 2007)

- Emilie Passemar, hired in Bern on July 1. 2007, ESR 2 years contract

1.9.4 ESR PERSONAL CAREER DEVELOPMENT PLAN TUTORING, ADVISING, OPPORTUNITIES

- **E. Passemar, ESR contract, Bern**

Emilie Passemar has started her two year ESR contract in Bern on July 1. 2007. Local advisor is Gilberto Colangelo. In addition, she is offered guidance by other senior members of the node, like J. Gasser, H. Leutwyler and C. Smith on different aspects related to her PhD work. At the University of Bern she can attend graduate courses on various topic of interest and also language courses (German and scientific english).
Career Development Plan

E. Passemar will finish her PhD in the coming months. Afterwards she will extend her research activity in other directions, in particular in studies of effects of supersymmetric particles in flavour physics at low energy and their connection to collider physics. In addition we plan to study radiative corrections in low energy hadronic processes. For both research directions she can find the necessary expertise locally. Particular attention will be given to giving E. Passemar the opportunity to present her achievements locally, in network meetings and at international conferences.

Training and collaboration

At the University of Bern E. Passemar can attend graduate courses in particle physics on various topic of interest and also language courses (German and scientific english). In July she attended a school on Supersymmetry at the University of Karlsruhe, just before the International conference on Supersymmetry. She is also starting an active collaboration with various members of the Institute for theoretical physics. We have invited two experimentalists to Bern to give seminars on the $K_{\mu 3}$ decay which is the subject of the PhD of E. Passemar.

Achievements

Since E. Passemar has arrived in Bern she has completed one paper with her advisor in Orsay and other collaborators also belonging to the network.

1.10 Node No. 10: Austria (Universität Wien)

1.10.1 OFFERED PH. D. COURSES (LOCALLY)

This node offers a complete programme of PhD courses in all fields of theoretical and experimental physics. The most relevant ones for the FLAVIANet topics are:

- Seminar on Particle Physics, winter term 2006/2007, summer term 2007
- Privatissimum for PhD students of theoretical physics, winter term 2006/2007
- Seminar on Noncommutative Quantum Field Theory, winter term 2006/2007

1.10.2 OFFERED COURSES at ANY LEVEL of interest for the FLAVIANET

- Course and Exercises: Particle Physics 1, winter term 2006/2007
- Course and Exercises: Particle Physics 2, summer term 2007
- Course: Quantum Field Theory and Noncommutative Geometry, summer term 2007
- Course: Tensors, Spinors, Twistors and all that, winter term 2006/2007
- Course: Entanglement, Decoherence and Geometry of Quantum Systems, winter term 2006/2007
- Course: Physics with Differential Forms, summer term 2007
- Course: Quantum Information, Entanglement and Geometry, summer term 2007
- 3rd Vienna Central European Seminar on Particle Physics and QFT, 1-3 December 2006

1.10.3 VISIT of SENIOR SCIENTISTS from OUTSIDE the NETWORK

- Wolfgang Hollik (MPI Munich) October - December 2006

1.10.4 GENERAL TRAINING

- Practical Course: Computers in Theoretical Physics 1, winter term 2006/2007
- Practical Course: Computers in Theoretical Physics 2, summer term 2007

1.10.5 ESR already selected and committed (their contract will start next year)

- Martin Zdráhal, January 2008 – December 2009

1.11 Node No. 11: Germany North ((DESY, Zeuthen)

The Universities of Berlin (Humboldt), Bonn, Mainz and Münster offer a complete programme of Ph.D courses in theoretical and experimental particle physics including nuclear physics at Bonn and Mainz. We list here courses which are particularly relevant for FLAVIANet.

1.11.1 OFFERED PH. COURSES (LOCALLY)

- Ph. D. Tutorial on "*Conformal invariant quantum field theory*" Berlin, October 2006-February 2007
- Ph. D. Tutorial on "*Schrödinger functional and chiral lattice fermion*", Berlin, April-July 2007
- Ph. D. Course on "*Quantum Chromodynamics*", Münster, April - July 2007.
- Ph. D. Course on "*Introduction to the Standard Model of Elementary Particle Theory*", Münster, October 2006 - February 2007.
- Ph. D. Tutorial on "*Effective field theories and lattice QCD*", Mainz, April - July 2007

1.11.2 OFFERED COURSES at ANY LEVEL of interest for the FLAVIANET

- Course on "*Lattice QCD and effective field theories*", Bonn, WS 2006/07, SS 2007
- Course on "*Quantum field theory I*", Berlin, October 2006-February 2007
- Course on "*Introduction to the standard model*", Berlin, October 2006-February 2007
- Course on "*Quantum field theory II*", Berlin, April-July 2007
- Course on "*Functional integration and lattice field theory*", Berlin, April-July 2007
- "*Lectures on Lattice Field Theory*", 26 March - 1 April, 2007, Florianopolis, Brazil
- "*Lectures on Lattice Field Theory*", Minischool on Lattice QCD, April 16-20 2007, Tian-Jin, China
- Course on "*Introduction to lattice QCD*", within the INT Summer School on "*Lattice QCD and its applications*", Seattle, August 2007

1.11.3 VISIT of SENIOR SCIENTISTS from OUTSIDE the NETWORK

- Herbert Neuberger, Rutgers University, USA, visiting Berlin Jul 2006 – Dec 2006 and Jun 2007 – Jul 2007
- R.P. Springer, Duke University, USA, visiting Bonn 26.08.07-09.09.07

- B.L. Ioffe, ITEP Moscow, Ru, visiting Bonn 15.05.07-31.05.07
- D. Lee, Raleigh, NC, USA, visiting Bonn 03.07.07-05.08.07

1.11.4 ORGANIZED SCHOOLS

- 24th Students' Workshop on Electromagnetic Interactions, Bosen (Saar), 9-14 September 2007
- INT Summerschool "Lattice QCD and its applications", August 8- Aug. 28, 2007, Seattle, USA
Participation of 40 students.
- Workshop on Lattice QCD, Chiral Perturbation Theory and Hadron Phenomenology , Trento, Italy, 2-6 October 2006
36 Participants

1.11.5 GENERAL TRAINING

- Computational Physics (Programming in matlab), Berlin, April-July 2007
- German for foreigners, DESY, October 2006 - July 2007
- English Conversation, DESY, October 2006 - July 2007
- Guidance in Scientific Research in Quantum field theory and Elementary Particle Physics, Münster, October 2006 - July 2007

1.11.6 PERIODS SPENT by MEMBERS of the FLAVIANET in OTHER NODES/SUBNODES

- 29/5/07 – 31/5/07 Training on HQET by Rainer Sommer at Tor Vergata, Rome (Node 5)

2 Conclusions

The FLAVIANet network has offered in this first year a first level training in Flavor Physics, theory and experiments, and all boundary research fields, to all the ESR and ER recruited and to all the FLAVIANet young researchers. The network constituted a very lively, cutting-edge scientific framework offering countless concrete and well structured opportunities to interact with the best European and International experts in this research field. Besides this, all the complimentary aspects of the training have been taken into account and an appropriate career and development path has been established for each researcher. It is no doubt that FLAVIANet is contributing and will contribute in the best way to the appropriate training of the young generations in Particle Physics maintaining an European leadership in the field.