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Report on my visit to Thailand
from January 16 to February 3 and on February 13, 2012

• Schedule

From January 16 to 31, 2012, I visited the University of Khon Kaen, Faculty of Science, Department of Mathematics, where I was invited by Sawian Jaidee to give a course on Number Theory. I reached Bangkok on January 16, where I discussed with Paolo Bertozzini.

The same day I reached Khon Kaen.

On January 23, I visited the Faculty of Science of the National University Of Laos (NUOL), Vientiane (Lao PDR). I wrote a report on this visit.

On February 3, in Bangkok, I visited the Centre of Excellence in Mathematics (CEM) and the Department of Mathematics of Mahidol University, where I was invited by Yongwimon Lenbury. I gave a lecture on *Transcendental Number Theory: recent results and open problems*.

On February 13, in Bangkok, on my way back from Lahore (where I was the CIMPA representative for a Research School on Local analytic geometry, held at the Abdus Salam School of Mathematical Sciences ASSMS), I visited the Department of Mathematics and Computer Science, Faculty of Science of Chulalongkorn University, where I was invited by Wanida Hemakul. I gave a lecture on *Diophantine approximation and Diophantine equations: an introduction*.

• January 16

With Paolo Bertozzini we discussed the general situation of mathematics in Thailand. On his website he will publish some information in English which will be most welcome. In particular it will be useful for the International Science Programme of Uppsala University since the Swedish International Development Cooperation Agency, Department for Research Cooperation Sida/SAREC now includes Thailand among the restricted list of countries which are supported.

We also discussed the CIMPA Research School on *Spectral Triples and Their Applications* which took place from May 22 to June 4 , 2011 in Chulalongkorn University. The Thai organizer in Chula was Wicharn Lewkeeratiyutkul. The reports by Wicharn Lewkeeratiyutkul and by Michel Jambu provide some interesting information on this event, including the lack of support of the French Embassy, in spite of its previous commitment. Another CIMPA Research School on *Graphs, Codes, and Designs* will be organized in Ramkhamhaeng University (Bangkok) in 2013.

• January 16 to 31

My course in Khon Kaen was devoted to Diophantine Approximation and Diophantine Equations. It was similar to the beginning of the course I gave

in December 2011 in the Harish-Chandra Research Institute (HRI), Allahabad (India), but in Khon Kaen I spent much more time to develop the background, which was possible since I gave 8 courses of 3 hours each. The first course was a general lecture on this topic, where I explained the basic facts to a general audience (about 20 people attended). My subsequent courses attracted only 4 to 6 participants, but those who attended were very eager to learn the subject and they asked many questions. Sawian Jaidee, Somchit Chotchaisthit, Somnuek Worrawiset attended all my courses, Thotsaphon Thongjunthug attended almost all of them. Whenever something was not clear for them, they asked me to explain it. I was led to recall basic facts about
— algebra: group of units of a ring, ring of polynomials; finitely generated groups, rings, modules; the structure theorem for finitely generated abelian groups;
— Diophantine approximation: Dirichlet's box principle, rational approximation, continued fractions;
— arithmetic of number fields, ring of integers, group of units, Dirichlet's unit theorem, S–integers, S–units;
— projective spaces.
This course included an introduction to Diophantine approximation culminating with Schmidt's Subspace Theorem, and a description of the links between Diophantine approximation and Diophantine equations. Notes have been taken by Sawian Jaidee who is going to write them in TeX.

This course was mainly an introduction to a research program which I suggested as a homework. The main results in the last lectures were equivalence statements dealing with different Diophantine equations or different Diophantine approximation results. They state that solving one of them enables one to solve the others. These equivalences are produced in a theoretical qualitative way. The first refinement will be to show that an upper bound for the number of solutions of these equations in one class yields upper bounds for the number of solutions of the equations in the other classes (this is a so-called *quantitative refinement*). The next step is to show that an upper bound for the size of the solutions for one of these classes implies upper bounds for the size of the solutions for the other ones (this is an *effective refinement*). The goal is to prove that a quantitative (resp. an effective) refinement of one of the equivalent statements implies the same for the other equivalent statements. The following fact shows that such a project may have deep consequences: *no effective refinement of Siegel's Theorem on the finiteness of the set of integral points on a curve a genus* 2 *is known so far.* Sawian Jaidee applied for a support from Research Fund of DPST Graduate with First Placement (Institute for the Promotion of Teaching Science and Technology) for a project on *Diophantine Approximation and Diophantine Equations* and I accepted to be her mentor.

• **February 3**

On February 3, I visited the Centre of Excellence in Mathematics (CEM) and the Department of Mathematics of Mahidol University. I was invited by

Yongwimon Lenbury. I met Amarisa Chantanasiri, my former student in Paris, and two young mathematicians whose interest is close to number theory. I discussed with Chatchawan Panraksa of arithmetic dynamics and Siegel's S–unit equation and with Aram Tangboonduangjit who works on Harmonic Analysis and Sigma-Delta Quantization.

I gave a lecture on *Transcendental Number Theory: recent results and open problems*. Some 25 people attended.

Due to the recent flooding in Thailand, the research budget of the country has been considerably reduced, and the support that CEM will receive in 2012 will be only 5% of what it should have been. Many programs have been cut, and it is not clear when the situation will improve.

After my talk I met Lin Mongkolsery, a student from the Master in Bangkok who pursued his studies in Hanoi and now in Mahidol where he is starting to prepare a PhD.

• **February 13**

On February 13, I visited the Department of Mathematics and Computer Science, Faculty of Science of Chulalongkorn University, where I gave a lecture on Diophantine approximation and Diophantine equations: an introduction.

This visit was organized by Wanida Hemakul, and it was planed in a very comfortable way, between a night flight from Lahore to Bangkok and another one from Bangkok to Paris. I had very interesting discussions with her (in particular on the forthcoming CIMPA Research School *Graphs, Codes, and Designs* in 2013), also with her colleague Ajchara Harnchoowong. I met also Ouemporn Phuksuwan who is going to participate with me to a conference in Newcastle (Australia) one month later. I also met again Lin Mongkolsery (to discuss the situation of Mathematics in Cambodia) and Amarisa Chantanasiri (to finalize a paper of her submitted to the Annales de l'Institut Blaise Pascal in Clermont Ferrand). I also discussed with Yotsanan Meemak, a student of Wen-Ching Winnie Li.

Thank you! I am very thankful to a number of colleagues and friends who contributed to make my stay an enjoyable one; first of all Sawian Jaidee who invited me to come to Thailand and deliver this course in KKU, her husband also for their kind hospitality, the Mathematics Department of KKU for its support for my local expenses, the colleagues in this department, in particular those who attended my courses, and the colleagues I met in Bangkok, Paolo Bertozzini on January 16, Yongwimon Lenbury and her colleagues of CEM and of Mahidol on February 3rd, Wanida Hemakul and her colleagues from Chula on February 13.

Appendix:
Some references on mathematical centers in Thailand

This appendix includes an update of the informations and references given in the report on a previous visit to Thailand in 2005 with Michel Jambu (then Director of CIMPA), at the invitation of TRF Thailand Research Fund with the support of the French Embassy in Thailand (at a time where the SCAC supported mathematics in the large, not only applied mathematics). Visits to Chulalongkorn University, Mahidol University, Suranaree University of Technology and Chiang Mai University were part of the program in 2005.

• **The Center for Promotion of Mathematical Research of Thailand**
CEPMART is a counterpart of the Mathematical Association of Thailand. Its website

`http://www.math.or.th/mat/`

provides some information in English, including Significant Research Activities in Mathematics, some of which is reproduced below. The head of CEPMART is for now Yongwimon Lenbury.

• **TRF Thailand Research Fund**
The Director of the TRF Thailand Research Fund

`http://www.trf.or.th/`

is Sawat Tuntravat and the Vice-Director is Vudhipong Techadamrongsin.

• **Centre of Excellence in Mathematics CEM**
The Director of Centre of Excellence in Mathematics CEM, PERDO

`http://www.sc.mahidol.ac.th/academics/CEM.htm`

is Yongwimon Lenbury.

• **Chiang Mai University CMU**

`http://www.chiangmai.ac.th/main_Eng.htm`

Faculty of Science

`http://www.science.cmu.ac.th/`

Suthep Suantai, Head
Somphong Dhompongsa
Amnuay Kananthai
Significant Research Activities in Mathematics: *Functional analysis, Banach spaces theory, Fixed point theory and Applications, Distribution theory, Complex analysis, Control theory, C* Algebra, Operator theory, Ring and module theory, Semigroups, Combinatorics and Graph theory, Algebraic graph theory, Optimization, Mathematical modeling, Universal algebras.*

• **Chulalongkorn University**
Faculty of Science, Department of Mathematics `http://www.math.sc.chula.ac.th/`
Kritsana Neammanee. Head, Department of Mathematics
Wanida Hemakul
Ajchara Harnchoowong
Chaichana Tuangrat
Wicharn Lewkeeratiyutkul
Significant Research Activities in Mathematics: *Algebraic Semigroup theory, Bio-informatics, Coding theory, Combinatorics and graph theory, Fixed point*

theory, Fluid mechanics, Functional analysis, G-structure theory, Geometry, Hyperstructure theory, Mathematical logic and set theory, Number theory, Numerical analysis, Operations research, Partial differential equations, Probability theory and stochastic analysis, Ring theory, Topology, Wavelet theory.

• **Kasetsart University** http://www.ku.ac.th/english/
Vichian Laohakosol
Significant Research Activities in Mathematics: *Algebra, Number theory, Financial mathematics, Fluid dynamics, classical analysis.*

• **Khon Kaen University** http://www.kku.ac.th/eng/main.php
Faculty of Science, http://www.champa.kku.ac.th/eng/,
Department of Mathematics http://202.28.94.84/joomla/index.php
Staff Members include:
— Nakprasit, Kittikorn, Combinatorics and Graph Theory Kitnak@hotmail.com
— Tawan Rermsungnern
— Teeranan Phukkuntrakorn, (Previous Head of the School)
— Bandid Pimarnjomemee
— Prakit Jamachon, Universal Algebra, Semigroups; prajam@kku.ac.th
— Pikul Puphasuk, ppikul@kku.ac.th
— Wijarn Sodsiri, Geometry; wijsod@kku.ac.th
— Weerachai Sarakorn
— Narakorn Kanasri
— Somnuek Worawiset, Algebraic graph Theory, Semigroupn Theory, group theory; wsomnu@kku.ac.th
— Aungkana Boonyun, Head of the School
— Somchit Chotchaisthit, Number theory and Fixed point Theory; somchit@kku.ac.th
— Sawian Jaidee: PhD Thesis 2010, University of East Anglia (UK),
Merten's Theorem for arithmetic dynamical systems
— Thotsaphon Thongjunthug
— Satit Saejung, Fixed point Theory; saejung@kku.ac.th
— Bundit Pibaljommee, Universal Algebra; banpib@kku.ac.th
— Tawun Remsungnen, Computational Science and Mathematical Modeling; rtawun@kku.ac.th
Significant Research Activities in Mathematics: *Functional analysis, Universal algebra, Probability theory and applications, Number theory and applications , Numerical analysis, Graph and combinatorics, Fixed point theory, Operation research, Optimization, Computational fluid dynamics, Control theory and applications, Semigroup theory, Financial mathematics, Finite element method, Boundary element method, Scientific computation, Distribution theory, Differential geometry, Complex analysis, Ring theory.*

• **King Mongkut's Institute of Technology North Bangkok (KMITNB)**
http://www.kmutnb.ac.th/en/index.php
Utomporn Phalavonk
Significant Research Activities in Mathematics: *Mathematics modeling, Computational fluid dynamics, Graph theory, Differential equations, Numerical anal-*

ysis, Financial mathematics, Real options theory, Evolutionary game theory, Optimal control, Nonlinear analysis and theory of ODEs, Functional analysis and its applications, Algebra, Innovation mathematics, Mathematics education.

• **Mahidol University**
Dept. of Mathematics http://www.sc.mahidol.ac.th/scma
Chaiwat Maneesawang, Chair, Department of Mathematics
Yongwimon Lenbury
Somsak Orankitjaroen
Wayne Lawton
Boribon Novaprateep – ex-Head of the Department of Mathematics
http://www.sc.mahidol.ac.th/scma/ReseachInterest/Boriboon.html
Significant Research Activities in Mathematics: *Functional analysis, Mathematical modeling, Dynamical systems, Algebra, Numerical analysis and computational mathematics, Operations research and logistics, Computer applications, Geometry, Analysis.*

• **Naresuan University**
http://www.nu.ac.th/english/
Significant Research Activities in Mathematics: *Nonlinear analysis, Convex and variational analysis, Semigroups, Number theory.*

• **Prince of Songkla University in Hat Yai**
http://www.psu.ac.th/en/node/252
Significant Research Activities in Mathematics: *Fixed point Theory, Semi groups, Number Theory, Partial differential equation, Mathematical Models, Numerical optimization, Analysis Algebra, Fuzzy set and Rough set of Algebraic System, Applied Harmonic Analysis, Functional Analysis, Operator Space Theory, Inverse Problem, Numerical Analysis, Stochastic integrals, Stochastic Analysis, Integration on Manifolds, Probability and Statistics, Statistical Modeling, Social Science research, Applied Multivariate Analysis, Epidemiology Research, Operations Research.*

• **Ramkhamhaeng University** http://www.math.sci.ru.ac.th/
http://joomla.ru.ac.th/oasc/eng/inbrief/
Somporn Sutinuntopas
CIMPA Research School on *Graphs, Codes, and Designs* in 2013.

• **Srinakharinwirot University** http://www.swu.ac.th/en/
Narong Punnim
Significant Research Activities in Mathematics: *Graph theory, Design theory, Combinatorics, Theory of Ordinary Differential Equations and Application, Partial Differential Equation, Mathematics education (Problem solving), Computer education (content management system).*

• **Suranaree University of Technology SUT**
http://web.sut.ac.th/sutnew/sut_en/
Arjuna Peter Chaiyasena

Significant Research Activities in Mathematics: *Differential equations, Computational Fluid Dynamics, Applied Analysis, Wavelet Theory, Financial Modeling, Fixed point theory and applications, Numerical analysis.*

• **Thammasat University** http://www.tu.ac.th/eng/
Samran Mantup, Head.
Paolo Bertozzini http://www.paolo-th.110mb.com
Significant Research Activities in Mathematics: *Group theory, Graph theory, Functional analysis, Numerical linear algebra, Nonlinear partial differential equations, Mathematical modeling, Numerical simulation, computational sciences, Probability and statistics theory, Mathematical statistics, Statistical modeling, Item response theory, Time series, Social science research, Geometry, Functional equations, Wavelet Analysis.*

This report is available on my website
http://www.math.jussieu.fr/∼miw/cooperation.html