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THE SIXTIETH BIRTHDAY OF JEAN-MARC DESHOUILLERS

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September 12, 2006 was a happy birthday for Professor Jean-Marc Deshouillers which we celebrated in Luminy (Marseilles) during the „Colloque International de Théorie Analytique des Nombres" (September 11-15, 2006). A large number of participants from many countries honored him by giving mathematical talks and enjoying social gatherings. My long collaboration and close friendship with Jean-Marc and his family are integral parts of my life, so I am particularly happy to write a few notes about him on this occasion. I think this is also an appropriate opportunity for revealing many important issues of Jean-Marcs activity which have contributed to his very distinguished standing.

Analytic Number Theory in France has been in the shadow of more fashionable areas of mathematics of algebraic nature, in spite of the fact that some fundamental results in ANT were established by French mathematicians (such as the Prime Number Theorem by J. Hadamard). It is clear today that Jean-Marc together with a little help from a few others and later followed by his numerous students has changed this trend for good. I have witnessed his enterprising advocacy from the early years of the Séminaire de Théorie des Nombres in Bordeaux I, where I was fortunate to meet (in 1979) his student Etienne Fouvry, who later moved to Orsay and built his own „empire" of analytic number theory. Philippe Michel was Fouvrys student and Emmanuel Royer was Michels student, so after claiming Fouvry as my half student I am proud to say that my „French Connection" is long and strong. I cannot imagine how this would have happened if I missed Jean-Marc in my career.

Let me begin by telling some facts from Jean-Marcs student period (my recollections come from listening to Jean-Marc during our numerous conversations). These may not be most essential; nevertheless I like to convey the spirit of the beginning. Jean-Marc studied mathematics in the École Polytechnique in 1965–68 which is one of the two most prestigious schools in France to study science (never mind its military designations), the other one being the École Normale Supérieure. J. Hadamard was still present at EP and Laurent Schwartz was actively teaching there, organized seminars for students. Although Schwartz was not working in number theory he never objected Jean-Marc to study this beautiful subject. While

in EP Jean-Marc made a friend Lê Dũng Tráng with whom he shares a lot of features in character issues, especially when it comes to organizational skill (Le Dung Trang is currently the Director of the Mathematics Department of the UNESCO institute ICTP in Trieste). May I also say they both are wine connoisseurs?

Next in 1968–73 Jean-Marc had a post at the CNRS in the Laboratory of L. Schwartz, part of which (1971–73) he spent in Bordeaux I, because his sweet-heart Francine Delmer was given a job there (see how love incidentally made a difference in Bordeaux mathematics!). However, the first contact of Jean-Marc with number theory on a professional scale began already in 1966 when he met Ch. Pisot (exactly the same time I began thinking seriously of number theory after being intercepted by Andrzej Schinzel in Warsaw). In 1971 Jean-Marc defended his Thèse de Troisième cycle (on Erathosthenes sieve) in Paris under Pisots formal supervision, and a year later he defended the Thèse d État in Paris 6 (on additive basis formed by sums of two integral parts of fractional powers).

In real terms L. Schwartz did not direct Jean-Marcs studies; nevertheless he should be acknowledged for creating a valuable sense of trust in his students, which I think is equally important for any young scholar to feel confident. Indeed in 1968 Schwartz sent Jean-Marc Deshouillers and Lê Dũng Tráng to Finland to prepare and organize a summer school on singularities, which was then a hot subject just after Hironakas celebrated work. I wonder if Jean-Marcs eagerness to learn Finish was a result of this enterprise, or was another engagement a factor.

Schwartz and Pisot let Jean-Marc see how much is done in number theory, yet Heini Halberstam was his first true teacher. The conditions surrounding their first relations are pretty natural. It happened that Halberstam was visiting France when Jean-Marc was delivering a talk on sieve methods (specifically on the weighted sieve paper of Miech in Acta Arithmetica). Instantly Halberstam invited Jean-Marc to visit the University of Nottingham for the year 1969–70, and the rest is a lovely lasting friendship between these two gentlemen of different generations.

At this point I am tempted to reveal my own beginnings in Warsaw as we do have so much in common even though we were growing up so far apart and not knowing each other (I met Jean-Marc for the first time in March of 1977 during the Journées Additives in Bordeaux). Interestingly enough we had similar affection for sieve methods although our advisors did not cultivate that territory. After defending my thesis in April 1972 under Schinzels supervision I was recognized by Heini who also invited me to visit Nottingham (in spring of 1974). I missed Jean-Marc in the Robin Hood country, but I learned about him a great deal. This could well be the „fourth color" story for Kieslowski series. Six more years past before I got closer to Jean-Marc (and Francine).

Contradicting a bit my opening statement that analytic number theory was neglected by the French mathematical avant-garde; let me point out that there were inspiring exceptions. Jean-Marc recalls that Jean-Pierre Serre returned from the Stony Brook conference in 1969 loaded with interesting questions for everybody. One of these (originally raised by Emmanuel Vegh) was to show that $\phi(p-1)/(p-1) > 1/3$ quite often, which has a lot to do with problems of primitive roots. Later in the early eighties when visiting Bordeaux University I observed

on several occasions that Professor Serre was fully aware of what was going on in the number theory group in Bordeaux. Serre published remarkable papers of his own in analytic number theory and Jean-Marc became his admirer and colleague.

Speaking about the Séminaire de Théorie des Nombres in Bordeaux I cannot forget how much I was overwhelmed by extraordinary group of active researchers and students working in diverse areas. Dress, Fresnel, Martinet, Mendès France and de Mathan were doing well before Jean-Marc made his home there, but his arrival in 1971 enhanced this already successful group substantially in new directions from classical to modern analytic number theory. For example he brought with him the sieve methods, the circle method, and the exponential sums methods among many other new ideas. But above all Jean-Marc is considered as the architect of additive number theory in Bordeaux and he is a significant contributor to the world literature. He also expanded applications of probability ideas to number theory. For broader interaction of number theorists with other faculty in Bordeaux one couldnt ask more, it was fully open; which in great measure is due to the wisdom and the vision of Jean-Marc.

Eventually, after years of engagements a Study Group of Analytic Number Theory emerged, led by Cohen, Deshouillers, Dress, Nicolas (it is not unusual in French schools of intellectuals to associate themselves in groups, like impressionists in paintings or the group „les six" in atonal music).

Jean-Marc has served vigorously for the advancement of mathematics in France and worldwide on every level; including research, education and international cooperation. From January 1, 1987 to December 30, 1990 he was the Director of the Mathematics Laboratory in Bordeaux I. From spring 1999 to the beginning of 2003 Jean-Marc had practically a full time job (four days a week in Paris and one day a week in Bordeaux) as the Directeur Scientifique for Mathematics in the Ministry in charge of education and research. Jean-Marc keeps tight relations with mathematicians in India.

Now let me speak briefly about some of the research accomplishments of Jean-Marc. There are too many to give a full account, so instead I attach the complete list of his publications and select some of them into groups (not all disjoint) which leaves a clear impression of Jean-Marcs diversity of interests. Many wonderful reviews in details are available on the MathSciNet.

Generally speaking Jean-Marcs main fields of interest are analytic and combinatorial number theory. These include probabilistic and algorithmic aspects. He also has interest in the theory of probability and statistics with applications to questions beyond number theory.

My favorite observation about Jean-Marc in action concerns his fascination in the „medium size numbers". I mean it often takes more than just numerical computations to cover missing ranges in analytic estimates which alone are not practical, because the implied constants are of astronomical magnitude. One needs new ideas to finish a problem. Jean-Marc succeeded in many cases, particularly in the Waring problem for biquadrates and the Goldbach-Shnirel'man problem for primes. The paper [36] of Jean-Marc alone is an absolute masterpiece, it contains the last key contribution to the solution of $g(4) = 19$.

I am happy to admit that I also stimulated Jean-Marc to explore together new directions, especially with analytic theory of automorphic forms. Soon after I arrived in Bordeaux in September 1979, we began our long collaboration in spectral methods for Kloosterman sums with applications to classical problems in conjunction with sieve methods. I recall it was my most productive period and having Jean-Marc as a partner made it most enjoyable. Our best idea on switching the modulus of Kloosterman sums with the level of congruence groups (which gave us vital density estimates for exceptional eigenvalues) appeared during one of many meetings in Warsaw. Of course, if the Ramanujan-Selberg conjecture is proved we shall be left with a theorem about the empty set, but it is not yet obsolete. To the contrary these results still serve as a full substitute for the Ramanujan-Selberg conjecture in true applications.

I divide Jean-Marcs publications in the following classes and subjects;

Analytic Number Theory:

(A) Arithmetic functions
(B) Sieve methods
(C) Circle methods
(D) Exponential sums and equidistribution
(E) Automorphic forms
(F) Prime Numbers

Additive Number Theory:

(G) General additive number theory
(H) Inverse problems
(I) Warings type problems
(J) Goldbachs type problems

Probability:

(K) Probabilistic number theory
(L) Sums of random variables

Miscellany:

(M) Geometry of numbers
(N) Combinatorics
(O) Computation and complexity
(P) Statistics

The above subject letters (which are my personal choice) are attached to the items in the publication list.

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