ABSTRACTS - PIMS DISTINGUISHED LECTURE SERIES

OLIVIER RAMARÉ (CNRS / UNIVERSITÉ DE LILLE 1)

(1) **Monday February 24, 12:00-12:50 pm, B650**
PIMS Lethbridge Number Theory and Combinatorics Seminar
Bilinear forms on prime numbers:
This talk will retrace the main steps of the modern theory of prime numbers and in particular how the combinatorial sieve combined with the Dirichlet series theory to give birth to the modern representation of the primes via a linear combination of terms, some of which being "linear", while the other ones are "bilinear". This will lead us to the recent developments of Green & Tao, Mauduit & Rivat, Tao, Helfgott, and Bourgain, Sarnak & Ziegler.

(2) **Monday February 24, 2:00-2:50 pm, D633**
A practical example of using a bilinear decomposition on the Moebius function:
We will prove the following theorem:
Let $\alpha \in [0, 1]$, and two real parameters $X \geq Q \geq 1$. Let also a/q be a rational that satisfies $Q \geq q$ and $|q\alpha - a| \leq 1/Q$. We have

$$\sum_{n \leq X} \mu(n) exp(2i\pi na/q) \leq \frac{30\, X}{\min(q, X/q, Q)} (1 + \log X)^{7/2}.$$

The method is simple and uses a combinatorial identity I've recently obtained. There has been no tentative to minimising the loss $30(1 + \log X)^{7/2}$.

(3) **Tuesday February 25, 9:25-10:40 am, D632**
Large values of Dirichlet polynomials: an introduction:
Dirichlet polynomials do not take large values at close-by points. The theory of large values of Dirichlet polynomials introduced by Montgomery in 1969 elaborates on this idea. We will present the large sieve argument of Montgomery, the dissection and reflexion arguments of Huxley and the powering method of Jutila. We will end this talk by showing how such information can be used to produce density estimates for the Riemann zeta funciton.

(4) **Friday February 28, 12:00-12:50, D631**
PIMS Lethbridge Mathematics and Computer Science Colloquium
Extremal problems of large primes in small intervals:
If the average behaviour of the prime numbers is well known, the local one is much more mysterious, and many questions are not even amenable (as of today) to heuristics! We will address three questions: what is the largest number of primes in a given interval, what is the smallest number of such numbers, and what happens if we relax the condition primes to integers with few primes factors.

(5) **Tuesday March 4, 9:25-10:40 am and 10:50am-12:05pm, L114**
Log-free zero-density estimates (I) and (II):
Motohashi (following Selberg) developped in 1978 a method to prove the Hoheisel and Linnik theorem without any deep mention of the zeros. We will present this approach. The first lecture will be a sketch of the argument and will introduce the tools (Barban & Vehov

weights, large sieve inequality, bilinear decomposition) while the seond one will be devoted to the proof in itself. We will also fill in as many details as time permits.

(6) **Thursday March 6, 9:25-10:40 am, D632**
A comparison of Perron's formula and smoothing:
We will present a surprising *exact and truncated* Perron summation formula as well as several other formulaes. We will proceed by comparing the relative strenghts of the smoothing method versus Perron summation.