Dissertation Defense

Topics in Analytic Number Theory

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Abstract: In this thesis, the author proves theorems on the distribution of primes by extending recent results in sieve theory and proving new results on the distribution of zeros of Rankin-Selberg L-functions. The author proves for any Galois extension of number fields K/Q, there exist bounded gaps between primes with a given "splitting condition" in K, and the primes in question may be restricted to short intervals. Furthermore, we can count these gaps with the correct order of magnitude. This follows from proving a short interval variant of the Bombieri-Vinogradov theorem in a Chebotarev setting and generalizing the recent progress in sieve theory due to Maynard and Tao. The author also proves several log-free zero density estimates for Rankin-Selberg L-functions with effective dependence on the key parameters. From this, the author proves an approximation of the short interval prime number theorem for Rankin-Selberg L-functions, an approximation of the short interval version of the Sato-Tate conjecture, and a bound on the least norm of a prime ideal counted by the Sato-Tate conjecture. All of these results exhibit effective dependence on the key parameters.

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