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I am generally interested in problems in analytic number theory, more specifically, the theory of large sieve and mean-value type theorems. Some of my most notable results are as follows.

a) In a series of joint papers with S. Baier, we proved that the asymptotic formulas in both the Sato-Tate conjecture for elliptic curves and the Hardy-Littlewood conjecture for primes represented by quadratic polynomials hold on average, up to some uniformity constraints. We obtained the savings of arbitrary powers of logarithm in the relevant error terms. From this one could immediately deduce that both of the conjectured asymptotics hold for almost all elliptic curves or polynomials in the relevant families with error terms that are majorized by the respective main terms divided by arbitrary powers of logarithm of the relevant parameters, hence verifying both conjectures in this regard.

b) In a series of papers, both jointly with S. Baier and independently, we extended the classical theory of large sieve to sparse sets of moduli, the most interesting of which is the set of squares. From this, we could extend the classical theorems of Bombieri-Vinogradov and Barban-Davenport-Halberstam to square moduli. These theorems enabled us to have a new approximation to the very difficult problem of finding primes of the form n^2+1, mentioned in the previous paragraph.

The afore-mentioned extended theory of large sieve will have numerous interesting implications, one of which will be in a forth-coming joint paper with S. Baier. Certain weaker versions of the hitherto unresolved conjecture of Birch-Swinnerton-Dyer are known under the assumption of the perhaps equally difficult Riemann hypothesis(RH) for Hasse-Weil, symmetric square and Dirichlet *L*-functions. We shall remove the dependency of these results on RH for symmetric square and Dirichlet *L*-functions, hence further adding our knowledge of the subject.

Selected Publications

1. S. Baier and **L. Zhao**, *The Sato-Tate conjecture on average for small angles*, Trans. Amer. Math. Soc., (to appear).

2. S. Baier and **L. Zhao**, *An improvement for the large sieve for square moduli*, J. Number Theory, **128** (2008), no. 1, 154-174.

3. S. Baier and **L. Zhao**, *Primes in quadratic progressions on average*, Math. Ann. **338** (2007), no. 4, 962 – 982.

4. **L. Zhao**, *Large sieve inequalities with quadratic amplitudes*, Monatsh. Math., **151** (2007), no. 2, 165 – 173.

5. S. Baier and **L. Zhao**, *Bombieri-Vinogradov type theorem for sparse sets of moduli*, Acta Arith., **125** (2006), no. 2, 187 – 201.

6. **L. Zhao**, *Oscillations of Hecke eigenvalues at primes*, Rev. Mat. Iberoamericana, **22** (2006), No. 1, 323 – 337.

7. **L. Zhao**, *An improvement on a large sieve inequality in high dimensions*, Mathematika, **52** (2005), 93 – 100.

8. S. Baier and **L. Zhao**, *Large sieve inequalities for characters to powerful moduli*, Int. J. Number Theory, **1** (2005), No. 2, 265 –279.

9. **L. Zhao**, *Large sieve inequalities for special characters to primes moduli*, Funct. Approx. Comment. Math., **32** (2004), 99 –106.

10. **L. Zhao**, *Large sieve inequalities for characters to square moduli*, Acta Arith., **112** (2004), No. 3, 297 – 308.