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On the binary additive divisor problem and its analogs in mean

In our recent paper [3] we have studied the following mean value of the classical additive divisor problem:

$$\sum_{f\sim F}\sum_{n\sim N}\left|\sum_{l\sim L} d(n+l)d(n+l+f) - \text{main term}\right|^2.$$

The main term we are interested in here is the one by Motohashi [2], but we also attain an upper bound for the case where the main term is that of Atkinson [1] from 1941. The proof is based on a spectral decomposition of the shifted convolution sum over the divisor function, immediately allowing an analogous treatment for a shifted convolution sum over Fourier coefficients of a fixed holomorphic cusp form in mean.

In the non-holomorphic case we face the problem of the lack of a proper analogy for the spectral decomposition. Hence in [4] we attack this case through Jutila's version of the classical circle method, deriving an upper bound for

$$\sum_{f\sim F}\sum_{n\sim N}\left|\sum_{l\sim L} t(n+l)t(n+l+f)\right|^2$$

over the Hecke eigenvalues of a fixed non-holomorphic cusp form. The proof also again yields an analogous upper bound for the holomorphic case.

In our talk we briefly illuminate the substantial history behind our sums and outline the main ingredients in our proofs.

References

[1] Atkinson F. V. : *The mean value of the zeta-function on the critical line.* Proc. London Math. Soc. (2) **47** (1941), 174–200.

[2] Motohashi Y. : *The binary additive divisor problem.* Ann. Sci. Éc. Norm. Supér. **27** (1994), 529–572.

[3] Suvitie E. : *On the binary additive divisor problem in mean.* Submitted. http://arxiv.org/abs/1110.3950

[4] Suvitie E. : *On the shifted convolution problem in mean.* J. Number Theory, to appear. http://arxiv.org/abs/1202.3906