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The Variance of Bounded Multiplicative Functions in Arithmetic Progressions

Let $f : \mathbb{N} \to \mathbb{U}$ be a 1-bounded multiplicative function. Improving on work of Hooley, we establish unconditional (quantitative) asymptotic formulae for

$$\sum_{\substack{n \leq x \\ n \equiv a \bmod q}} f(n)$$

for *almost all* coprime residue classes a modulo q, and all but $O\left(xe^{-(\log x)^{0.66}}\right)$ moduli $q \in (x, 2x]$. Time permitting, we will also discuss some conditional analogues (weaker than GRH) for which no exceptional set of moduli is required, as well as some extensions for divisor-bounded functions. (Joint work with O. Klurman and J. Teräväinen)