

# Improving and Maximal Inequalities for Primes in Progressions

Christina Giannitsi, Georgia Institute of Technology

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**Abstract:** Assume that  $y < N$  are integers, and that  $(b, y) = 1$ . Define an average along the primes in a progression of diameter  $y$ , given by integer  $b$ .

$$A_{N,y,b} := \frac{\phi(y)}{N} \sum_{\substack{n < N \\ n \equiv b \pmod{y}}} \Lambda(n) f(x - n),$$

where  $\Lambda$  is the von Mangoldt function and  $\phi$  is the totient function. We establish improving and maximal inequalities for these averages, with bounds that are uniform in the choice of progression. For instance, for  $1 < r < \infty$  there is an integer  $N_{y,r}$  so that

$$\| \sup_{N > N_{y,r}} |A_{N,y,b} f| \|_r \ll \|f\|_r.$$

The implied constant is only a function of  $r$ .

This is joint work with Michael Lacey, Hamed Mousavi and Yaghoub Rahimi.