1154-11-2358 **Lola Thompson*** (lola.thompson@oberlin.edu) and **Harald Andres Helfgott**. *Summing $\mu(n)$: a faster elementary algorithm.*

Consider either of two related problems: determining the precise number $\pi(x)$ of prime numbers $p \leq x$, and computing the Mertens function $M(x) = \sum_{n \leq x} \mu(n)$, where μ is the Möbius function.

The two best algorithms known are the following:

1. An analytic algorithm (Lagarias-Odlyzko, 1987), with computations based on integrals of $\zeta(s)$; its running time is $O(x^{1/2+\epsilon})$.

2. A more elementary algorithm (Meissel-Lehmer, 1959 and Lagarias-Miller-Odlyzko, 1985; refined by Deléglise-Rivat, 1996), with running time about $O(x^{2/3})$.

The analytic algorithm had to wait for almost 30 years to receive its first rigorous, unconditional implementation (Platt), which concerns only the computation of $\pi(x)$. Moreover, in the range explored to date ($x \leq 10^{24}$), the elementary algorithm is faster in practice.

We present a new elementary algorithm with running time $O(x^{3/5} \log x)$ for computing $M(x) = \sum_{n \leq x} \mu(n)$. The algorithm should be adaptable to computing $\pi(x)$ and other related problems. This talk is based on joint work with Harald Andrés Helfgott. (Received September 17, 2019)