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Sieve weights and their smoothings

I will discuss moments of partially smoothed, truncated divisor sums of the Möbius function. Such divisor sums appear naturally in the theory of the Selberg sieve and they play a key role in the GPY sieve and its recent improvements due to Maynard and Tao. It turns out that if the truncation is smooth enough, the main contribution to the moments comes from almost primes. However, for rougher truncations, the dominant contribution comes from integers with many prime factors.

Analogous questions can be asked for polynomials over finite fields and for permutations, and in these cases the moments behave rather differently, a rare exception. As we will see, a plausible explanation for this phenomenon is given by studying the analogous sums for Dirichlet characters and obtaining different answers depending on whether or not the character is "exceptional".

This is joint work with Andrew Granville and James Maynard.