Higher moments of averages of Ramanujan sums

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While studying the trigonometric series expansion of certain arithmetic functions, Ramanujan, in 1918, defined a sum of the nth power of the primitive q^{th} roots of unity and denoted it as $c_q(n)$. These sums are now known as Ramanujan sums.

Our focus lies in the distribution of Ramanujan sums. One way to study distribution is via moments of averages. This problem was initially considered by Chan and Kumchev, who were motivated by its potential applications in solving problems related to Diophantine approximations of real numbers using sums of rational numbers. They estimated the first and second moments of Ramanujan sums. Building upon their work, we extend the estimation of the moments of Ramanujan sums for cases where $k \geq 3$. To accomplish this, we use the Brèteche Tauberian theorem.