1026-60-167 **Eric A Carlen*** (carlen@math.gatech.edu), School of Math, Georgia Tech, Atlanta, GA 30332, **Jeff Geronimo**, School of Math, Georgia Tech, Atlanta, GA 30332, and **Michael Loss**, School of Math, Georgia Tech, Atlanta, GA 30332. *Sharp spectral gap in the Kac model for three dimensional momentum conserving collisions.*

The Kac model considered here models the collisions of N particles with three dimensional velocities by a random walk in which the steps correspond to binary collisions that conserve momentum as well as energy. The state space of this walk is a sphere of dimension $3N-4$. The Kac conjecture concerns the spectral gap in the one step transition operator Q for this walk. In this paper, we compute the exact spectral gap.

As in previous work by Carlen, Carvalho and Loss where a lower bound on the spectral gap was proved, we use a method that relates the spectral properties of Q to the spectral properties of a simpler operator P, which is simply an average of certain non commuting projections. The new feature is that we show how to use a knowledge of certain eigenfunctions and eigenvalues of P to determine spectral properties of Q, instead of simply using the spectral gap for P to control the spectral gap for Q, inductively in N, as in previous work. We also use some deep results on Jacobi polynomials to obtain the required spectral information on P, and we show how the identity through which Jacobi polynomials enter our problem may be used to obtain new bounds on Jacobi polynomials. (Received February 26, 2007)