Fig. IIIA-A2 shows these functions for the plane $0 \leq x \leq L_x$, $0 \leq y \leq L_y$.

Exercise A1. Sketch the wave function and probability distribution for the quantum set (2, 1).

An inspection of Fig. IIIA-A2 shows that the probability that the particle will be on the line $y = L_y/2$ is zero.[38] The fact that such lines exist is inconsistent with our macroscopic expectations of particle behavior. It is absurd to think that there are lines on a billiard table upon which we will never observe a billard ball as it moves. To

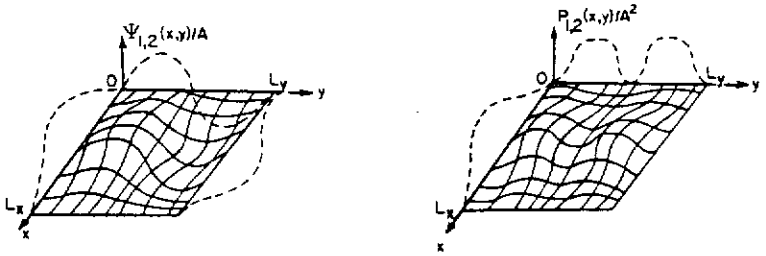

Fig. IIIA-A2. The Wave Function and Probability Distribution for a Particle in State (1, 2) in a Plane

resolve this apparent paradox we must extend the concept of the probability distribution function to particles whose energies are relatively enormous in comparison to the initial energy levels we have pictured. Fig. IIIA-A3 shows that in this limit the probability distribution will resemble an array of infinitesimally small hills distributed over the xy plane. Although these hills are separated by lines of zero probability, they are so close together that one cannot distinguish between the zones of "allowed" particle position and the grid of excluded lines. Thus the effective position probability is uniform over the plane and in the limit of energetic particles, the Quantum Mechanical prediction is consistent with intuition, i.e., the ball is uniformly likely to be anywhere on the table.

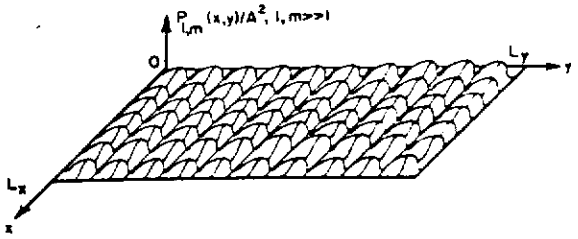

Fig. IIIA-A3. A Representative Probability Distribution for a Particle of "High" Energy Confined Within a Plane

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[38]The line of zero probability does not imply that the particle is trapped on one half. A solution of the unsteady state Schroedinger equation shows that the particle can move across the line.