1.6: Tunneling

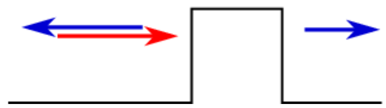

Figure 1.6.1: The tunneling phenomenon, where a particle can sometimes be found at the othee side of a barrier.

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In classical mechanics a billiard ball bounces back when it hits the side of the billiard. In the quantum world it might actually "tunnel" through. Let me make this a little clearer. Classically a particle moving in the following potential would just be bouncing back and fourth between the walls. This can be easily seen from conservation of energy: The kinetic energy can not go negative, and the total energy is conserved. Where the potential is larger than the total energy, the particle cannot go. In quantum mechanics this is different, and particles can penetrate these classically forbidden regions, escaping from their cage.

This is a wave phenomenon, and is related to the behaviour of waves in impenetrable media: rather than oscillatory solutions, we have exponentially damped ones, that allow for some penetration. This also occurs in processes such as total reflection of light from a surface, where the tunneling wave is called "evanescent".