

Harvard University  
Department of Physics Colloquium

November 23, 2009, Monday  
Jefferson 250 @ 4:15 p.m.  
Tea Served in Jefferson 450 @ 3:30



**"A Quantum Computer Can Determine  
Who Wins a Game Faster Than  
a Classical Computer"**

**Edward Farhi**

**M.I.T.**

Imagine a game where two players go back and forth making moves, and at the end of a fixed number of moves the position is either a win or a loss for the first player. In this case, if both players play best possible, it is determined at the first move who wins or loses. To figure out who will be the winner you need not look at all of the  $N$  final positions, but only at  $N^{0.753}$ . I will show that with a quantum computer the exponent can be reduced to 0.5. The technique involves quantum scattering theory and illustrates how ideas from physics can be used to design quantum algorithms that outperform even the best possible classical algorithms.

<http://www.physics.harvard.edu>