



The Abdus Salam  
International Centre for Theoretical Physics



Workshop on  
NEW TRENDS IN QUANTUM DYNAMICS AND ENTANGLEMENT  
21 - 25 February 2011

**Transport, Disorder and Entanglement**

**Andreas BUCHLEITNER**

Optics and Statistics, Institute of Physics  
Albert Ludwigs University of Freiburg, D-79104 Freiburg, Germany

Abstract:

Transport, disorder, and entanglement. In many areas of physics we witness dramatic differences between classical and quantum transport - from the theory of charge or heat conduction in the solid state, over radiation transport in multiple scattering media, to energy transport in various scenarios of light-matter interaction. In general, we expect quantum features to fade away on large scales, due to the ever more unavoidable - and detrimental - influence of the environment which scrambles relative phases and damps quantum amplitudes. Recent experimental evidence suggests, however, that the functional efficiency of large biomolecular units may stem from quantum coherence phenomena, despite strong environment coupling. We explain such efficiency, under the assumption that evolution is able to steer finite size three dimensional systems into molecular conformations with optimal coherent transport properties. It turns out that such optimal conformations are characterized by specific, optimal entanglement properties between different sites of the molecular complex.