



**DIPARTIMENTO DI FISICA "E.Fermi"**  
UNIVERSITÀ DI PISA  
**CORSO DI DOTTORATO IN FISICA**  
VIA BUONARROTI,2 - Edificio B-C  
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# **Ciclo di lezioni per il CORSO DI DOTTORATO IN FISICA**

**Prof. Thomas Elze**

## **"Quantum Decoherence and the Emergence of Classical Behaviour from Quantum Mechanics"**

da Lunedì 5 giugno 2006 - ore 15:00-17:00

Aula S1- Ed. B -Polo Didattico Fibonacci

Le lezioni proseguiranno per un mese con questo orario ogni  
lunedì e giovedì

### **Programma:**

- Motivation for studying decoherence, from quantum computation to quantum cosmology ...
- Density matrices and Wigner functions; defining properties and applications
- Dynamics of density matrices; path integral derivation
- Decoherence of a density matrix and its relation to entropy production
- Environment induced superselection, pointer states; the unsolved Measurement Problem
- Quantum Brownian motion; sub-/super-Ohmic environments, radiation field as an environment
- Feynman-Vernon influence functional; Caldeira-Leggett model
- Decoherence in quantum field theory; functional Schroedinger picture;
- Cornwall-Jackiw-Tomboulis effective action and Hartree approximation from a variational principle
- Model calculations: semiquantum chaos
- Gell-Mann & Hartle decoherent histories approach
- Outlook: recent ideas on deterministic foundations of quantum mechanics motivated by the study of decoherence