



**UNIVERSITATEA
BABEŞ-BOLYAI**

FACULTATEA DE FIZICĂ

România
Ministerul Educaţiei şi Cercetării
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Cluj-Napoca 17.07.2013

ADMITERE DOCTORAT 2013

Conducator de doctorat: **Prof.dr. Zoltan NEDA**

Tema propusa: **Statistical Physics Methods in the Study of Complex Networks**

TEMATICA ADMITERE DOCTORAT 2013

Elements Statistical Physics

1. Elements of Thermodynamics, Thermodynamic Potentials, Thermal and Caloric Equation of State
2. Microcanonical ensemble
3. Ideal gas in microcanonical ensemble
4. Density of Schottky defects
5. The Shannon Entropy
6. The canonical ensemble
7. Ideal gas in canonical ensemble
8. Density of Schottky defects (two state non-interacting systems)
9. Interacting systems
10. The real gas
11. Magnetic systems
12. The Ising system
13. The macrocanonical ensemble
14. Fermi-Dirac and Bose-Einstein distribution
15. The ideal photon gas
16. Critical phenomena and phase-transitions

Elements of Quantum Mechanics

1. The wave function
2. The Schrodinger equation
3. The stationary Schrodinger equation
4. Compatible and complementary variables
5. The measurement postulate
6. The infinite deep potential valley

7. The 1D harmonic oscillator
8. The potential step and potential barrier
9. Movement in central potential
10. Perturbation theory
11. Variational methods

Elements of Monte Carlo methods

1. The Metropolis Monte Carlo method
2. Monte Carlo simulation of Ising systems
3. The BKL Monte Carlo method and kinetic Monte Carlo
4. Cluster Monte Carlo methods
5. The histogram Monte Carlo method
6. Quantum Monte Carlo methods