Module name	Theory
Number	**2008-M03**
Aims	Computer simulation tool box to investigate complex disordered structures exhibiting rugged free-energy landscapes. Combining a multitude of analytical (quantum field theory, series expansions) with computer modeling approaches in generalized ensembles. Applications range from diluted ferromagnets, spin glasses and glasses over polymeric scaffolds and proteins to random lattices, graphs and networks.
Basics	(The topics are covered by lectures from existing master courses): Soft matter physics, nonlinear dynamics, self-assembly and self-organization, statistical physics, non-equilibrium physics, quantum mechanics and chemistry
Contents	1. Markov Chain Monte Carlo simulation techniques - from basics to advanced 2. Generalized ensemble methods (e.g., multicanonical, Wang-Landau, parallel tempering, …) for problems with rugged free-energy landscapes 3. Quenched, disordered ferromagnets, random lattices/graphs and complex networks 4. Spin glass models, including combinatorial optimization
Methods	Monte Carlo simulation techniques, generalized ensemble methods, modeling of disordered systems, combinatorial optimization
Type	Two-day block course/ yearly recurrence with modification
Date (month/year)	March/April 2008
Time	9.00 – 18.00
Work load	15 hours presence/ 45 hours self-study
Examination	oral/ written
Credit points	2
Responsible scientists	Janke, Kroy, Müller
International guest lecturers	**Bertrand Berche (Nancy, France), Helmut G. Katzgraber (ETH Zürich, Switzerland), David P. Landau (Univ. of Georgia, Athens, USA), Frauke Liers (Cologne, Germany), Victor Martin-Mayor (Madrid, Spain), Andrea Pelissetto (Rome, Italy), Martin Weigel (Mainz, Germany)**
Industrial partners	
Recommendations for literature, e-learning	B.A. Berg, *Markov Chain Monte Carlo Simulations and Their Statistical Analysis* (World Scientific, Singapore, 2004), with web-based codes. D.P. Landau and K. Binder, *Monte Carlo Simulations in Statistical Physics, 2nd ed. (Cambridge University Press, Cambridge, 2005).* *W. Janke (Ed.), Rugged Free-Energy Landscapes: Common Computational Approaches to Spin Glasses, Structural Glasses and Biological Macromolecules*, Lect. Notes Phys. **736** (Springer, Berlin, 2008).

Graduate School BuildMoNa
Universität Leipzig
Johannisallee 29
04103 Leipzig
Germany

Phone: +49 341 97-36016
Fax: +49 341 97-36094

buildmona@uni-leipzig.de
www.buildmona.de