Theory and Phenomenology of Glassy Systems
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Phenomenology
Window glasses, strong and fragile glass classification, glass transition, configurational entropy, Adam-Gibbs Theory, Kauzmann paradox, dynamic etherogeneities, spin-glasses, aging, memory effects, effective temperatures.

Solvable models: idealized mean-field thermodynamic properties

Solvable models for the glassy behavior: mean-field dynamics

Glassy behavior on sparse graphs

Random first order transition theory
From mean-field to real structural glasses. Adam-Gibbs theory revisited. Entropic “driving” and complexity of the states space, mosaic glassy state, definition of a static correlation length, barrier “softening”, predictions and limits of the theory.

Continuous Replica Symmetry Breaking
Multiple discrete and infinite steps RSB, Parisi equation, Ultrametricity, Stabilty analysis in the replica Fourier space.

Supersymmetric dynamics
Supersymmetric field theoretic dynamic arrest description in quenched disorder.

Mode Coupling Theory in Fisica dei Liquidi
Emanuela Zaccarelli
Dynamic equations for the density-density correlation length, long-time and general solution, dynamic arrest, asymptotic expansions. Link between statics and dynamics: from static structure factor to slow relaxation. Collidal glasses and gels.

Critical slowing down beyond MCT
MCT as a mean-field theory. Critical slowing down exponents computation in replica field theory.
Off-equilibrium thermodynamics
Effective temperature
Memory effects: Kovacs, aging

Mode-Coupling* transition or dynamic (RFOT)

Cage effect

Kauzmann or thermodynamic (?) Glass transition
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Starting date: January
Period: January-March 2017
40 hours = 20 + 20
Examination:
* Written assay + talk on chosen subjects
   OR
* Standard oral examination chalk&blackboard
   OR
* Delivery of written exercises during the course

Goal & philosophy:
follow lectures, ask questions, discuss, interact, think about something, learn something, give your examination BEFORE AUGUST and be free to work at your PhD thesis