

## GOALS:

- 1) the simplest SAT-UNSAT transition (→ Chris Moore)
- 2) the simplest replica calculation (→ Giulio Biroli, Florent Krzakala)
- 3) illustrate RSB in fully connected models (→ Federico Ricci)
- 4) connection of SAT-UNSAT and jamming (→ Sid Nagel, Karen Daniels)
- 5) connection between spin glasses and glasses (→ Giulio Biroli, Gilles Tarjus, Ludovic Berthier)
- 6) connection with packing problems in large dimensions (→ Henry Cohn)

## OUTLINE

### A. Perceptron

1. Definitions
  - a. *Perceptron*
  - b. *Constraint satisfaction*
  - c. *Stat mech formulation*
2. Replica method
  - a. *General calculation*
  - b. *Replica symmetric solution*
3. The SAT-UNSAT transition
  - a. *SAT phase*
  - b. *UNSAT phase*
  - c. *Landscape*
  - d. *Isostaticity*
4. Non-convex perceptron
  - a. *Full phase diagram and RSB*
  - b. *Geometric interpretation*

### B. Spheres

1. Spheres as constraint satisfaction problem
  - a. *General formulation*
  - b. *Differences: quenched disorder, crystal*
  - c. *The Franz-Parisi potential*
2. Spheres in infinite dimensions
  - a. *Liquid phase: virial expansion*
  - b. *Results for the transition densities*
  - c. *Out-of-equilibrium: phase diagram and J-line*
3. Criticality of jamming

## REFERENCES:

- Part A and part B1 are based on SciPost Phys. 2, 019 (2017), also on arXiv:1702.06919
- For Replica Symmetry Breaking, see Castellani-Cavagna arXiv:cond-mat/0505032 or FZ, arXiv:1008.4844
- Part B2 is based on the draft of the book available in this Dropbox folder
- For part B3 see Annual Review of Condensed Matter Physics, Vol. 8, 265-288 (2017), also on arXiv:1605.03008