Putting order into disorder: an application to the chronology of my works.

Giorgio Parisi

I have worked in many field that are far away one from the others.

In same case I have done a very fast intrusion for example:

Stochastic resonance, Multifractal in turbolence.

It is clear that the driving force was curiosity, but I will try to find some logic in the trajectory.

A possibility can be found by looking to the toolbox.

I will start with some papers where I have learned many techniques. Later on I will put together papers with similar subjects.

- Parisi, Testa *Generating functionals, Ward identities and scalar mesons* (1969) and *Gauge invariance and dynamical symmetry breaking* (1970)

Functional integral symmetries of functional integrals, generating functionals disconnected, Connected correlation functions, funtional Legendre transform, Ward Identities as invariance of the functionals with local group rotations and the role of the Noether currents.

- Cabibbo, Parisi, Testa, *Hadron production in e+e collisions* (1970); Cabibbo, Parisi, Testa, Verganelakis *Deep inelastic scattering and the nature of partons* (1970); Parisi, Zirilli *Hard bremsstrahlung in e^+e^- collisions* (1971), Parisi, Zirilli *Simple method for computing electrodynamic processes of high order*

Asymtotics behaviours in field theory, perturbation theory infinite momentum frame.

- d'Eramo, Parisi, Peliti *Theoretical predictions for critical exponents at the λ-point of Bose liquids*(1971): Parisi, Peliti *Critical indices for the spherical model from conformal covariant self consistency conditions*

Scaling and conformal invariant field theory.

- Ferrara Gatto Grillo Parisi *The shadow operator formalism for conformal algebra. vacuum expectation values and operator products* (1972) *Covariant expansion of the conformal four-point function*

Complex analytic computations in conformal field theory: Fourier, Laplace transform, complex integrals and contour deformations.

- Lucano, Pace, Parisi, Romano *Experimental check of non linear effects in Al thin films close to Tc*(1972) Parisi *On non linear external field effects in quasi-superconducting films* (1972) *On the mean life-time of the persistent current in a two-dimensional superconductor*

Non linear equations in field theory, non-perturbative field theory, tunnel effects.

- Parisi Cargese Lectures (1973) *Field-theoretic approach to second-order phase transitions in two-and three-dimensional systems* (1980)

Phase transitions, critical exponents, loop computations.

Renormalizability of unrenormalizable theories. (1973) The theory of non-renormalizable interactions: The large N expansion (1975)

Field theory, renormalization group, non perturbative effects.

- Parisi *How to measure the dimension of the parton field* (1973) *Detailed predictions for the pn structure functions in theories with computable large momenta behaviour* (1974) • Parisi Petronzio *On the breaking of Bjorken scaling* (1976)

QCD predictions for deep inelastic scattering: evolution equations for effective for the structure function.

- Altarelli Parisi *Asymptotic freedom in parton language*

Evolution equations for effective parton distributions.

- Parisi *Summing large perturbative corrections in QCD* (1980)

- Parisi *Values of fundamental constants* (1975)

Renormalization group up to the gravity scale

- Maiani, Parisi, Petronzio *Bounds on the Number and Masses of Quarks and Leptons* (1978)

- Cabibbo, Maiani, Parisi, Petronzio *Bounds on the fermions and Higgs boson masses in grand unified theories* (1979)

- Parisi *Quark imprisonment and vacuum repulsion* (1975)

- Cabibbo Parisi *Exponential hadronic spectrum and quark liberation* (1975)

Non perturbative phenomena

- Benzi Parisi Martinelli Anomalous dimensions from a high temperature expansion without a lattice (1976) *High temperature expansion without lattice* (1978)

- Amati Ciafaloni Marchesini Parisi *Expanding disc as a dynamical vacuum instability in Reggeon field theory* (1976)

- Drouffe, Parisi, Sourlas Strong coupling phase in lattice gauge theories at large dimension (1979)

Field theories on the lattice.

- Parisi estimates in perturbation theory (1976)

- Parisi expansion of Feynman diagrams (1976)

- Parisi estimates in perturbation theory with Fermions (1976)

- C Itzykson, G Parisi, JB Zuber *Asymptotic estimates in quantum electrodynamics* (1977)

- Brezin Parisi *Critical exponents and large-order behavior of perturbation theory* (1978)

- Parisi *The Borel transform and the renormalization group* (1979)

- Parisi *On infrared divergences* (1979)

Brézin, Itzykson, Parisi, Zuber *Planar diagrams* (1978)

Matrix models

• Parisi *The perturbative expansion and the infinite coupling limit* (1976)

Resummation techniques. Perturbation theory at non integer order.

- Parisi Sourlas *Random magnetic fields, supersymmetry, and negative dimensions* (1979)

- Fucito, Marinari, Parisi, Rebbi s Proposal for Monte Carlo simulations of Fermionic systems (1980)

- Parisi, Wu Yongshi *Perturbation theory without gauge fixing* (1981)

Stochastic differential equations

- Parisi 5 papers on **spin glasses** (1979)

Replica theory and Spontaneus Replica Simmetry Breaking

- Parisi *Order parameter for spin-glasses* (1983)
- M Mézard, G Parisi, N Sourlas, G Toulouse, M Virasoro *Replica symmetry breaking and the nature of the spin glass phase* (1984)
- Mézard, Parisi, Virasoro *Random free energies in spin glasses* (1985)

Probability theory and spin glasses.

- Parisi *The magnetic properties of the Sherrington-Kirkpatrick model for spin glasses: Theory versus Montecarlo simulations* (1980)

My first Montecarlo.

- F Fucito, F Marchesoni, E Marinari, G Parisi, L Peliti, S Ruffo, A Vulpiani *Approach to equilibrium in a chain of nonlinear oscillators* (1982)

My first molecular dynamics simulation: the role of complex singularities

- G Martinelli, G Parisi, R Petronzio *Monte Carlo simulations for the two-dimensional O (3) non-linear sigma model* (1981)

- Parisi *Correlation functions and computer simulations* (1981)

- M Falcioni, E Marinari, ML Paciello, G Parisi, B Taglienti *Complex singularities in the specific heat of the SU (2) lattice gauge model* (1982)

- G Parisi, F Rapuano, R Petronzio *A measurement of the string tension near the continuum limit* (1983)

- E Marinari, G Parisi, C Rebbi *Computer estimates of meson masses in SU (2) lattice gauge theory* (1982)

- Hamber, G Parisi *Numerical estimates of hadronic masses in a pure SU (3) gauge theory* (1982)

- G Martinelli, G Parisi, R Petronzio, F Rapuano *The proton and neutron magnetic moments in lattice QCD* (1983)

- R Benzi, G Parisi, A Sutera, A Vulpiani *A theory of stochastic resonance in climatic change* (1983)

- Frisch Parisi *On the similarity structure of fully developed turbulence* (1984)

- R Benzi, G Paladin, G Parisi, A Vulpiani *On the multifractal nature of fully developed turbulence and chaotic systems* (1985)

- P Bacilieri, D Passuello, RW Rusack, F Marzano, C Giovannella, D Pascoli, E Remiddi, Roberto Petronzio, P Paolucci, Nicola Cabibbo, F Rapuano, G Fiorentini, G Salina, S Petrarca, F Costantini, G Parisi, E Marinari, S Cabasino, A Fucci, P Rossi, R Tripiccione, S Galeotti *The APE project: a gigaflop parallel processor for lattice calculations* (1985)

- The APE collaboration: *Glueball masses and string tension in lattice QCD* (1987)

The Hadronic Mass spectrum in quenched lattice qcd: Results at $\beta = 5.7$ and $\beta = 6.0$ (1988)

From APE to APE-100: From 1 to 100 Gflops in lattice gauge theory simulations (1990)

- Parisi, Zhang *Eden model in many dimensions* (1984)

- Parisi, Zhang *Driven interfaces moving in a random medium* (1985)

- Kardar, Parisi, Zhang *Dynamic scaling of growing interfaces* (1986)

- Mézard, Parisi:

Replicas and optimization (1985)

Replica Analysis of the travelling salesman problem (1986)

The Euclidean matching problem (1988)

Replica field theory for random manifolds(1991)

The Bethe lattice spin glass revisited (2001)

The cavity method at zero temperature (2003)

- M Mézard, G Parisi, R Zecchina *Analytic and algorithmic solution of random satisfiability problems* (2002)

- Parisi *A memory which forgets* (1986)

Asymmetric neural networks and the process of learning (1987)

Immunological memory in a network perspective (1988)

Two signals from B cells control the expansion of T cells: only one is immunologically specific (1988)

A simple model for the immune network (1990)

- DJ Amit, G Paris, S Nicolis *Neural potentials as stimuli for attractor neural networks* (1990)

- Caracciolo, Parisi, Patarnello, Sourlas *Low temperature behaviour of 3-D spin glasses in a magnetic field* (1990)

- E Marinari, G Parisi *Simulated tempering: a new Monte Carlo scheme* (1992)

- E Marinari, G Parisi, F Ritort *On the 3D Ising spin glass* (1993)

- E Marinari, G Parisi, J Ruiz-Lorenzo, F Ritort *evidence for spontaneously broken replica symmetry in 3D spin glasses* (1996)

- Marinari, Parisi, Ricci-Tersenghi, Ruiz-Lorenzo *Violation of the fluctuation-dissipation theorem in finite-dimensional spin glasses* (1998)

- E Marinari, G Parisi, F Ricci-Tersenghi, JJ Ruiz-Lorenzo, F Zuliani *Replica symmetry breaking in short-range spin glasses: Theoretical foundations and numerical evidences* (2000)

L Leuzzi, G Parisi, F Ricci-Tersenghi, JJ Ruiz-Lorenzo *Dilute one-dimensional spin glasses with power law decaying interactions* (2008)

- S Franz, G Parisi, MA Virasoro *Interfaces and lower critical dimension in a spin glass model*(1992)

- S Franz, G Parisi *Recipes for metastable states in spin glasses* (1995)

U Bastolla, G Parisi *A numerical study of the critical line of Kauffman networks* (1997)

A Cavagna, I Giardina, G Parisi *Barriers between metastable states in the p-spin spherical model* (1997)

A Cavagna, I Giardina, G Parisi, M Mézard *On the formal equivalence of the TAP and thermodynamic methods in the SK model* (2003)

- Marinari, G Parisi, F Ritort *Replica field theory for deterministic models. II. A non-random spin glass with glassy behaviour* (1994)

- LF Cugliandolo, J Kurchan, G Parisi *Off equilibrium dynamics and aging in unfrustrated systems* (1994)

- G Parisi *Off-equilibrium fluctuation-dissipation relation in fragile glasses* (1996)

- Mézard, Parisi *A tentative replica study of the glass transition* (1996)

- B Coluzzi, G Parisi *On the approach to the equilibrium and the equilibrium properties of a glass-forming model* (1998)

- Parisi, *Slanina Toy model for the mean-field theory of hard-sphere liquids* (2000)

TS Grigera, V Martín-Mayor, G Parisi, P Verrocchio *Vibrational spectrum of topologically disordered systems* (2001)

- Michele Ballerini, Nicola Cabibbo, Raphael Candelier, Andrea Cavagna, Evaristo Cisbani, Irene Giardina, Alberto Orlandi, Giorgio Parisi, Andrea Procaccini, Massimiliano Viale, Vladimir Zdravkovic *Empirical investigation of starling flocks: a benchmark study in collective animal behaviour* (2008)

- Andrea Procaccini, Alberto Orlandi, Andrea Cavagna, Irene Giardina, Francesca Zoratto, Daniela Santucci, Flavia Chiarotti, Charlotte K Hemelrijk, Enrico Alleva, Giorgio Parisi, Claudio Carere *Propagating waves in starling, Sturnus vulgaris, flocks under predation* (2011)

- The **Janus** collaboration: Belletti, Cruz, Fernandez, Gordillo-Guerrero, Guidetti, Maiorano, Mantovani, Marinari, Martin-Mayor, Monforte, Muñoz Sudupe, Navarro, Parisi, Perez-Gaviro, Ruiz-Lorenzo, Schifano, Sciretti, Tarancon, Tripiccione, Yllanes *An in-depth view of the microscopic dynamics of Ising spin glasses at fixed temperature* (2009)

  Nature of the spin-glass phase at experimental length scales (2010)

  Thermodynamic glass transition in a spin glass without time-reversal symmetry (2012)

  A statics-dynamics equivalence through the fluctuation–dissipation ratio provides a window into the spin-glass phase from nonequilibrium measurements (2017)

  The Mpemba effect in spin glasses is a persistent memory effect (2019)

- G Parisi, F Zamponi *The ideal glass transition of hard spheres* (2005)
- Jorge Kurchan, Giorgio Parisi, Francesco Zamponi *Exact theory of dense amorphous hard spheres in high dimension I. The free energy* (2012) *II. The high density regime and the Gardner transition* (2013
- Patrick Charbonneau, Jorge Kurchan, Giorgio Parisi, Pierfrancesco Urbani, Francesco Zamponi *Exact theory of dense amorphous hard spheres in high dimension. III. The full replica symmetry breaking solution* (2014)
- Charbonneau, Yuliang Jin, Parisi, Rainone, Seoane, Zamponi *Numerical detection of the Gardner transition in a mean-field glass former* (2015)
- Berthier, Charbonneau, Yuliang Jin, Parisi, Seoane, Zamponi *Growing timescales and lengthscales characterizing vibrations of amorphous solids* (2016)
- Silvio Franz, Giorgio Parisi *The simplest model of jamming* (2016)

- P Facchi, U Marzolino, G Parisi, S Pascazio, A Scardicchio *Phase transitions of bipartite entanglement* (2008)

- Caracciolo, Lucibello, Parisi, Sicuro *Scaling hypothesis for the Euclidean bipartite matching problem* (2014)

- Carlo Lucibello, Flaviano Morone, Giorgio Parisi, Federico Ricci-Tersenghi, Tommaso Rizzo *Finite-size corrections to disordered Ising models on random regular graphs* (2014)

- MC Angelini, C Lucibello, G Parisi, F Ricci-Tersenghi, T Rizzo *Loop expansion around the Bethe solution for the random magnetic field Ising ferromagnets at zero temperature* (2020)

Angelini, Lucibello, Parisi, Perrupato, Ricci-Tersenghi, Rizzo *The loop expansion around the Bethe solution at zero temperature predicts an upper critical dimension equal to 8 for spin glass models in a field* (2021)

A big thank to all the people I was lucky to work with!

This list of 317 scientists is updated up 2018; the size of the name is roughly proportional to the number of paper we wrote together.