

**Iniziativa Specifica: FI11**

Responsabile Nazionale: A. Cappelli

**Elenco dei Partecipanti**

Sezione di FI		Responsabile Locale: Andrea Cappelli									
Nome e Cognome	Ruolo	Incarico	In.Sp.1	Tempo (%)	In.Sp.2	Tempo (%)	In.Sp.3	Tempo (%)	Altri Gruppi	Tempo (%)	Commenti
ANTONIAZZI Andrea	Dottorando	Associato	FI11	100							XIX Ciclo - Dinamica non lineare sistemi complessi
BAGNOLI Franco	Ricercatore Universitario	Associato	FI11	30	FB11	70			ex - INFM		Ric. Univ. Dipart. Energetica Firenze
CAPPELLI Andrea	Dirigente di Ricerca INFN	Dipendente	FI11	70	PI14	30					
CASETTI Lapo	Ricercatore Universitario	Ricerca	FI11	50	FB11	50			ex - INFM		
COLOMO Filippo	Ricercatore INFN	Dipendente	FI11	100							
LIVI Roberto	Professore Associato	Associato	FI11	50	FB11	50	TV12	00	ex - INFM		
PETTINI Marco	Altro	Associato	FI11	70	FB11	30			ex - INFM		Ricercatore Ist.Naz.Astrofisica
PRONKO Andrei	Borsista Post-Doc	Associato	FI11	100							Borsa INFN 1/9/2004 - 31/8/2006
RODRIGUEZ Ivan Diego	Dottorando	Associato	FI11	100							XX Ciclo
RUFFO Stefano	Professore Associato	Associato	FI11	70	FB11	30			ex - INFM		Dip. Energetica
TOGNETTI Valerio	Professore Ordinario	Associato	FI11	30					ex - INFM	70	
ZILLMER Ruediger	Borsista Post-Doc	Associato	FI11	50	FB11	50					Borsa INFN - 1/9/2004 - 31/8/2006

Sezione di GE		Responsabile Locale: Nicodemo Magnoli									
Nome e Cognome	Ruolo	Incarico	In.Sp.1	Tempo (%)	In.Sp.2	Tempo (%)	In.Sp.3	Tempo (%)	Altri Gruppi	Tempo (%)	Commenti
Magnoli Nicodemo	Ricercatore Universitario	Ricerca	FI11	100							

Sezione di TS		Responsabile Locale: Giuseppe Mussardo									
Nome e Cognome	Ruolo	Incarico	In.Sp.1	Tempo (%)	In.Sp.2	Tempo (%)	In.Sp.3	Tempo (%)	Altri Gruppi	Tempo (%)	Commenti
Controzzi Davide	Borsista Post-Doc	Associato	FI11	100							Ott 2006
Delfino Gesualdo	Professore Associato	Associato	FI11	100							
Feverati Giovanni	Borsista Ass. Ric.	Associato	FI11	100							Ott 2005
Mussardo Giuseppe	Professore Ordinario	Ricerca	FI11	100							
Niccoli Giuliano	Dottorando	Associato	FI11	100							SISSA Ott 2006
Ponsot Benedicte	Borsista Post-Doc	Associato	FI11	100							Ott. 2006

STATISTICAL MECHANICS AND FIELD THEORY

INTRODUCTION

This INFN initiative represents a 25-year long tradition of studies in Statistical Mechanics that developed in Florence and other Italian places.

All the people have a quantum field theory background, and thus have been investigating the fruitful relations and analogies among statistical mechanics, condensed matter and particle physics.

The main theme is the study of exactly solvable models in two dimensions, namely the conformal field theories and the integrable systems, and their application to statistical mechanics and condensed matter problems.

Exact solutions provide the tools to understand many physical problems which are characterized by strong interactions and non-perturbative effects. These same problems are also investigated by a variety of numerical methods, and the comparison between the two approaches can often be done.

There is a rather broad spectrum of strongly-interacting systems in statistical mechanics and condensed matter physics, and, accordingly, there are several research lines in this INFN Initiative.

Among others, let us mention the quantum Hall effect and in general the strongly-interacting electron systems in low dimension, the random and disordered systems, the many-body dynamical systems and the approach to equilibrium near a phase transition.

Exactly solvable field theories in two dimensions can also be applied to rather different domains, like the model building in String Theory (here condensed-matter analogies have been rather fruitful).

MAIN INTERESTS OF PARTICIPANTS

Florence Group

A. Cappelli, F. Colomo, A. Pronko: conformal field theories and integrable systems applied to condensed matter and statistical mechanics;

A. Antoniazzi, F. Bagnoli, L. Casetti, R. Livi, M. Pettini, S. Ruffo, R. Zillmer: statistical mechanics and dynamical systems with many degrees of freedom; transport theory and the approach to thermal equilibrium;

V. Tognetti: magnetic systems in low dimensions, applications of the path integral to condensed-matter problems

Genova group

N. Magnoli: conformal field theories and integrable systems applied to condensed matter and statistical mechanics;

Trieste group

D. Controzzi, G. Delfino, G. Feverati, A. Michelangeli, G. Mussardo, G. Niccoli: conformal field theories and integrable systems applied to condensed matter and statistical mechanics;

B. Ponsot: Liouville theory and integrable systems applied to String Theory and quantum gravity.

RECENT RESULTS AND EXPECTED DEVELOPMENTS

Florence Group

In the context of conformal field theory and integrable systems, the recent achievements concern the analysis of boundary conditions, their multicritical properties and their effect on the integrability of the system on the lattice. In the future, we shall describe the properties of defect lines in conformal field theory and obtain further exact results in the 6-vertex model with domain wall boundary conditions.

Regarding the field theoretical descriptions of the quantum Hall effect, we expect to completely understand the mapping of Laughlin electrons into the Chern-Simons matrix model and to develop the associated non-commutative field theory.

Among the several research lines of statistical mechanics and dynamical systems

described in the Activity Report, we would like to point out the progresses in understanding the systems with unscreened long-range interactions, their phases and the dynamics of their quasi-stationary states. Here we shall describe the physical signatures of the relaxation to the quasi-stationary states. Another important sector of investigations concerns the anomalous transport properties of one-dimensional systems and the associated dynamics out of equilibrium. The future developments are expected to explain the heat transport in realistic models of polymers and carbon nanotubes.

#### Genova group

In the framework of conformal perturbation theory, we have studied the Ising model perturbed by the magnetic field by using analytical and numerical techniques (TCS). For the future we plan to study the 3-point function of magnetization operators in the Potts model.

In the framework of Chern-Simons Composite Fermion theories for the Fractional Quantum Hall Effect, we have studied the possible mechanisms for the formation of electron pairs and paired states. Further studies in the quantum Hall effect will consider the issues of fractional charge and statistics for quasiparticles, using both the Chern-Simons approach and the one-dimensional Chiral Luttinger theory of boundary excitations.

#### Trieste group

The recent results include the determination of universal quantities for scaling lattice models, the semiclassical study of the double sine-Gordon model, the study of the mass spectrum of the O(3) sigma model with theta term, the quasiparticle description of conformal field theories, the determination of structure constants for the boundary Liouville theory, the study of boundary renormalisation group flows.

The research activity on these topics will be continued, with particular attention for the study of lattice models directly in the scaling limit through field theoretical methods, the characterisation of the operator space of massive integrable models within the form factor approach and the perturbative and semiclassical study of integrability breaking effects.

### Elenco delle Pubblicazioni

Sezione di FI	Responsabile Locale: Andrea Cappelli
1)	A. Cappelli, G. D'Appollonio, M. Zabzine, Landau-Ginzburg Description of Boundary Critical Phenomena in Two Dimensions, JHEP 0404 (2004) 010
2)	F. Colomo, A.G. Pronko, On the partition function of the six-vertex model with domain wall boundary conditions, Jour. Phys. A37 (2004) 1987
3)	R. Franzosi, and M. Pettini, Theorem on the origin of Phase Transitions, Phys. Rev. Lett. 92, 060601 (2004)
4)	G. Ciriaolo, C. Chandre, R. Lima, M. Vittot, M. Pettini, C. Figarella, P. Ghendrih, Controlling chaotic transport in a Hamiltonian model of interest to magnetized plasmas, J. Phys. A 37, 3589 (2004)
5)	T. Dauxois, S. Lepri and S. Ruffo, Clustering and ensembles inequivalence in the $\phi^4$ and $\phi^6$ mean-field Hamiltonian models, Commun. in Nonlinear Science and Numer. Simul. 8, 375 (2003).
6)	C. Pennetta, E. Alfinito, L. Reggiani and S. Ruffo, Non gaussianity of resistance fluctuations near electrical breakdown, Semic. Sci. Techn. 19, S164 (2004)
7)	Y.Y. Yamaguchi, J. Barre', F. Bouchet, T. Dauxois, S. Ruffo, Stability criteria of the Vlasov equation and quasi-stationary states of the HMF model, Physica A 337, 36 (2004).
8)	R. Khomeriki, Y.A. Kosevich and S. Ruffo, Supersonic discrete kink-solitons and sinusoidal patterns with magic wavenumber in anharmonic lattices, Europhys. Lett. 66, 21 (2004).
9)	J. Barre', T. Dauxois, G. De Ninno, D. Fanelli, S. Ruffo, Statistical theory of high-gain free-electron laser saturation, Phys. Rev. E 69, 045501 (2004).
10)	M. Antoni, A. Torcini, S. Ruffo, First-order microcanonical transitions in finite mean-field models, Europhys. Lett. 66, 645 (2004)
11)	Bagnoli F, Cecconi F, Flammini A, Vespignani A, Short-period attractors and non-ergodic behavior in the deterministic fixed-energy sandpile model, Europhys. Lett. 63 (2003) 512
12)	S. Lepri, R. Livi and A. Politi, Thermal Conduction in Classical Low-dimensional Lattices, Phys. Rep. 377, 1 (2003).
13)	H. Kunz, R. Livi and A. Suto, A Mechanical Model of normal and anomalous diffusion, Phys. Rev. E 67, 011102 (2003)
14)	F. Piazza, S. Lepri and R. Livi, Cooling nonlinear lattices toward localization, Chaos 13, 637 (2003).

- 15) F. Ginelli, R. Livi, A. Politi and A. Torcini, Relationship between directed percolation and the synchronization transition in spatially extended systems, Phys. Rev. E 67, 046217 (2003)
- 16) R. Livi and S. Lepri, Heat in One Dimension, Nature 421, 327 (2003).
- 17) H. Hinrichsen, R. Livi, D. Mukamel, A. Politi, Wetting under nonequilibrium conditions, Phys. Rev. E 68, 041606 (2003).
- 18) F.Colomo, A.G.Pronko, On some representations of the six-vertex model partition function, Phys. Lett. A315 (2003) 231
- 19) L.Capriotti, A.Fubini, T.Roscilde and V.Tognetti, Ising Transition in the two dimensional quantum J1-J2 Heisenberg model, Phys.Rev.Lett 92, 157202 (2004)

Sezione di GE	Responsabile Locale: Nicodemo Magnoli
1) P. Grinza e N. Magnoli, On the magnetic perturbation of the Ising model on the sphere, J.Phys. A36 (2003) L509	
2) M. Caselle, P. Grinza, R. Guida e N. Magnoli, A new class of short distance universal amplitude ratios, J.Phys. A37 (2004) L47	

Sezione di TS	Responsabile Locale: Giuseppe Mussardo
1) G. Mussardo, V. Riva, G. Sotkov, SEMICLASSICAL PARTICLE SPECTRUM OF DOUBLE SINE-GORDON MODEL, Nucl. Phys. B 687, 189 (2004)	
2) D. Controzzi, G. Mussardo, ON THE MASS SPECTRUM OF THE TWO-DIMENSIONAL O(3) SIGMA MODEL WITH THETA TERM, Phys. Rev. Lett. 92, 21601 (2004)	
3) G. Mussardo, V. Riva, G. Sotkov, FINITE VOLUME FORM-FACTORS IN SEMICLASSICAL APPROXIMATION, Nucl. Phys. B 670, 464 (2003)	
4) G. Delfino, INTEGRABLE FIELD THEORY AND CRITICAL PHENOMENA: THE ISING MODEL IN A MAGNETIC FIELD, J. Phys. A 37, R45 (2004)	
5) G. Delfino and P. Grinza, UNIVERSAL RATIOS ALONG A LINE OF CRITICAL POINTS: THE ASHKIN-TELLER MODEL, Nucl. Phys. B 682, 521 (2004)	
6) D. Controzzi, K. Schoutens, ON THE QUASIPARTICLE DESCRIPTION OF C = 1 CFTS, J. Phys. A 37, 4289 (2004)	
7) P. Grinza, A. Mossa, TOPOLOGICAL ORIGIN OF THE PHASE TRANSITION IN A MODEL OF DNA DENATURATION, Phys. Rev. Lett. 92, 158102 (2004)	
8) G. Feverati, EXACT (D) ---> (+)&(-) BOUNDARY FLOW IN THE TRICRITICAL ISING MODEL, JSTAT 0403, P001 (2004)	
9) G. Feverati, P. A. Pearce, F. Ravanini, EXACT PHI(1,3) BOUNDARY FLOWS IN THE TRICRITICAL ISING MODEL, Nucl. Phys. B 675, 469 (2003)	
10) G. Feverati, P.A. Pearce, CRITICAL RSOS AND MINIMAL MODELS: FERMIONIC PATHS, VIRASORO ALGEBRA AND FIELDS, Nucl. Phys. B 663, 409 (2003)	
11) B. Ponsot, LIOUVILLE THEORY ON THE PSEUDOSPHERE: BULK BOUNDARY STRUCTURE CONSTANT, Phys. Lett. B 588, 105 (2004)	
12) I. K. Kostov, B. Ponsot, D. Serban, BOUNDARY LIOUVILLE THEORY AND 2-D QUANTUM GRAVITY, Nucl.Phys.B683, 309 (2004)	

### Theses

Sezione di FI	Responsabile Locale: Andrea Cappelli			
Autore	Titolo	Relatore	Tesi di:	Iniz.Spec.
1)Mauro RICCARDI	Applications of Noncommutative Geometry to the Quantum Hall Effect	A. Cappelli	Dottorato	FI11

Sezione di GE	Responsabile Locale: Nicodemo Magnoli			
Autore	Titolo	Relatore	Tesi di:	Iniz.Spec.
1)CIRIO Lucio	Coomologia equivariante e teorie super Yang-Mills	Nicodemo Magnoli, Ugo Bruzzo	Laurea	FI11
2)PEZZOLI Maria Elisabetta	Stati di Edge nell'Effetto Hall Quantistico Frazionario	Maura Sassetti, Nicodemo Magnoli	Laurea	FI11

Sezione di TS	Responsabile Locale: Giuseppe Mussardo			
Autore	Titolo	Relatore	Tesi di:	Iniz.Spec.
1)Alessandro Mossa	Analytic properties of the free energy in the tricritical Ising model	G. Mussardo	Dottorato	FI11
2)Valentina Riva	Semiclassical QFT on plane and cylindrical geometries	G. Mussardo	Dottorato	FI11

### Consuntivo per l'anno 2004 (cifre in KEuro)

Sezione	Interno	Inviti	Estero	Altro	Totale
FI	4	3.5	8	0	15.5

<b>GE</b>	3.5	1	2.5	0	7
<b>TS</b>	4	4	12	0	20
<b>Totali</b>	11.5	8.5	22.5	0	42.5

**Richieste per l'anno 2005 (cifre in KEuro)**

<b>Sezione</b>	<b>Interno</b>	<b>Inviti</b>	<b>Eestero</b>	<b>Altro</b>	<b>Totale</b>
<b>FI</b>	5	8.5	12	0	25.5
<b>GE</b>	2	1	2	0	5
<b>TS</b>	4	3	11.5	0	18.5
<b>Totali</b>	11	12.5	25.5	0	49

**Assegnazioni per l'anno 2005 (cifre in KEuro)**

<b>Sezione</b>	<b>Interno</b>	<b>Inviti</b>	<b>Eestero</b>	<b>Altro</b>	<b>Totale</b>
<b>FI</b>	3.5	2	9	0	14.5
<b>GE</b>	0.5	0.5	1.5	0	2.5
<b>TS</b>	2	1	5.5	0	8.5
<b>Totali</b>	6	3.5	16	0	25.5

**Ulteriori Richieste 1 per l'anno 2005 (cifre in KEuro)**

(Da richiedere solo durante l'anno 2005 )

<b>Sezione</b>	<b>Interno</b>	<b>Inviti</b>	<b>Eestero</b>	<b>Altro</b>	<b>Totale</b>
<b>FI</b>	2	3	6	0	11
<b>GE</b>	0.5	0	0.5	0	1
<b>TS</b>	2	1.5	4	0	7.5
<b>Totali</b>	4.5	4.5	10.5	0	19.5

**Ulteriori Assegnazioni 1 per l'anno 2005 (cifre in KEuro)**

<b>Sezione</b>	<b>Interno</b>	<b>Inviti</b>	<b>Eestero</b>	<b>Altro</b>	<b>Totale</b>
<b>FI</b>	0	0	0	0	0
<b>GE</b>	0	0	0	0	0
<b>TS</b>	0	0	0	0	0
<b>Totali</b>	0	0	0	0	0

**Ulteriori Richieste 2 per l'anno 2005 (cifre in KEuro)**

(Da richiedere solo durante l'anno 2005 )

<b>Sezione</b>	<b>Interno</b>	<b>Inviti</b>	<b>Eestero</b>	<b>Altro</b>	<b>Totale</b>
<b>FI</b>	0	0	3.5	0	3.5
<b>GE</b>	0	0	0	0	0
<b>TS</b>	0	1.5	4	0	5.5
<b>Totali</b>	0	1.5	7.5	0	9

**Ulteriori Assegnazioni 2 per l'anno 2005 (cifre in KEuro)**

<b>Sezione</b>	<b>Interno</b>	<b>Inviti</b>	<b>Eestero</b>	<b>Altro</b>	<b>Totale</b>
<b>FI</b>	0	0	0	0	0
<b>GE</b>	0	0	0	0	0
<b>TS</b>	0	0	0	0	0

<b>Totali</b>	0	0	0	0	0
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**Ulteriori Richieste 3 per l'anno 2005 (cifre in KEuro)**

(Da richiedere solo durante l'anno 2005 )

Sezione	Interno	Inviti	Estero	Altro	Totale
<b>FI</b>	0	0	0	0	0
<b>GE</b>	0	0	0	0	0
<b>TS</b>	0	0	0	0	0
<b>Totali</b>	0	0	0	0	0

**Ulteriori Assegnazioni 3 per l'anno 2005 (cifre in KEuro)**

Sezione	Interno	Inviti	Estero	Altro	Totale
<b>FI</b>	0	0	0	0	0
<b>GE</b>	0	0	0	0	0
<b>TS</b>	0	0	0	0	0
<b>Totali</b>	0	0	0	0	0

**Totale Assegnazioni per l'anno 2005 (cifre in KEuro)**

Sezione	Interno	Inviti	Estero	Altro	Totale
<b>FI</b>	3.5	2	0	9	14.5
<b>GE</b>	0.5	0.5	0	1.5	2.5
<b>TS</b>	2	1	0	5.5	8.5
<b>Totali</b>	6	3.5	0	16	25.5

<b>Richieste Finanziarie: Sez. FI</b>	<b>Richieste per l'anno 2005</b>
<b>Allegati</b>	
<p>The Florence group is asking 3kEuro of Italian missions to continue the series of period internal meetings of the FI11 collaboration</p> <p>A. Cappelli is asking 1.5kEuro for visiting G. D'Appollonio at the Phys. Dept, King's College, London, for 2 weeks for collaboration on ``Defect lines in conformal field theories``</p> <p>F. Bagnoli is asking 1kE to participate to the Statistical Mechanics meeting, Rutgers Univ.</p> <p>M. Pettini is asking 1kE to visit the CPT-CNRS, Luminy, Marseille, for two weeks to collaborate on ``Control of chaos in Hamiltonian systems``.</p> <p>INVITATIONS =====</p> <p>A. Cappelli is asking 1.5kEuro for inviting P. Pearce of the Dept. of Math and Statistics, Melbourne, for one month for collaboratinf on ``Renormalization group flows in boundary conformal field theory``</p> <p>F. Bagnoli is asking 1.5kE for inviting R. Rechtman of the Energy Research Center, Nat. Autonomous Univ. of Mexico (UNAM), Mexico for one months for collaborating on "Synchronization and propagation of information in nonchaotic systems".</p> <p>F. Colomo is asking 1.5KE for inviting V. S. Kapitonov of St. Peterburg Techn. Inst., for one month for collaboration on ``Exact results in Integrable Models of Statistical Mechanics``</p> <p>F. Colomo is asking 1.5KE for inviting N. M. Bogoliubov from Steklov Inst., St Petersburg, for one month for collaboration on ``Exact results in Integrable Models</p>	

of Statistical Mechanics''

L. Casetti is asking 1.5kE to invite M. Kastner, Phys. Dept., Univ. of Bayreuth, for one month to collaborate on ``Topology and microcanonical phase transitions''

R. Livi is asking 1kE for inviting H. Kunz, Lousanne Polytech., for two weeks for collaborating on ``Out-of-equilibrium phase transitions in spin sytems and interfaces''

N.B.

Curriculum vitae of invited scientists are available at <http://arturo.fi.infn.it/cappelli/is/>

**Richieste Finanziarie: Sez. FI**

Ulteriori Richieste 1 per l'anno 2005

**Allegati**

New researcher: Ivan D. Rodriguez, Ph-D student, XX cycle, supported by a EC fellowship.

The Florence group is asking 2kEuro of Italian missions to continue the series of internal meetings of the FI11 collaboration

F. Colomo is asking 1.5KEuro for participating to the program "Random Matrices, Random Processes and Integrable Systems" Montreal, 20 June-8 July 2005

A. Pronko is asking 1.5KEuro to participate to the Amsterdam Summer Workshop: "Low-D Quantum Condensed Matter 2005" Amsterdam, 25-30 July 2005

A. Cappelli is asking 1.5KEuro to participate to the Amsterdam Summer Workshop: "Low-D Quantum Condensed Matter 2005" Amsterdam, 25-30 July 2005

S. Ruffo is asking 1.5KEuro to participate to the conference "News, Expectations and Trends in Statistical Physics NEXT-SigmaPhi", Kolymbari CRETE, 13-18 August 2005.

Invitations

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F. Colomo and A. Pronko are asking 1.5KEuro for inviting V. S. Kapitonov of St. Peterburg Techn. Inst., for one month for collaboration on ``Exact results in Integrable Models of Statistical Mechanics''

F. Colomo and A. Pronko are asking 1.5KEuro for inviting N. Reshetikhin, of the Univ. of California at Berkeley, for one month for collaboration on ``Exact results in Integrable Models of Statistical Mechanics''

**Richieste Finanziarie: Sez. FI**

Ulteriori Richieste 2 per l'anno 2005

**Allegati**

S. Ruffo is asking 1.5KEuro to participate to the conference "News, Expectations and Trends in Statistical Physics NEXT-SigmaPhi", Kolymbari CRETE, 13-18 August 2005 (this is the reiteration of an earlier request not funded).

F. Colomo is asking 1kEuro to participate to the conference ``Integrable Models and Applications: from Strings to Condensed Matter'', Santiago de Compostela, Spain, 12-16 September 2005.

V. Tognetti is asking 1kEuro to participate to the conference ``Integrable Models and Applications: from Strings to Condensed Matter'', Santiago de Compostela, Spain, 12-16 September 2005.

**Richieste Finanziarie: Sez. FI**

Ulteriori Richieste 3 per l'anno 2005

**Allegati**

**Richieste Finanziarie: Sez. GE**

Richieste per l'anno 2005

**Allegati**

N. Magnoli is asking 1kEuro of Italian missions to continue the series of period internal meetings of the FI11 collaboration

N. Magnoli is asking 1kEuro for inviting R. Guida of Spht, Saclay, for two weeks for collaborating on ``Massive deformations of conformal field theories''

**Richieste Finanziarie: Sez. GE**

Ulteriori Richieste 1 per l'anno 2005

**Allegati**

N. Magnoli is asking .5kE on Italian missions to continue the scientific exchanges internal to the FI11 initiative.

N. Magnoli is asking 0.5KEuro to participate to the Amsterdam Summer Workshop: "Low-D Quantum Condensed Matter 2005" Amsterdam, 25-30 July 2005

**Richieste Finanziarie: Sez. GE**

Ulteriori Richieste 2 per l'anno 2005

**Allegati****Richieste Finanziarie: Sez. GE**

Ulteriori Richieste 3 per l'anno 2005

**Allegati****Richieste Finanziarie: Sez. TS**

Richieste per l'anno 2005

**Allegati**

The Trieste group is asking 3kEuro of Italian missions to continue the series of period internal meetings of the FI11 collaboration

Invitation of V. Fateev, Univ. of Montpellier, for 1 month, for collaboration on non-linear sigma models, 1.5 KEuro.

Invitation of G. Sotkov, Univ. of Sofia, for 1 month, for collaboration on semi-classical methods, 1.5 KEuro.

**Richieste Finanziarie: Sez. TS**

Ulteriori Richieste 1 per l'anno 2005

**Allegati**

The Trieste group is asking 2kEuro of Italian missions to continue the series of period internal meetings of the FI11 collaboration

G. Mussardo asks 2 KEuro for participating to the APCTP Focus Program: 20 June - 9 July 2005, Finite-Size Technology in Low Dimensional Quantum Field Theory, to be held in Pohang, Korea

G. Delfino asks 2 KEuro for participating to the APCTP Focus Program: 20 June - 9 July 2005, Finite-Size Technology in Low Dimensional Quantum Field Theory, to be held in Pohang, Korea

Inviti:

Invitation of A. Sedrakian, Univ. of Erevan, for 1 month, for collaboration on 3D Ising model, 1.5 KEuro.

**Richieste Finanziarie: Sez. TS**

Ulteriori Richieste 2 per l'anno 2005

**Allegati**

G. Mussardo asks 2 KEuro to participate to workshop "Low-D Quantum Condensed Matter 2005", Amsterdam, July 2005

G. Feverati asks 1 KEuro to participate to the conference "Integrable models and applications", Santiago de Compostela, September 2005

G. Niccoli asks 1 KEuro to participate to the conference "Integrable models and applications", Santiago de Compostela, September 2005

Invitation of prof. A. Belavin, Landau Institute Moscow, for 1 month, for collaboration on perturbed conformal field theories, 1.5 KEuro.

**Richieste Finanziarie: Sez. TS**

Ulteriori Richieste 3 per l'anno 2005

**Allegati****Elenco Descrizione Attivita':**



FIRENZE F111 2005 PROGRAM

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New researchers:

A. Antoniazzi, Ph-D student; A. Pronko and R. Zillmer, INFN Postdocs;  
L. Casetti, University permanent researcher.

- A. Cappelli, M. Riccardi, G.R. Zemba

``Noncommutative field theories and the quantum Hall effect''

Analyze the description of the Laughlin Hall state in terms of the non-commutative Chern-Simons field theory as proposed by L. Susskind in 2001: quantization of the corresponding Chern-Simons Matrix Model. Study the quantum mechanics of electrons in the Landau levels when one introduces a further non-commutativity among the coordinates.

- A.Cappelli, G. D'Appollonio, P. Pearce

``Boundary conformal field theories''

Study the renormalization-group flows that change the boundary conditions in a conformal invariant theory, that are relevant for tachyon condensation in string theory. Similar analysis of the defect lines that can be introduced in the conformal theory.

- F. Colomo, A. G. Pronko

``Finite-size corrections to the Partition Function of the 6-vertex model''

The six vertex model with domain wall boundary condition is interesting for its deep connection with the theory of alternating sign matrix and domino tiling. The partition function is known only in the thermodynamic limit, but we are computing the finite size corrections by representing the partition function as a Freedholm determinant of an integral operator. We are moreover investigating exact evaluation of the partition function at some specific values of the deformation parameter of the model.

- M. Pettini, L. Casetti, R. Franzosi

``Topological theory of phase transitions''

The earlier explanation of the origin of phase transitions involving concepts and methods of differential topology will be further developed. We shall investigate the topology changes of equipotential submanifolds of configuration space which entail a thermodynamic phase transition. The description of first order, second order and glassy phase transitions within this differential-topological framework will be a main research topic.

- L. Casetti, M. Kastner

``Topology and microcanonical phase transitions''

We plan to investigate the relation between topology changes of submanifolds of configuration and phase spaces from the microcanonical point of view. This research will be pursued considering simple models as well as studying general properties of classes of physical systems.

- A. Antoniazzi, S. Ruffo, M. Antoni, J. Barre', T. Dauxois, H. Hinrichsen, D. Mukamel

``Dynamics and thermodynamics in systems with long-range interactions''

Long-range interactions (e.g. gravity and Coulomb interactions) lead to inequivalences between the canonical and microcanonical ensembles and to metastable states whose lifetime goes to infinity with the size of the system. We want to derive the thermodynamic limit properties of systems with long-range interactions and to study the relaxation to equilibrium. We have recently developed a general method, based on the theory of large deviations, which allows to obtain the exact solution in the microcanonical and canonical ensembles of a large class of models. The quasi-stationary states, whose relaxation time diverges with system size, have been related to stable stationary states of the Vlasov equation. Next we would like to apply the large-deviation method to models describing more "realistic" systems possessing both long and short-range interactions. Moreover, we would like to find a physical signature of the relaxation to quasi-stationary states: a first indication comes from the analysis of the saturated state of the Free Electron Laser, as described by the Colson-Bonifacio model.

- S. Ruffo, R. Khomeriki, S. Lepri

``Localized excitations in non-linear lattices''

Clusters of ``breathers'' can be produced in the FPU lattices by exciting the modes at the band edges.

- F. Bagnoli, F. Franci, R. Rechtman

"Synchronization and unpredictable behavior of nonchaotic systems"

We investigate the origin of unpredictability in extended systems which are not chaotic from the usual point of view, and their synchronization properties. In particular, we would like to study the connection among damage spreading and our definition of finite-distance Lyapunov exponent in discrete systems (cellular automata) and coupled map lattices. We would like to obtain informations about the chaotic properties of a system from its propension to synchronization with a replica of the system itself.

- R. Livi, S.Lepri and A. Politi

"Study of transport in low-dimensional nonlinear and disordered systems"  
We have pointed out the existence of the universality classes characterizing the divergence of heat conductivity for models in one space dimension.  
We plan to study the anomalous heat transport in realistic models of polymers and carbon nanotubes.

- R. Livi, S. Lepri, F. Piazza and A. Politi  
" Study of localization phenomena in the presence of nonlinearity"  
We have understood the mechanism of spontaneous formation of localized periodic solutions in anharmonic lattices.  
We want to describe the appearance of localized solutions induced by periodic perturbations applied to the boundaries of anharmonic lattices.

- R. Livi, A. Politi, A. Torcini and R. Zillmer  
"Dynamical approach to neural networks dynamics"  
This is a new research line which is going to start in fall 2004 in collaboration with the new INFN postdoc R. Zillmer.  
We would like to characterize quantitatively the robustness of information flow in single neurons and neural networks in the presence of noise.

- V.Tognetti, C.Biagini, A.Varlamov, L. Capriotti  
"Quantum fluctuations in superconductors"  
We have studied quantum fluctuations of magnetic conductivity in two-dimensional superconductors, including doping effects.  
We plan to further analyze transport properties (conductivity, Hall conductivity, thermal conductivity) near the superconductor-insulator transition driven by doping-induced disorder.

Remaning funds at 23/06/2004

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Italian trips 2.5kE, Invitations 1.25kE, Foreign trips 2.5kE  
This remaining money is already allocated and will be spent completely

#### Sezione di GE

GENOVA FI11 2005 PROGRAM  
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- N. Magnoli, M. Caselle, P. Grinza, R. Guida  
``Massive deformations of conformal field theories``  
In the framework of conformal perturbation theory we have studied, by using analytical and numerical techniques (TCS), the Ising model perturbed by the magnetic field on the plane and on the sphere.  
For the future we plan study the 3-point function of magnetization operators in Potts model.

- B. Kramer, N. Magnoli, M. Sassetti  
``Effective field theories of the quantum Hall effect``  
In the framework of Chern-Simons Composite Fermions (CSCF) theories for the Fractional Quantum Hall Effect (FQHE), we have studied the effects of interaction in a two-component Hall fluid at total filling factor 1, addressing the competition between different paired states formation mechanisms.  
We plan to investigate the issues of fractional charge and statistics for FQHE quasiparticles, both with the CSCF approach and in the context of boundary excitations described by the one-dimensional model of the Chiral Luttinger Liquid.

Remaning funds at 23/06/2004

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Italian trips 0 kE, Invitations 0.5kE, Foreign trips 0 kE

TRIESTE F111 2005 PROGRAM

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New researcher: G. Niccoli, A. Michelangeli, new Ph-D students

Research activities:

"Exact correlators and form factors in massive integrable models"  
 Classification of the operators by the solution of the Watson equations of the form factors, study of the spectral series of correlation functions and their exact resummation.

"Non-integrable quantum field theory"  
 Study of the mass spectrum and correction to scattering amplitudes. Confinement of topological excitations and application to nonlinear sigma models with topologic terms within the framework of form factor perturbation theory applied to massless theories. Phase diagrams of several models, including Ising model and double-Sine Gordon

"Semiclassical approach to quantum field theory"  
 A new formulation of semiclassical methods relying on classical solutions of equations of motion allows the determination of finite size energies and quantum matrix elements. This method proves to be efficient to study non-integrable quantum field theories and field theories at finite volume.

"Quantum field theory at finite temperature and finite volume"  
 A new approach has been developed to deal with finite temperature problem. This consists in quantising the theory at finite volume by semi-classical method and extracting in this way the exact matrix elements in finite volume. Correlation functions can be recovered using their spectral representation.

"Boundary Liouville theory and 2-D quantum gravity"  
 Study of boundary correlation functions in Liouville theory and in solvable statistical models of 2D quantum gravity by means of functional equations.

"Quasiparticle description of Conformal Field Theories"  
 Alternative description of massless excitations with fractional statistics and fractional charges. This method shows interesting connections with lattice models such as Calogero-Sutherland.

"Field theory of scaling lattice models"  
 Computation of universal features of the scaling region, including the case of lines of critical points; study of the role of lattice symmetries in the continuum limit of critical antiferromagnets; numerical investigation of analytic properties through the truncated conformal space approach.

"Boundary field theory and surface phase diagrams"  
 Study of the effects induced on field theories and strongly correlated systems by the boundary conditions and their relative boundary flows.

Remaning funds at 23/06/2004

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Italian trips 1.3kE, Invitations 1kE, Foreign trips 3.5kE

This remaining money is already allocated and will be spent completely

## Elenco delle Collaborazioni

### Sezione di FI

	Istituto - Collaboratore	Note
1	CONICET, Buenos Aires / G.R. Zemba	Quantum Hall Effect
2	King's College, London / G. D'Appollonio	Boundary Conformal Field Theory
3	UNAM, Mexico City / R. Rechtman	Synchronization in chaotic sytems
4	Steklov Inst., St. Petersburg / A. G. Pronko	Integrable statistical models
5	CPT - CNRS, Luminy, Marseille / R. Lima and others	Statistical Mechanics, Dynamical Systems
6	Phys Dept, Bayreuth, Germany / M. Kastner	Topology and microcanonical phase transitions
7	Lab. Physique, ENS, Lyon / T. Dauxois and others	Statistical mechanics with long-range forces
8	Hahn Meitner Inst., Berlin / D.H.E. Gross	Statistical mechanics with long-range forces
9	DAMP, Kyoto Univ / Y. Y. Yamaguchi	Statistical mechanics with long-range forces

10	Theory Div., Los Alamos / J. Barre'	Relaxation to statistical equilibrium
11	Polytechnique, Lousanne / H. Kunz	Out-of-equilibrium phase transitions
12	Weizmann Inst., Rehovot, Israel / D. Mukamel	Complex systems
13	KIPT, Santa Barbara / L. Capriotti	Quantum fluctuations in superfluids
14	Rockefeller University, New York / E. G. D. Cohen	Topology and phase transitions

#### Sezione di GE

	Istituto - Collaboratore	Note
1	Dept. of Physics, Hamburg Univ. / B. Kramer	Applications of Luttinger Theory
2	SPhT, Saclay / G. Guida	Massive deformations of conformal field theories

#### Sezione di TS

	Istituto - Collaboratore	Note
1	SPhT, Saclay / R. Guida, I. Kostov and others	integrable field theories
2	ITP, Amsterdam Univ. / K. Schoutens	Conformal Field Theory applications to cond-mat
3	IFT, Univ. Estadual Paulista, Sao Paulo / G. Sotkov	Exact S-matrices and bootstrap approaches
4	Dept. of Math. and Statistics, Univ. of Melbourne / P. Pearce	Integrable lattice statistical models

#### Elenco degli Altri Lavori:

##### Sezione di FI

F.Colomo, A.G.Pronko, On the refined 3-enumeration of alternating sign matrices, preprint math-ph/0404045, submitted to Advances in Applied Mathematics
R. Franzosi, M. Pettini, L. Spinelli, Topology and Phase Transitions: Theorem on a necessary relation, Comm. Math. Phys., (2003) submitted, preprint math-ph/0305032
C. Chandre, M. Vittot, G. Ciraolo, Y. Elskens, M. Pettini, Controlling chaos in area-preserving maps, Physica D, (2004) submitted
L. Sguanci, D.H.E. Gross and S. Ruffo, Apparent fractal dimensions in the HMF model, submitted to Transport Theory and Statistical Mechanics
C. Pennetta, E. Alfinito, L. Reggiani and S. Ruffo, Nongaussian resistance noise near electrical breakdown in granular materials, Physica A (2004) in press.
F. Bagnoli, F. Franci, R. Rechtman, Phase transitions of extended-range probabilistic cellular automata with two absorbing states, preprint cond-mat/0405604
P. Bruscolini, A. Pelizzola, L. Casetti, Phase diagram of a simple model of water: a CVM and Monte Carlo analysis, in "Modeling of Complex Systems", Seventh Granada Lectures (2002), P. L. Garrido and J. Marro, eds., AIP Conf. Proc. 661 (New York, 2003).
R. Livi, S. Ruffo, D. Shepelyansky, Chapter I in "Kolmogorov's legacy in physics", R. Livi, A. Vulpiani Eds., Belin-Springer (2003)
F. Piazza, S. Lepri and R. Livi, Localization as an activated process in 2D non-linear lattices, Proc. Conf. on "Localization and energy transfer in nonlinear systems", World Scientific (2003).
S. Lepri, R. Livi and F. Piazza, Stationary energy transport in nonlinear lattices, ibidem

##### Sezione di GE

M. Merlo, N. Magnoli, M. Sasseti e B. Kramer, On ground states of interacting Composite Fermions with spin at total filling factor 1, preprint cond-mat/0312666
B. Kramer, M. Merlo, N. Magnoli, M. Sasseti, Spin singlet exciton of composite fermions, Phys. Stat. Sol. (B), in press

##### Sezione di TS

G. Mussardo, V. Riva, G. Sotkov, SEMICLASSICAL SCALING FUNCTIONS OF SINE-GORDON MODEL, preprint hep-th/0405139
G. Feverati, P. Grinza, INTEGRALS OF MOTION FROM TBA AND LATTICE-CONFORMAL DICTIONARY, preprint hep-th/0405110
B. Ponsot, FORM-FACTORS IN THE SS MODEL AND ITS RSOS RESTRICTIONS, preprint hep-th/0405218

#### Competing Research Project

We only report main Institutions outside Italy

All Depts of Phys belonging to the European Network  
 "EUCLID, Conformal Field Theory and Applications",  
 see <http://www-users.york.ac.uk/~ec9/fp5data.html>

**Florence Group**

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**Steklov Inst, St Petersburg**

**ITP, Amsterdam Univ.**

**Lab. de Physique, Ecole Normale, Lyon**

**Hahn Meitner Institut, Berlin**

**Phys. Dept., Rockefeller University, NY**

**Phys. Dept., Rutgers University**

**Centers for Nonlinear Studies, Los Alamos and  
 San Diego**

**Centers for Complex Systems, Santa Fe' (USA) and  
 Dresden (D)**

**II Inst. Theo. Phys., Stuttgart**

**Inst. fur Physik, Johannes-Gutenberg-Univ., Mainz**

**Genova Group**

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**Weizmann Institute, Rehovot**

**Trieste Group**

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**Dept of Physics and Astronomy, Rutgers University**

**Newman Labs, Cornell Univ., Ithaca, NY.**

**Theoretical Physics, Univ. of Oxford.**

**Inst. de Fisica Teorica, UAM-CSIC, Madrid**

**Ecole Normale Superieure de Lyon, France**

**Elenco dei Talks**

**Sezione di FI**

Speaker	Titolo	Conferenza	Localita	Data	Autori	Rivista
1 A. Cappelli	Landau-Ginzburg description of boundary multicritical points in two dimensions	Workshop on "Branes in curved backgrounds" at E. Schrodinger Inst.	Vienna	June 2004		
2 F. Bagnoli	Pinching Synchronization of Coupled Map Lattices	Mathematical Problems in the Analysis of Synchronous States in Networks	Huston	May 2004		
3 S. Ruffo	Long-range interactions, a Pandora-box of new phenomena	Non-equilibrium physics in long-range interacting systems, Waseda Univ.	Tokyo	Febr 2004		
4 S. Ruffo	Wave-particle interaction: from plasma physics to the free electron laser	Chaotic transport and complexity in Fluids and Plasmas	Carry-Le-Rouet (Marseille)	June 2004	S. Ruffo	J. Phys. CS (2005)
5 A. Cappelli	Noncommutative field thory and quantum Hall effect	EUCLID EC Network annual conference	Sozopol (BG)	Sept. 2004		
6 F. Bagnoli	Chaos in a Simple Cellular Automaton Model of a Uniform Society	6th Int. Conf. on Cellular Automata for Research and Industry, ACRI 2004	Amsterdam	Oct. 2004	F. Bagnoli, F. Franci, R. Rechtman,	Lecture Notes in Computer Science, Vol. 3305, Springer (2004)

7	S. Ruffo	Non-Gaussian Resistance Fluctuations in Disordered Materials	2nd. Int. SPIE Symp. on Fluctuations and Noise	Maspalomas (Spain)	May 2004	C. Pennetta, E. Alfinito, L. Reggiani, S. Ruffo	"Noise in Complex Systems and Stochastic Dynamics", SPIE Proc. 5471 (2004)
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#### Sezione di GE

	Speaker	Titolo	Conferenza	Localita	Data	Autori	Rivista
1	M. Merlo	On ground states of interacting Composite fermions with spin at half filling	DPG Spring meeting	Regensburg	March 2004		
2	N. Magnoli	Ground state of interacting Composite Fermions with spin at total filling factor one	Int. Work. on Nanoscale Dynamics and Quantum Coherence	Hamburg	Sept. 2004		

#### Sezione di TS

	Speaker	Titolo	Conferenza	Localita	Data	Autori	Rivista
1	D. Controzzi	Mass spectrum of the two-dimensional O(3) sigma model with topological term	APS March meeting	Montreal	March 2004		
2	G. Feverati	Integrals of motion from TBA and lattice-conformal dictionary	EC Network EUCLID Spring School	Montpellier	May 2004		
3	G. Mussardo	The role of topology in sigma models	Int. Conf. STATPHYS 22	Bangalore	July 2004		
4	G. Mussardo	Breaking integrability	EUCLID EC Network annual conference	Sozopol (BG)	Sept. 2004		
5	G. Mussardo	Universal ratios in quantum field theory	Int. Conf. on Statistical Mechanics	Brisbane (AU)	Dec. 2004		
6	G. Delfino	Integrable quantum field theory and critical phenomena	Christmas Workshop on particle physics	Madrid	Dec. 2004		