# Gravità Quantistica

## 4 Aprile 2007

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**Salvatore Capozziello** (Napoli): Dark Energy and Dark Matter or Extended Gravity?

Abstract*: Higher order theories of gravity have recently attracted a lot of interest as alternative candidates to explain the observed cosmic acceleration, the flatness of the rotation curves of spiral galaxies and other relevant astrophysical phenomena. Very likely, what we call "dark matter" and "dark energy" are nothing else but signals of the breakdown of General Relativity at large scales. Furthermore, PPN-parameters deduced from Solar System experiments do not exclude, a priori, the possibility that such theories could give small observable effects also at these scales. We review these results giving the basic ingredients of such an approach.*

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**Ugo Bruzzo** (SISSA): Equivariant cohomology, partition functions and Donaldson invariants

Abstract: *Moduli spaces of instantons carry an action of suitable toric groups. Thus we have an equivariant cohomology for such spaces, and one can identify equivariant cohomology classes with partition functions and expectation values of observables of topological super Yang-Mills theories. This opens the way to a direct computation of Donaldson invariants of (some) projective surfaces. We shall give a brief introduction to this programme and present some work in progress.*

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**Alessandra Feo** (Parma): Toward a lattice formulation of N=2 Super Yang-Mills theory in two dimensions

Abstract: *We consider a lattice formulation of the two dimensional $N=2$ Super Yang-Mills theory where the gauge fields are represented by ordinary unitary link variables and the exact supercharge $Q$ is nilpotent up to infinitesimal gauge transformations.*
*This formulation preserve exactly a single supercharge at finite lattice spacing and the lattice action has an exact $Q$-form. In the continuum limit this lattice supersymmetry is enough to guarantee continuum supersymmetry without fine tuning of any parameters of the theory. Then we show that it is possible to construct other three supercharges that are nilpotent up to infinitesimal gauge transformations and we write a lattice action as an exact ($\tilde Q$ or $Q_1$ or $Q_2$)-form. At finite lattice spacing they define four different lattice models and in each model only one supersymmetry is realized while in the continuum limit, they are all realized at the same time. We also comment about the possibility by using this formulation to improve supersymmetry by just keeping more than one supercharge exact.*

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**Pietro Menotti** (Pisa): Reduced Hamiltonian for intersecting shells
(F. Fiamberti and P. Menotti)

Abstract: *The gauge usually adopted for extracting the reduced hamiltonian of a thin spherical shell of matter in general relativity, becomes singular when dealing with two or more intersecting shells. We introduce here a more general class of gauges which is apt for dealing with intersecting shells. As an application we give the Hamiltonian treatment of two intersecting shell, both massive and massless. Such a treatment can be useful in dealing with the semiclassical approach to the black hole radiation.*

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**Giampiero Esposito** (Napoli): La scuola di quantum gravity di Holbaeck

Abstract: *Dal 12 al 16 Maggio 2008 si terra', presso la baia di Holbaek in Danimarca, la Scuola "New Paths Towards Quantum Gravity". Vi saranno le lezioni di Ambjorn su "Quantum Gravity as a Sum Over Spacetime Histories", Bouwknegt su "Selected Mathematical Aspects of Modern Quantum Field Theory", Gracia-Bondia su "Current Trends in NonCommutative Geometry", Klemm su "Topological Strings and Gromov-Witten Invariants", Reshetikhin su "Quantum Invariants and Quantum Moduli Spaces". La Scuola,*

*pur non potendo coprire tutti gli sviluppi in corso, ha un taglio interdisciplinare e di interazione con la matematica moderna. Gli edifici sono immersi in una foresta di raro fascino e affacciano su una baia, fornendo il clima ideale per lavorare a nuove idee in fisica teorica. Il Seminario si propone di presentare questo progetto alla comunita' italiana di fisica teorica.*

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**Eugenio Bianchi** (Pisa, SNS): Large scale correlations in spinfoam models for quantum gravity

Abstract: *In the loop approach to quantum gravity, we study large scale correlations of geometric operators on a semiclassical state peaked on a flat geometry. The calculation involves spinfoam techniques and the boundary amplitude formalism. The correlations found correspond to the two-point function of perturbative quantum gravity on a flat background.*

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**Simone Speziale** (Perimeter Institute): Recent advances on the semiclassical limit of Loop Quantum Gravity

Abstract*: A key open question of Loop Quantum Gravity is how to study the semiclassical limit, and whether it correctly reproduces General Relativity. At stake is not only the consistency of the theory, but also the possibility of unveiling its physical implications for classical gravity and particle physics. Crucial progress has recently been obtained by looking at the weak field approximation, when the effects of gravity are small but quantum mechanics is still relevant: a proposal to compute the free graviton propagator has been shown to reproduce the behaviour expected from the conventional theory of linearised quantum gravity.These developments rely on the use of a quantum state encoding the classical geometry of the (flat) background around which the weak field limit is taken. Yet there is no unique prescription for such a state. In this talk, I will propose a choice of the state leading to a representation of the propagator as an integral over SU(2). This integral representation is crucial to support the proposal numerically. I will then discuss further possible improvements on understanding the state, coming from the analysis of the Regge action emerging from the propagation kernel, and from constructing spin network states which encode a classical geometry around each node.*

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**Roberto Percacci** (SISSA): TBA

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**Mario Nadalini** (Trento): Thermodynamical Properties of Hairy Black Holes With Cosmological Constant

Abstract: *We present an analysis of solutions of General Relativity with a scalar field conformally coupled to the gravity sector. These are interesting thanks to the possibility, in principle, of obtaining black hole solutions with negative thermodynamical entropy. Then, we move on to a thermodynamical analysis of those solutions and give a prescription for how to deal with such entropies and focus our attention to a somewhat unexpected result regarding the AdS/CFT correspondence.*

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**Luca Parisi** (Salerno): Stability of static solutions in LQC closed models

*Loop Quantum Gravity has been successfully employed to tackle cosmology in FRW universes. Loop Quantum Cosmology provides a new mechanism for avoiding the initial singularity. The typical models pass through a bounce, but one can also consider models that emerge from a static initial state.*
*In general relativity the Einstein static model is unstable and one requires extreme fine-tuning. Within an earlier version of LQC, the Einstein static model has been shown to be a centre of stability, thus avoiding the fine-tuning. Using a more recent version of the LQC Friedman equation, we analyze the general issue of the Einstein static model and its stability, by employing dynamical systems theory and numerical integrations. We compare our results with those obtained in the earlier version of LQC, and with results for certain braneworld models with a similar Friedman equation.*