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**[2011-016T] 1DDisQuaRM**

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Porteur : **Christophe Texier**

Axe **B**

## The Lyapunov Exponent of Products of Random 2x2 Matrices Close to the Identity

*Article publié en 2013*

Auteurs : Comtet, Alain; Luck, Jean-Marc; Texier, Christophe; Tourigny, Yves

Réf. : JOURNAL OF STATISTICAL PHYSICS Volume: 150 Issue: 1 Pages: 13-65 DOI: 10.1007/s10955-012-0674-8 Published: JAN 2013

We study products of arbitrary random real 2x2 matrices that are close to the identity matrix. Using the Iwasawa decomposition of  $SL(2, \mathbb{R})$ , we identify a continuum regime where the mean values and the covariances of the three Iwasawa parameters are simultaneously small. In this regime, the Lyapunov exponent of the product is shown to assume a scaling form. In the general case, the corresponding scaling function is expressed in terms of Gauss' hypergeometric function. A number of particular cases are also considered, where the scaling function of the Lyapunov exponent involves other special functions (Airy, Bessel, Whittaker, elliptic). The general solution thus obtained allows us, among other things, to recover in a unified framework many results known previously from exactly solvable models of one-dimensional disordered systems.

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**[2011-027T] BLOCOS**

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Porteur : **Y. Sortais**

Thème **1**

## Sub-Poissonian atom-number fluctuations using light-assisted collisions

*Article publié en 2012*

Auteurs : Sortais Y. R. P.; Fuhrmanek A.; Bourgain R.; et al.

Réf. : PHYSICAL REVIEW A Volume: 85 Issue: 3 Article Number: 035403 DOI: 10.1103/PhysRevA.85.035403 Published: MAR 13 2012

We investigate experimentally the number statistics of a mesoscopic ensemble of cold atoms in a microscopic dipole trap loaded from a magneto-optical trap and find that the atom-number fluctuations are reduced with respect to a Poisson distribution due to light-assisted two-body collisions. For numbers of atoms  $N$  greater than or similar to 2, we measure a reduction factor (Fano factor) of  $0.72 \pm 0.07$ , which differs from 1 by more than four standard deviations. We analyze this fact by a general stochastic model describing the competition between the loading of the trap from a reservoir of cold atoms and multiatom losses, leading to a master equation. Applied to our experimental regime, this model indicates an asymptotic value of  $3/4$  for the Fano factor at large  $N$  and in the steady state. We thus show that we have reached the ultimate level of reduction in number fluctuations in our system.

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**[2011-030T] DySpaN**

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Porteur : **L. Zdeborova**

Axe **B**

## **Probabilistic reconstruction in compressed sensing: algorithms, phase diagrams, and threshold achieving matrices**

*Article publié en 2012*

Auteurs : Krzakala, Florent; Mezard, Marc; Sausset, Francois; Sun, Yifan; Zdeborova, Lenka

Réf. : JOURNAL OF STATISTICAL MECHANICS-THEORY AND EXPERIMENT Article Number: P08009  
DOI: 10.1088/1742-5468/2012/08/P08009 Published: AUG 2012

Compressed sensing is a signal processing method that acquires data directly in a compressed form. This allows one to make fewer measurements than were considered necessary to record a signal, enabling faster or more precise measurement protocols in a wide range of applications. Using an interdisciplinary approach, we have recently proposed in Krzakala et al (2012 Phys. Rev. X 2 021005) a strategy that allows compressed sensing to be performed at acquisition rates approaching the theoretical optimal limits. In this paper, we give a more thorough presentation of our approach, and introduce many new results. We present the probabilistic approach to reconstruction and discuss its optimality and robustness. We detail the derivation of the message passing algorithm for reconstruction and expectation maximization learning of signal-model parameters. We further develop the asymptotic analysis of the corresponding phase diagrams with and without measurement noise, for different distributions of signals, and discuss the best possible reconstruction performances regardless of the algorithm. We also present new efficient seeding matrices, test them on synthetic data and analyze their performance asymptotically.

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**[2011-033T] JELIC**

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Porteur : **Cécile APPERT-ROLLAND**

Axe **B**

## **Properties of pedestrians walking in line: Fundamental diagrams**

*Article publié en 2012*

Auteurs : Jelic Asja; Appert-Rolland Cecile; Lemerrier Samuel; et al

Réf. : PHYSICAL REVIEW E Volume: 85 Issue: 3 Article Number: 036111 DOI:  
10.1103/PhysRevE.85.036111 Part: Part 2 Published: MAR 28 2012

We present experimental results obtained for a one-dimensional pedestrian flow using high precision motion capture. The full pedestrians' trajectories are obtained. In this paper, we focus on the fundamental diagram, and on the relation between the instantaneous velocity and spatial headway (distance to the predecessor). While the latter was found to be linear in previous experiments, we show that it is rather a piecewise linear behavior which is found if larger density ranges are covered. Indeed, our data clearly exhibits three distinct regimes in the

behavior of pedestrians that follow each other. The transitions between these regimes occur at spatial headways of about 1.1 and 3 m, respectively. This finding could be useful for future modeling.

Accession Number: WOS:000302019200001

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## [2011-035T] RASYCOH

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Porteur : **M.E Couprie**

Thème 6

### Soft x-ray femtosecond coherent undulator radiation in a storage ring

*Article publié en 2012*

Auteurs : Evain C.; Loulergue A.; Nadji A.; et al.

Réf. : NEW JOURNAL OF PHYSICS Volume: 14 Article Number: 023003 DOI: 10.1088/1367-2630/14/2/023003 Published: FEB 1 2012

We propose to produce femtosecond pulses of soft x-ray coherent undulator radiation in a storage ring for user pump-probe experiments using two energy exchanges between a picosecond relativistic electron bunch and two external ultra-short laser pulses. The coherent emission is generated thanks to the two laser-electron interactions that modulate the longitudinal charge distribution of the electron bunch at a harmonic of the laser wavelength, such as in the echo-enabled harmonic generation in free-electron lasers. Application to the SOLEIL storage ring in the soft x-ray range leads to coherent radiation and improvement of the flux of the photons by several orders in magnitude compared to the conventional slicing scheme. This is also accompanied by a significant enhancement of the signal-to-noise ratio.

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## [2011-045T] Gravicold

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Porteur : **Thomas Bourdel**

Thème 1

### Phase diagrams of two-dimensional and three-dimensional disordered Bose gases in the local density approximation

*Article publié en 2012*

Auteurs : Bourdel, Thomas

Réf. : PHYSICAL REVIEW A Volume: 86 Issue: 6 Article Number: 063626 DOI: 10.1103/PhysRevA.86.063626 Published: DEC 21 2012

We study superfluid transitions in bidimensional (2D) and tridimensional (3D) disordered and interacting Bose gases. We work in the limit of long-range correlated disorder such that it can be treated in the local density

approximation. We present superfluid transition curves in both the disorder-temperature plane and the disorder-entropy plane in 2D and 3D Bose gases. Surprisingly, we find that a small amount of disorder is always favorable to the apparition of a superfluid. Our results offer a quantitative comparison with recent experiments in 2D disordered ultracold gases, for which no exact theory exists. DOI:10.1103/PhysRevA.86.063626

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## [2011-080T] SPECORYD

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Porteur : Christian Jungen

Axe B

### Resonances in photoionization: Cross sections for vibrationally excited H-2

*Article publié en 2012*

Auteurs : Mezei J. Zs; Schneider I. F.; Roueff E.; et al.

Réf. : PHYSICAL REVIEW A Volume: 85 Issue: 4 Article Number: 043411 DOI: 10.1103/PhysRevA.85.043411 Published: APR 13 2012

Multichannel quantum defect theory is used to calculate photoionization cross sections for vibrationally excited diatomic hydrogen. The calculations are based on the state-of-the-art clamped-nuclei potential energy curves and electronic dipole transition moments of Wolniewicz. The calculations indicate that, in contrast to what had been assumed previously, autoionization resonances dominate the cross section.

### Dissociative recombination of electrons with diatomic molecular cations above dissociation threshold: Application to H-2(+) and HD+

*Article publié en 2013*

Auteurs : Chakrabarti, K.; Backodissa-Kiminou, D. R.; Pop, N.; Mezei, J. Zs.; Motapon, O.; Lique, F.; Dulieu, O.; Wolf, A.; Schneider, I. F.

Réf. : PHYSICAL REVIEW A Volume: 87 Issue: 2 Article Number: 022702 DOI: 10.1103/PhysRevA.87.022702 Published: FEB 6 2013

Our approach to the dissociative recombination and competitive processes based on the multichannel quantum defect theory is extended to the full account of the dissociative excitation, including the electronic excitation of the molecular ion. Compared to other existing modelings, ours relies on a simpler and less-time-consuming discretization of the vibrational continua of the target ion and to a more accurate account of the Rydberg-valence interactions via a second-order solution of the Lippman-Schwinger equation. A thorough study of the competition among the dissociative recombination, vibrational excitation, and dissociative excitation is performed, including a detailed analysis of the two different mechanisms governing the ion dissociation. The application of our method to the high-energy electron collisions with H-2(+) and HD+ ions results in a cross section in good agreement with the best previous modeling and with the most recent measurements performed in the Test Storage Ring of the Max-Planck-Institut für Kernphysik in Heidelberg. DOI: 10.1103/PhysRevA.87.022702

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**[2011-084T] Cocain**

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Porteur : J-M George

Thème 5

## Electrical and thermal spin accumulation in germanium

*Article publié en 2012*

Auteurs: Jain, A.; Vergnaud, C.; Peiro, J.; Le Breton, J. C.; Prestat, E.; Louahadj, L.; Portemont, C.; Ducruet, C.; Baltz, V.; Marty, A.; Barski, A.; Bayle-Guillemaud, P.; Vila, L.; Attane, J. -P.; Augendre, E.; Jaffres, H.; George, J. -M.; Jamet, M.

Réf. : APPLIED PHYSICS LETTERS Volume: 101 Issue: 2 Article Number: 022402 DOI: 10.1063/1.4733620 Published: JUL 9 2012

In this letter, we first show electrical spin injection in the germanium conduction band at room temperature and modulate the spin signal by applying a gate voltage to the channel. The corresponding signal modulation agrees well with the predictions of spin diffusion models. Then, by setting a temperature gradient between germanium and the ferromagnet, we create a thermal spin accumulation in germanium without any charge current. We show that temperature gradients yield larger spin accumulations than electrical spin injection but, due to competing microscopic effects, the thermal spin accumulation remains surprisingly unchanged under the application of a gate voltage. (C) 2012 American Institute of Physics. [<http://dx.doi.org/10.1063/1.4733620>]