

# GPP Theory group

— [ 3 members:

— [ David London (phenomenology; applying 07)

— [ Richard MacKenzie (field theory; quantum information)

— [ Manu Paranjape (field theory and gravity; applying 07)

# Overall statistics: HQP

— [ Two postdocs: Alejandro Szynkman, Makiko Nagashima [DL]

— [ Three students: Maxime Imbeault [PhD, DL], Faïza Nebia-Rahal [PhD, RM+MP], Olivier Landon-Cardinal [MSc, RM+GB]

— [ 2002-2007 inclusive: 6 postdocs, 4 PhD, 18 MSc, 18 Undergraduate (summer students)

— [

# Research interests: DL

Weak interaction phenomenology, B physics and CP violation

— [ Some individual projects:

- B- $\rightarrow$ pi K data and supersymmetry?
- polarization in B decays
- CP violation in tau decays
- CP violation in SUSY theories
- Triple products in B decays

# Research interests: RM

## 1) Various field theory applications

### — [ Some individual projects:

- Q-balls (nontopological solitons) in Maxwell-Chern-Simons theory
- Josephson effect via field theory; non-abelian generalization
- Confinement and phase transitions in Abelian Higgs model (2+1d) – lattice

# Research interests: RM

## 2) Quantum information

### — [ Some individual projects:

- Adiabatic approximation in quantum mechanics (useful in QI and beyond!)
- State discrimination in multipartite systems
- Entanglement and communication

# Research interests: MP

— [ on sabbatical leave at the Center for Quantum Spacetime,  
Department of Physics, Sogang University, Seoul, Korea

# Sabbatical tour (2007/2008):

— [ July 2nd, 2007 - August 23rd, 2007, (Kavli) Institute for Theoretical Physics, Chinese Academy of Sciences, Beijing, China

— [ August 24th, 2007 - June 30th, 2008, Center for Quantum Spacetime, Department of Physics, Sogang University, Seoul, Korea

— [ December 7th, 2007 - December 28th, 2007, Inter-University Center for Astronomy and Astrophysics, Pune, India

— [ December 29th, 2007 - January 19th, 2008, Institute of Physics, Bhubaneswar, India

— [ April 26th, 2008 - May 10th, 2008, Institute of Systems, Biology and Bioinformatics, Department of Physics, National Central University, Chongli, Taiwan

— [ July 1st, 2008 - August 10th, 2008, Department of Physics, Osaka University, Osaka, Japan

# Quantum field theory, solitons and other quantum dynamical systems

— [ Noncommutative geometry

— [ Conformal/alternative gravity

— [ 2+1 dimensional abelian Higgs model and anyons

— [ Non-abelian Josephson effect

— [ Path Integration with complex actions

— [ Bethe Ansatz and the AdS/CFT correspondence



# Noncommutative geometry and the quantum Hall effect:

— [ **A. Khare and M. B. Paranjape,** Solitons in (2+1)-dimensional noncommutative Maxwell Chern-Simons Higgs theories, JHEP 0104:002,2001.

— [ **D. Arnaudon, G. Alexanian, M. B. Paranjape,** On plane wave and vortex-like solutions of noncommutative Maxwell-Chern-Simons theory, JHEP 0311:011,2003.

— [ **I. Prémont-Schwarz, G. Alexanian, M. B. Paranjape,** Solitons in finite droplets of noncommutative Maxwell-Chern-Simons theory, JHEP 0601:020,2006.

— [ **J. Lambert, M. B. Paranjape,** Quasi-hole solutions in finite noncommutative Maxwell-Chern-Simons theory, JHEP 0705:007,2007

— [ **G. Alexanian, J.-F. Rajotte, M. B. Paranjape,** Deformation of noncommutative solitons, in preparation, based on thesis work of J.-F. Rajotte

# Conformal Gravity

— [ **A. Edery, M. B. Paranjape,** Classical tests for Weyl gravity: Deflection of light and radar echo delay, Phys.Rev.D58:024011,1998.

— [ **A. Edery, M. B. Paranjape,** Causal structure of vacuum solutions to conformal (Weyl) gravity, Gen.Rel.Grav.31:1031-1047,1999.

— [ **A. Edery, A. Méthot, M. B. Paranjape,** Gauge choice and geodetic deflection in conformal gravity, Gen.Rel.Grav.33:2075-2079,2001.

— [ **A. Edery, L. Fabbri, M. B. Paranjape,** Spontaneous breaking of conformal invariance in theories of conformally coupled matter and Weyl gravity, Class.Quant.Grav.23:6409-6423,2006.

— [ **J. Bouchami, M. B. Paranjape,** Spontaneous breaking of conformal invariance and gravitational waves in theories of conformally invariant gravitation, in preparation, based on thesis work of J. Bouchami.

# 2+1 d Abelian Chern-Simons Higgs Model

— [ **P. Irwin, M. B. Paranjape,** Topological symmetry breaking and confinement of anyons, submitted to PRD.

— [ **R. MacKenzie, F. Nebia-Rahal, M. B. Paranjape,** Phase transitions in the spontaneously broken sector of the 2+1 dimensional abelian Higgs model, arXiv:0710.3236 [hep-lat], submitted to PRL.

# Complex Actions and the Feynman Path Integral

— [ **G. Alexanian, R. MacKenzie, M. B. Paranjape, J. Ruel,** Problems With  
Complex Actions, Can. J. Phys 85(6), 699-705 (2007).

# Non-abelian Josephson Effect and Pseudo-Goldstone Bosons

— [ P. Esposito, L.-P. Guay, R. MacKenzie, M. B. Paranjape, L. C. R.  
**Wijewardhana,** Field theoretic description of the abelian and non-abelian Josephson effect, Phys.Rev.Lett.

98:241602,2007.

# Bethe Ansatz, the string hypothesis and the ADS/CFT correspondence

— [ **K. Isler and M. B. Paranjape,** Violations of the string hypothesis in the solutions of the Bethe ansatz equations in the XXX Heisenberg model, Phys.Lett.B319:209-214,1993.

— [ **B.-H. Lee, M. B. Paranjape and J.-H. Park,** Consequences of threshold magnon bound states for the AdS-CFT correspondence, in progress.

# Conclusion

— [ Active research projects

— [ Creative ideas

— [ Crying need for money for a post-doc, at least shared, with  
Richard MacKenzie