

## Allegato A PROGETTO Scienza senza Frontiere – Brasile

### Name of the doctoral program

PhD in Physics

Full degree X Cotutelle X

### Title of the research activity

Ultracold atoms for the study of strongly correlated systems

### Short description of the research activity

A fascinating aspect of *trapped ultracold atoms* is the possibility of realizing *low-dimensional systems*, able to display *strongly correlated quantum effects*. On the one hand, the group will explore extended versions of the *1D Hubbard model* where the tunneling amplitudes between sites of an optical lattice can be tuned depending on the local particle occupation, a situation realized in recent experiments. On the other hand, the physics of *rotating atomic gases* will be studied under dynamical deformation of the trap parameters, allowing the preparation of emblematic quantum states, like the ones that characterize the physics the fractional *quantum Hall effect*. The work will be focused on the search for new quantum states of matter and the study of their most interesting properties, like topological phases and entanglement properties.

#### References:

- M. Roncaglia, C. Degli Esposti Boschi and A. Montorsi, Phys. Rev. B 82, 233105 (2010).
- A. Anfossi, L. Barbiero, and A. Montorsi, Phys. Rev. A 81, 043630 (2010).
- M. Allegra, P. Giorda, and A. Montorsi, Phys. Rev. B 84, 245133 (2011).
- T. Keilmann, S. Lanzmich, I. McCulloch and M. Roncaglia, Nature Communications 2, 361(2011).
- M. Roncaglia, M. Rizzi, J. Dalibard, Scientific Reports 1, 43 (2011).

### Scientific responsible (name, surname, role)

Arianna Montorsi (Associate professor, theoretical physics)

Email: [arianna.montorsi@polito.it](mailto:arianna.montorsi@polito.it)

### Number of vacancies for XXVIII cycle (begin January 2013)

1 (one)

### Specific requirements (experiences, skills)

M. Sc. in Physics; Basic notions on quantum statistical mechanics, and solid state physics

### Website of the research group (if any)

<http://areweb.polito.it/ricerca/nqs/NQS/Home.html>