**PhD Physics course at Bari University (XXXIII Cycle)**

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| **Title** | States, Observables, and Evolution |
| **Proponent** | Prof. Paolo Facchi |
| **# CFU**  **(1 CFU = 8 hours)** | 2 |
| **Schedule** | March-April 2018 |
| **Brief Summary of the course** | The course provides an introduction to the standard statistical model of classical and quantum physics in an algebraic framework.  The course is structured in four parts dealing with 1) an introduction to the algebras of observables; 2) Weyl relations and Heisenberg algebra; 3) introduction to the geometry of states and observables; 4) Symmetries, kinematics and dynamics. |
| **Programme** | 1. Introduction to quantum physics. Stern-Gerlach experiment and measurement algebra in finite dimensional systems.  2.1 General postulates of a statistical description. States and observables. Mixture and pure states.  2.2 The standard statistical model of quantum mechanics. Basic concepts. Weyl relations. Symmetries, kinematics and dynamics.  2.3 Composite systems. Entanglement and quantum nonseparability. Statistics of quantum measurements. Generalized observables.  3. Symmetries, kinematics and dynamics. Evolution of closed and open systems. Unitary groups and completely positive maps. |
| **Recommended texts** | F. Strocchi–An introduction to the mathematical structure of quantum mechanics (World Scientific, Singapore 2008)  A.S. Holevo–Statistical Structure of Quantum Theory (Springer, Berlin2001) |
| **Assessment methods** | Seminar on a selected topic. |