Quantum Field Theory in Quantum Information

Local Quantum Physics

2nd, 3rd, 4th December 2013 (Schedule: 10-13 h, 15 -18 ½ h)

New Venue:

Facultad de Ciencias Físicas UCM

Seminar Rooms of the Departments Física Teórica I and II

	Dec 2 (Room FT I)	Dec 3 (Room FT I)	Dec 4(Room FT II)
10.00-11.00	Haggard	Rovelli	Haggard
11.30-13.00	Yngvason	Haggard/Rovelli	Haggard
15.00-16.30	Yngvason	Yngvason	
17.00-18.30	Round table	Yngvason	

Hal Haggard (Centre de Physique Theorique, Marseille) "Entanglement and thermality in finite spacetime regions "

Entanglement compellingly explains the thermal properties of quantum black holes: it naturally encodes an area law for entropy that is independent of the matter species surrounding the black hole and of the cutoff on these quantum fields. Surprisingly, this turns out to be just one example of an entire formalism for treating the thermodynamics of quantum isolated systems: an entanglement thermodynamics. In these lectures I will introduce entanglement thermodynamics, examine hot finite regions, and discuss how entanglement is being used to expose the architecture of spacetime.

Carlo Rovelli (Centre de Physique Theorique, Marseille) "What is a particle?"

Gravity makes the notion of particle problematic in quantum field theory. In general Poincaré invariance is not available, and the standard notion of quantum particles is ill-defined on curved spacetime and quantum gravity. I observe that already on flat space there exist two distinct notions of particles: globally defined n-particle Fock-states and *local particle states*. The last describe the physical objects detected by finite-size particle detectors, are eigenstates of local field operators. In an appropriate limit, global and local particle states converge in a weak topology (not in norm). Unlike conventional global particle states, local particle states remain meaningful in the presence of classical and quantum gravity.

Jakob Yngvason (Institute for Mathematical Physics, Vienna): "An invitation to Local Quantum Physics."

The combination of (special) relativity and quantum theory leads to mathematical structures that differ in several respects from those familiar from quantum mechanics of systems with a finite number of degrees of freedom. The mini-course will survey a selection of insights into the structure of relativistic quantum physics that have accumulated through the efforts of many people over more than 50 years. A central concept is that of the localization of observables in space and time, and the name "Local Quantum Physics" has been coined to emphasize this aspect. Topics: Relativistic symmetries; problems with position operators in relativistic quantum mechanics and their resolution; relativistic causality and local algebras of observables; from local algebras to scattering of particles

Students in the Master's program of Theoretical Physics are most welcome. For further information on the lectures or the schedule, please check: http://quinfog.iff.csic.es/qfields-qi-2013