COURS THEMATIQUES

Les 4 et 11 décembre 2018, une série de leçons sera organisée sur le thème

Many-body quantum chaos:
from black holes to hydrodynamics

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Abstract: **Chaos is a well-understood phenomenon within classical physics. According to its simplest definition, it stems from the dynamics of particles, which follow trajectories with extreme sensitivity to initial conditions. Two commonly associated phenomena are the exponential Lyapunov divergence of initially nearby trajectories and the butterfly effect.**

In many-body quantum physics, the situation is completely different. There, the very definition of what quantum chaos is remains unclear. Even more elusive are its characterisation and classification. In this four-hour lecture course, I will discuss exciting recent revival of interest in addressing these questions, which was largely ignited by studies of the physics of black holes.

CPHT – ECOLE POLYTECHNIQUE

First and second lectures: Tuesday December 4
11:00 & 14:00 – salle Louis Michel – CPHT

Plan:

- A short review on classical chaos: Lyapunov exponents and the butterfly effect.

- A measure of quantum chaos: the out-of-time-ordered correlation function (OTOC).

- When is the OTOC a good measure of chaos?

- An example of a quantum (maximally) chaotic system: the Sachdev–Ye–Kitaev model.

- A primer on black-hole physics and gauge-string duality (holography).

- Calculation of OTOCs in holography and the Maldacena–Shenker–Stanford bound.

Third and fourth lectures: Tuesday December 11
11:00 & 14:00 – salle Louis Michel – CPHT

Plan:

- Hydrodynamics and collective dynamics of energy and momentum.

- Holographic aspects of hydrodynamics.

- A new universal property of Einstein gravity and connection between (complex) analytic properties of hydrodynamics and quantum chaos: "pole-skipping".