Speaker: **Benoît Zumer, LPTM, Cergy Université, Cergy, France**

Title: **A theoretical description of classical and quantum phenomena associated with three Rydberg atoms in a circular trap**

Date: **Tuesday, April 15, 11:00 am**

Place: **Seminar room 915**

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Abstract:

Our work deals with the classical and quantum dynamics of three interacting particles modeling three Rydberg atoms in a circular trap. This is a novel, experimentally feasible system of trapped particles displaying a striking classical-quantum correspondence [1][2].

First, we study the classical dynamics of the system. It exhibits a classical mixed phase space, that is to say that it comprises both ergodic regions and non-ergodic islands. Then, we construct the system and compare it with integrable and non-integrable systems with the same symmetry group. Then we identify periodic trajectories in the system and calculate their Lyapunov exponent. We identify the appearance of bifurcations in this system, discuss their stability and analyse the impact of symmetries on them.

Then, we turn to the quantum mechanics. We initiate the study of the quantum eigenstates which we sort in terms of the discrete symmetries of the system. We numerically calculate the quantum eigenstates of the system and show that some of them are scarred by a classically unstable periodic trajectory, in the vicinity of which the classical analog exhibits chaos. The few-body scar we consider is stabilized by quantum mechanics, and we analyze it along the lines of the original quantum scarring mechanism.

References

[1] D. J. Papoular and B. Zumer. Quantum scar affecting the motion of three interacting particles in a circular trap. Phys. Rev. A, 107:022217, Feb 2023..

[2] D. J. Papoular and B. Zumer. Quantum signatures of the mixed classical phase space for three interacting particles in a circular trap. Phys. Rev. A, 110:012230, Jul 2024