



Institut für
Angewandte Physik



Physikalisches
Institut



RHEINISCHE
FRIEDRICH-WILHELMS-UNI-
VERSITÄT BONN

COLLOQUIUM „OPTICS AND CONDENSED MATTER“

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Many-body radiative decay in strongly interacting Rydberg ensembles

When atoms are excited to high-lying Rydberg states they interact strongly with dipolar forces. The resulting state-dependent level shifts allow to study many-body systems displaying intriguing nonequilibrium phenomena, such as constrained spin systems, and are at the heart of numerous technological applications, e.g., in quantum simulation and computation platforms. Here, we show that these interactions have also a significant impact on dissipative effects caused by the inevitable coupling of Rydberg atoms to the surrounding electromagnetic field. I will discuss how their presence modifies the frequency of the photons emitted from the Rydberg atoms, making it dependent on the local neighborhood of the emitting atom. Interactions among Rydberg atoms thus turn spontaneous emission into a many-body process which manifests, in a thermodynamically consistent Markovian setting, in the emergence of collective jump operators in the quantum master equation governing the dynamics. We discuss how this collective dissipation – stemming from a mechanism different from the much studied super- and sub-radiance – accelerates decoherence and affects dissipative phase transitions in Rydberg ensembles.

[1] Chris Nill, Kay Brandner, Beatriz Olmos, Federico Carollo and Igor Lesanovsky, Many-body radiative decay in strongly interacting Rydberg ensembles, Physical Review Letters 129, 243202 (2022)

January 17th, starting with discussion at 17:00 h, talk at 17:15 h, live IAP lecture hall or via Zoom

<https://uni-bonn.zoom.us/j/98441612025?pwd=a01SSjlkY1Q3SDFhL09JQk1qc1V6dz09>

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