Fast thermalization of a frozen Rydberg gas in long-range interatomic dipole-dipole coupling

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In a cold, disordered and dense cesium Rydberg gas in a Förster resonance configuration, two atoms or a group of few atoms can exchange internal energy by a resonant way. We consider the two-atom reaction for the cesium atom

$$np + np \rightarrow ns + (n+1)s$$

We observe a saturation regime, characterized by an amazing behavior corresponding to the "thermalization" of the atomic sample, meaning an equal- distribution of the populations of the relevant level of the resonant reaction. The dynamics of the thermalization seems to be the result of few-body effects. The interplay between two-, few- and many-body regime in a dipole coupling will be discussed, as so well as the role of the diffusion scattering of the products of the reaction.