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Dissipation as a resource for atomic binding and crystallization MIKHAIL LEMESHKO, Harvard/ITAMP, JOHANNES OTTERBACH, Harvard, HENDRIK WEIMER, Leibniz Universität Hannover — The formation of molecules and supramolecular structures results from bonding by conservative forces acting among electrons and nuclei and giving rise to equilibrium configurations defined by minima of the interaction potential. Here we show that bonding can also occur by the non-conservative forces responsible for interaction-induced coherent population trapping. The bound state arises in a dissipative process and manifests itself as a stationary state at a preordained interatomic distance. Remarkably, such a dissipative bonding is present even when the interactions among the atoms are purely repulsive. The dissipative bound states can be created and studied spectroscopically in present-day experiments with ultracold atoms or molecules and can potentially serve for cooling strongly interacting quantum gases [1]. An extension of this technique to a many-particle system (Bose-Einstein Condensate of Rydberg-dressed atoms) allows to observe long-range ordered crystalline structures emerging due to dissipation [2].

[1] M. Lemeshko, H. Weimer, "Dissipative binding of atoms by non-conservative forces" Nature Communications 4, 2230 (2013)
[2] Johannes Otterbach, Mikhail Lemeshko, "Long-Range Order Induced by Dissipation," arXiv:1308.5905

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