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Abstract for an Invited Paper
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Nonperturbative Rydberg excitations triggered by electrons or photons[1]

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Recently investigated processes with autoionizing Rydberg atoms or molecules will be discussed. In one class of processes, two or more Rydberg state are dressed by a laser field that couples them nonperturbatively, after which the coupled states are subsequently probed by XUV photons in a transient absorption experiment. This class will be discussed in the context of two recent experiments involving doubly-excited autoionizing states of atomic helium. In the second class of processes, the Rydberg states are initially created when electrons collide with molecular ions in a plasma environment, then get trapped temporarily in a high Rydberg state after giving up part of their energy to vibrational or rotational degrees of freedom. The Rydberg molecules then have competitive decay pathways, via photon emission, autoionization, or dissociation. The theory will be discussed in the context of experiments that bear on this second class of dynamical processes, which have been performed in Berkeley and also in Prague.

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