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Cooling and Infrared Emission due to Molecular Collisional Excitation in Astrophysical Environments[1]

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Non-thermal popluations of molecules in a variety of astronomical environments, including photodissociation regions, X-ray dominated regions, and protoplanetary disks, are controlled by collisional excitation and quenching of their rovibrational levels. The important colliders are the dominant neutral species: H, He, and H_2. Resulting emission lines are primary cooling transitions and can be observed by current and upcoming IR/submillimeter observatories including Spitzer, Herschel, SOFIA, and ALMA. Modeling these environments, however, requires large-scale computation of collisional excitation processes. The status, needs, and astrophysical applications for important molecular targets will be reviewed including H_2, HD, CO, H_2O, and NH_3.

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