Alkane Reaction Dynamics at Metal Surfaces
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Molecular beam, laser, surface science, and computational techniques are used to study the reactions of alkanes with catalytic metal surfaces. The outcome of gas-surface reactions is determined by the energy of the gas-surface collision complexes formed and the dynamical forces exerted upon them. Quantifying such reaction dynamics under the high pressure conditions of industrial catalysis would be exceedingly difficult because of prompt thermalization of both reactants and products by intermolecular collisions. Instead, reactivity is studied under ultra-high vacuum conditions where reactants can be prepared in particular states prior to collision with the surface and product states can be examined afterwards to yield a diverse set of data that is informative about the elementary reaction dynamics. The impacts of dynamics and van der Waal’s interactions on the reactivity of alkanes, ranging from methane to nonane, at Pt(111) surfaces are discussed. Simple shrubbery, it seems, promotes alkane reactivity.