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The valleys and mountains shown (potential energy surface) describe the femtosecond journey of a chemical reaction: the addition of ethylene or cleavage of cyclobutane. The dynamics describe one of the most fundamental processes in chemistry—the making and breaking of a covalent bond. The transient structures are frozen on the femtosecond time scale, and their existence elucidates the non-concerted nature of the mechanism. See page 1359 and the Perspective on page 1338. [Illustration: S. Pedersen]

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