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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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Change of address: allow 6 weeks, giving old and new addresses and 11-digit account number. Postmaster: Send change of address to Science P.O. Box 2030, Marion, OH 43305-2033. Single copy sales: $6.00 per issue prepaid includes surface postage; Guide to Biotechnology Products and Instruments, $20. Bulk rates on request. Authorization to photocopy material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by AAAS to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of $1 per copy plus $.10 per page is paid directly to CCC, 27 Congress Street, Salem, MA 01970. The identification code for Science is 0036-8075/83 $1 .10. Science is indexed in the Reader’s Guide to Periodical Literature and in several specialized indexes.