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Geometry and Mechanics of Kirigami[1] SURAJ SHANKAR, Department of Physics, Syracuse University, MICHAEL MOSHE, Department of Physics, Syracuse University and Department of Physics, Harvard University, DAVID R. NELSON, Lyman Laboratory of Physics, Harvard University, MARK J. BOWICK, Department of Physics, Syracuse University and Kavli Institute for Theoretical Physics, University of California, Santa Barbara — *Kirigami*, the art of cutting and folding paper, often has dramatic effects on the elasticity of thin sheets, thereby offering a novel and promising strategy for 2D material engineering and design. In order to elucidate the mechanical consequences of Kirigami, we study the mechanics of an isolated frame under external load, as a simple building block for more complex structures. Towards this aim we develop a technique within the geometric formalism of elasticity, for solving elastic problems of sheets punctured with holes. Our approach allows us to demonstrate the generic features of holes under stress as sources of geometric incompatibility, i.e. as strain-dependent elastic charges. This formalism allows us to translate complicated Kirigami problems into simpler ones involving interacting elastic charges. It therefore allows concrete predictions about the response of an elastic sheet interrupted by various Kirigami patterns. By studying the problem both numerically and analytically, we explore the properties of both planar and buckled configurations of frames under load, which reveals that thin isolated frames display a softening in response to external forces, by trading stretching for bending energy.

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