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The virial theorem for water waves and its application to deep-water wave breaking NICHOLAS PIZZO, W. KEN MELVILLE, Scripps Institution of Oceanography, University of California, San Diego — The connection between the geometry, kinematics and dynamics of steep and breaking waves is crucial for an improved understanding of air-sea interaction processes. In this study, we present a virial theorem for deep-water surface gravity waves, related to a conserved integral quantity originally derived by Benjamin and Olver (1982), and we apply this theorem to the study of properties of steep and breaking waves. Specifically, we relate the geometry and dynamics of these wave scenarios in an attempt to better understand the breakdown of equipartition between the kinetic and potential energy. The virial theorem will be studied both analytically and numerically, where in the latter case we make use of a variational description of water waves in a conformally mapped reference frame (Balk 1996) that we have developed for use in a numerical model. Particular attention will be given to the application of these findings to recent theoretical and laboratory studies in which it has been shown that the potential energy available to breaking waves plays a crucial role in setting the scales of post-breaking phenomena; for example, the breaking induced energy dissipation rate (Drazen et al. 2008) and the circulation generated by breaking (Pizzo and Melville 2013).

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