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Phantom-Divide Crossing: Geometry and Stability

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Phantom-divide crossing is examined in single-clock cosmology through phase-space geometry and scalar perturbative stability. For a locally unique autonomous flow, tangency everywhere on the regular divide \(w_{\mathrm{DE}}=-1\) makes it invariant, preventing finite-time crossing, whereas transversal evolution yields local crossing. Supplementary effective-field-theory and k-essence calculations illustrate the distinction between this geometric obstruction, and ghost and gradient stability conditions. Dynamically allowed crossing alone therefore does not establish a physically viable dark-energy model.

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