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Evidence for phantom divide line crossing from the latest data sets

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The recent constraints from DESI (arXiv: 2404.03002, arXiv: 2503.14738), when combined with various SNeIa data, indicate a strong preference ($\sim 3-4\sigma$) for a phantom divide line (PDL) crossing in the equation of state parameter of a supposed dynamical dark energy (DE). This is evident from their constraints preferring $w_0 > -1$, $w_a < 0$ for the CPL parametrization of the DE, i.e., $w(a) = w_0 + (1-a)w_a$. We confirm these constraints and replace the DESI data with SH0ES measurements and show that the situation does not change despite the incompatibility of SH0ES with DESI. The constraints in both cases imply an early time phantom dark energy with a late time quintessence-like behavior. In order to test if either one of these features are artifacts, we make two different modifications to the CPL parametrization such that a PDL crossing is not allowed. We show that the features of late time quintessence and early time phantom behavior are still preferred for the DESI+SNeIa combination in accordance with the usual CPL parametrization, whereas they are at some discordance when DESI is replaced with SH0ES and the late-time phantom behavior is preferred to quintessence.

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