Title:	Scalar field dark energy perturbations and the integrated Sachs-Wolfe effect
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Abstract:	Dark energy perturbation affects the growth of matter perturbations even in scenarios with noninteracting dark energy. We investigate the integrated Sachs-Wolfe effect in various canonical scalar field models with perturbed dark energy. We do this analysis for models belonging to the thawing and freezing classes, which are classes based on the way the equation of state evolves with time. For thawing models, the dark energy equation of state remains the same as that of a cosmological constant and deviates from this value at late times. In freezing models, the equation of state evolves in the opposite manner, namely it "freezes" to cosmological constant-type behavior at late times. We show that between these classes there is no clear difference for the Sachs-Wolfe effect. We show that on taking perturbations into account, the contribution due to different models is closer to each other and to the cosmological constant model than it is to the case of an unperturbed scalar field, i.e., the dark energy component is homogeneous. Therefore, considering dark energy to be homogeneous gives an overestimate in distinction between different models. However, the difference between contribution to the angular power spectrum due to different models remains large, and future observations pertaining to growth of perturbations may be able to distinguish between these.
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