Equivariant model structures via orbit spaces

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Abstract: Let G be a group. The category of G-spaces and G-equivariant maps admits a model structure in which the weak equivalences (resp. fibrations) are defined as G-maps that induce weak equivalences (resp. fibrations) on H-fixed point spaces for every $H \leq G$. This is a standard way to study equivariant homotopy theory. The fibrant-cofibrant objects in this model category are G-CW-complexes. A weak equivalence between G-CW-complexes is a G-homotopy equivalence. Such a map induces weak equivalences on H-orbits for every $H \leq G$. The converse, however, is not always true. It is natural to ask when a map inducing weak equivalences on H-orbits for every $H \leq G$ induces weak equivalences on H-fixed point spaces. To answer this question, we construct a new model structure on the category of G-spaces in which the weak equivalences and cofibrations are defined as maps inducing weak equivalences and cofibrations on H-orbits for each $H \leq G$. We show that a weak equivalence between objects that are fibrant in this new model structure is a weak equivalence in the fixed point model structure. This is a joint work with Aslı Güçlükan İlhan.

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