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Galois coverings and mutation of G-orbits

For an algebraically closed field $\mathbb{K}$, we consider a Galois G-covering $\mathcal{B} \to \mathcal{A}$ between locally bounded $\mathbb{K}$-categories given by bound quivers, where G is torsion-free and acts freely on the objects of $\mathcal{B}$. We define the notion of $(G, \tau_{\mathcal{B}})$-rigid subcategory and of support $(G, \tau_{\mathcal{B}})$-tilting pairs over $\mathcal{B}\text{-mod}$. These are the analogues of the similar concepts in the context of a finite-dimensional algebra, where we additionally require that the subcategory be G-equivariant. When $\mathcal{A}$ is a finite-dimensional algebra, we show that the corresponding push-down functor $\mathcal{F}_\lambda : \mathcal{B}\text{-mod} \to \mathcal{A}\text{-mod}$ sends $(G, \tau_{\mathcal{B}})$-rigid subcategories (respectively support $(G, \tau_{\mathcal{B}})$-tilting pairs) to $\tau_{\mathcal{A}}$-rigid modules (respectively support $\tau_{\mathcal{A}}$-tilting pairs). We further show that there is a notion of mutation for support $(G, \tau_{\mathcal{B}})$-tilting pairs over $\mathcal{B}\text{-mod}$. Mutations of support $\tau_{\mathcal{A}}$-tilting pairs and of support $(G, \tau_{\mathcal{B}})$-tilting pairs commute with the push-down functor. We derive some consequences of this, and in particular, we derive a τ-tilting analogue of the result of P. Gabriel that locally representation-finiteness is preserved under coverings. Finally, we prove that when the Galois group G is finitely generated free, any rigid $\mathcal{A}$-module (and in particular $\tau_{\mathcal{A}}$-rigid $\mathcal{A}$-modules) lies in the essential image of the push-down functor.