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Group actions on cluster categories and cluster algebras

We introduce the notion of admissible action of a group G on a quiver with potential (Q,W). This induces an action of G on the corresponding cluster category $\mathcal{C}(Q,W)$ and on the corresponding cluster algebra $A(Q)$. At the level of $\mathcal{C}(Q,W)$, this yields a G-precovering functor $F:\mathcal{C}(Q,W)\to\mathcal{C}(Q_G,W_G)$ where Q_G is the orbit quiver and W_G is the orbit potential. This functor is compatible with the Iyama-Yoshino mutation of a G-orbit of a summand of a cluster-tilting object of $\mathcal{C}(Q,W)$. At the level of the cluster algebra $A(Q)$, the action of G yields an algebra A_G of G-orbits of the cluster variables of the G-stable clusters. This gives generalized cluster algebras that are different from the ones introduced by Lam and Pylyavskyy. For cluster algebras arising from surfaces, those algebras are associated to some triangulated orbifolds. As in the classical case of an oriented Riemann surface with marked points, the algebra can be obtained by mutations that are specified by exchange polynomials. These algebras are different from the ones defined by Felikson-Shapiro-Tumarkin. A cluster character can also be defined to relate the category $\mathcal{C}(Q_G,W_G)$ to the algebra A_G.