Euler characteristics of a given order $k$ is a generalization of the so-called orbifold Euler characteristic (for a space with a finite group action) introduced by physicists. For a complex quasi-projective manifold $X$ with a finite group $G$ action, we define a generalized Euler characteristics of order $k$ of the pair $(X, G)$ (a sort of their motivic versions) with values in the Grothendieck ring of complex quasi-projective varieties extended by the rational powers of the class of the affine line.

The geometric description of the power structure over such a ring allows us to compute, for a fixed $k$, the generating series whose $n$ coefficient is the generalized Euler characteristics of a fixed order $k$ of the $n$-wreath product orbifolds $(X^n, G^n \wr S_n)$ in terms of some local data (not depending on $X$) to the power $-k$-th generalized Euler characteristics of the pair $(X, G)$.

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