

## Research Plan

- (1) As a corollary of our result concerning representation covering, it turns out that there exist infinitely many torus manifolds having no invariant Morse function. The non-existence of invariant Morse function follows from the fact that these torus manifolds never admit representation covering with respect to the torus action, however, the criteria is not effective for manifolds admitting representation coverings.

Accordingly, we consider to strengthen our previous result (existence of equivariant hyperbolic diffeomorphism) to existence theorem of invariant Morse function, or to find out a condition stronger than the existence of representation covering which implies the existence of invariant Morse function.

- (2) A typical example of a class of manifolds admitting representation coverings is the class of toric manifolds. In Hamiltonian case the existence of invariant Morse functions follows from the generality of moment map, however, in the general case existence of invariant Morse function is not known. Moreover, we can not use the result stating in the research result since they have representation coverings. Accordingly, we consider the existence of invariant Morse function on toric manifolds.

- (3) I continue to consider GKM-theory from Morse theoretic point of view. By our previous result it is revealed that there exist infinitely many torus manifolds having no invariant Morse function, so it seems difficult to approach the problem using finite dimensional Morse theory. Accordingly, I examine approach via infinite dimensional Morse theory on Borel construction which is used in the definition of equivariant cohomology.