My works

Hiroshi Sato

The paper [1] concerns about the classification of toric Fano varieties. Toric Fano varieties are important from a viewpoint of the minimal model program, and they relates to the mirror symmetry of the mathematical physics. In this paper, I classified smooth toric Fano 4-folds. There exist exactly 124 smooth toric Fano 4-folds.

In [2], I complete the classification of smooth toric weakened Fano 3-folds, that is, smooth toric weak Fano 3-folds which deform into Fano 3-folds. By studing this toric result, we can find the interesting property about crepant morphisms on "general" smooth weakened Fano 3-folds, and complete the classification of smooth weakened Fano 3-folds. This fact is a good example of an application of the toric geometry for general algebraic varieties.

The topological type of a Hirzebruch surface is determined by its degree. More precisely, there exist two topological types: the degree is even or odd. Moreover, Hirzebruch surfaces are deformed into each other in their classes. In [4], I generalized this result. As a result, I constructed families whose fibers are compact toric manifolds. As an application of this construction, I obtained complex families such that certain smooth toric weakened Fano 3-folds classified in [3] deformed into Fano in the families.

In [5], I classified smooth toric Fano varieties of any dimension which have divisorial contractions to curves. We can consider a generalization of this classification, that is, the classification of smooth Fano varieties which have divisorial contractions to curves. However, by checking the proof for the toric case, we see that this generalization is very complicated. This is also a good example of an application of the toric geometry as above.

In [6], I studied the following problem: for a smooth toric Fano 4-fold, determine whether it admits an embedding from an abelian surface or not. In this paper, we associated a certain graph for a such embedding, and checked the existence by the connectivity of the graph. As a result, I determined for about 100 smooth toric Fano 4-folds.

In [7], we studied the toric Mori theory, and as applications, we obtained some results concerned about the minimal models for hypersurface singularities in toric varieties. In addition, in [9], I gave the combinatorial descriptions for the relative toric Mori theory which were not dealt in [7]. By [7] and [9], I can say that the foundation of the relative toric Mori theory is completed.

In [8], I dealt with a phenomenon in positive characteristic. A wild hypersurface bundle is a pecular phenomenon in positive characteristic, and there are few examples of wild hypersurface bundles. In this paper, we constructed many examples of wild hypersurface bundles over toric varieties.

In [10], we studied toric projective birational morphisms from smooth toric 3-folds onto the 3-dimensional affine space whose relative canonical divisors are anti-nef. There exist infinitely many such morphisms, however, the classified list is very simple. One of the reasons for this phenomenon is the correspondence with Du Val singularities. We can associate a Du Val singularity for a such toric morphism.

In [11], we classified smooth toric Fano 5-folds of coindex 5. By this classification, we complete the classification of toric Fano manifolds of coindex 5.