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Spherical blow-ups of Grassmannians and Mori dream spaces

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SPHERICAL BLOW-UPS OF GRASSMANNIANS AND MORI DREAM SPACES

ALEX MASSARENTI AND RICK RISCHTER

ABSTRACT. In this paper we classify weak Fano varieties that can be obtained by blowing-up general points in prime Fano varieties. We also classify spherical blow-ups of Grassmannians in general points, and we compute their effective cone. These blow-ups are, in particular, Mori dream spaces. Furthermore, we compute the stable base locus decomposition of the blow-up of a Grassmannian in one point, and we show how it is determined by linear systems of hyperplanes containing the osculating spaces of the Grassmannian at the blown-up point, and by the rational normal curves in the Grassmannian passing through the blown-up point.

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1. INTRODUCTION

Mori dream spaces were introduced by Y. Hu and S. Keel in [HK00]. The birational geometry of a Mori dream space X can be encoded in some finite data, namely its cone of effective divisors $\text{Eff}(X)$ together with a chamber decomposition on it, called the *Mori chamber decomposition* of $\text{Eff}(X)$. We refer to Section 2 and the references therein for the rigorous definition and special properties of Mori dream spaces.

Mori dream spaces can be algebraically characterized as varieties whose total coordinate ring, called the *Cox ring*, is finitely generated. Cox rings of projective varieties have been studied in various contexts [AHL10], [AL11], [AGL16], [CT06], [DHH⁺15], [HKL16], [Muk01].

In addition to this algebraic characterization there are several algebraic varieties characterized by positivity properties of the anti-canonical divisor that turn out to be Mori dream spaces [BCHM10, Corollary 1.3.2].

Mori dream spaces obtained by blowing-up points in projective spaces have been studied in a series of papers [CT06], [Muk01], [AM16], and their relationships with moduli spaces of pointed rational curves and of parabolic vector bundles on \mathbb{P}^1 have been investigated as well [Bau91], [AC17], [BM17]. In this paper we consider more general prime Fano varieties.

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