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Topics in the arithmetic of del Pezzo and K3 surfaces

Festi, D.

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Author: Festi, Dino

Title: Topics in the arithmetic of del Pezzo and K3 surfaces

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Summary

In the thesis titled “Topics in the arithmetic of del Pezzo and K3 surfaces”, the author presents the results he achieved during his PhD. Some of these results have already been published, or are anyway available online, see [FGvGvL13], [FvL15] and [FvL16].

The thesis consists of four chapters: the first one is meant to introduce the notation and the basic results that are needed in order to address the problems treated in the rest of the thesis; each of the other three chapters deals with a different problem.

In [STVA14], C. Salgado, D. Testa, and A. Várilly-Alvarado show that all del Pezzo surfaces of degree 2 over a finite field are unirational, except possibly for three isomorphism classes of surfaces. In 2015, Ronald van Luijk and the author of the thesis show that the statement holds also for the remaining three cases. This result is presented in the second chapter.

During the Arizona Winter School 2015, A. Várilly-Alvarado, one of the lecturer of the winter school, asked to compute the Galois module structure of the Picard lattice of the K3 surfaces in a given 1-dimensional family. Chapter 3 provides an answer to that question. The whole chapter is joint work with F. Bouyer, E. Costa, C. Nicholls, and M. West.

In [Ogu15], K. Oguiso proved that if a K3 surface S has Picard lattice isometric to a particular rank 2 lattice, then S admits a fixed point free automorphism of positive entropy and can be embedded into $\mathbb{P}^3$ as a quartic surface. In the same paper, Oguiso remarks that “it seems extremely hard but highly interesting to write down explicitly the equation of S and the action of g in terms of the global homogeneous coordinates of $\mathbb{P}^3$, for at least one of such pairs” (cf. [Ogu15, Remark

4.2]). In [FGvGvL13], A. Garbagnati, B. van Geemen, R. van Luijk, and the author of the thesis provide an explicit example of such S and g , described using the global homogeneous coordinates of $\mathbb{P}^3$. The contribution of the author of the thesis to the paper is presented in the fourth and last chapter.