Algebra Seminar

Bounds on the Torsion Subgroups of Second Cohomology

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Abstract: Let $X \hookrightarrow \mathbb{P}^r$ be a smooth projective variety defined by homogeneous polynomials of degree $\leq d$ over an algebraically closed field k. Let $\mathbf{Pic}\, X$ be the Picard scheme of X, and $\mathbf{Pic}^0 X$ be the identity component of $\mathbf{Pic}\, X$. The Néron–Severi group scheme of X is defined by $\mathbf{NS} X = (\mathbf{Pic}\, X)/(\mathbf{Pic}^0 X)_{\mathrm{red}}$, and the Néron–Severi group of X is defined by $\mathrm{NS}\, X = (\mathbf{NS} X)(k)$. We give an explicit upper bound on the order of the finite group $(\mathrm{NS}\, X)_{\mathrm{tor}}$ and the finite group scheme $(\mathbf{NS} X)_{\mathrm{tor}}$ in terms of d and r. As a corollary, we give an upper bound on the order of the torsion subgroup of second cohomology groups of X and the finite group $\pi^1_{\mathrm{et}}(X, x_0)^{\mathrm{ab}}_{\mathrm{tor}}$. We also show that $(\mathrm{NS}\, X)_{\mathrm{tor}}$ is generated by $(\deg X - 1)(\deg X - 2)$ elements in various situations.

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