SEMINARIO DI GEOMETRIA

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Cubic fourfolds containing a plane and $K3$ surfaces of rank two

Let X be a smooth cubic hypersurface in $\mathbb{P}^5_{\mathbb{C}}$: Investigating the rationality of X is a classical problem in algebraic geometry. The general X is conjectured to be not rational but not a single example of non rational cubic fourfold is known. The cubic fourfolds containing a plane form a divisor $\mathcal{C}_8$ in the moduli space $\mathcal{C}$ of cubic fourfolds. The general fourfold containing a plane is also expected to be non rational. Nevertheless, there exists a countable infinite collection of divisors in $\mathcal{C}_8$ which parameterize rational cubic fourfolds. The fourfolds containing a plane are birational to a quadric bundle and those divisors in $\mathcal{C}_8$ are rational since the associated quadric bundle has a rational section. We focus on cubic fourfolds containing a plane presenting a review of the current state of the art on rationality question. Finally, we present a family of cubic fourfolds containing a plane whose associated quadric bundle does not have a rational section. This family is obtained using the $K3$ surface double cover of the plane ramified over the discriminant sextic of the quadric bundle associated to the fourfold.