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4. Algebraic Geometry

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Deformation of function fields

Our function fields are equivalent to the birational equivalence classes of complete algebraic varieties defined over the complex number field. Let $f : X \to S$ be a proper smooth connected morphism between smooth varieties with relative divisors A, B on X/S. Assume $A_{red} + B_{red}$ is normal crossing. The dual notion of $\Omega_{X/S}(A, B)$ denotes $\Theta_{X/S}(A, B)$. There exists a variation of deformation theory of Kodaira-Spencer-Kawamata's. If Kodaira-Spencer map $\rho_{X/S}(A, B) : \Theta_S \to R^1 f_* \Theta_{X/S}(A, B)$ is zero, then $X \setminus B$ is locally S-biregular outside A. This will be applied to Viehweg conjecture: $\kappa(\det f_* \omega_{X/S}^{\otimes m}) \geq var(X/S)$ for any $m > 0$ unless $f_* \omega_{X/S}^{\otimes m} \neq 0$. This statement says deformation theory of function fields for algebraic varieties of non negative Kodaira dimension. The torsion freeness of $R^1 f_* \omega_{X/S}^{\otimes m}$ is difficult to show.