42. *Poles of Instantons and Jumping Lines of Algebraic Vector Bundles on $\mathbf{P}^3$*

By Motohico MULASE
Research Institute for Mathematical Sciences, Kyoto University

(Communicated by Kunihiko KODAIRA, M. J. A., May 12, 1979)

Let E be an algebraic vector bundle of rank n on the complex 3-dimensional projective space $\boldsymbol{P}^3$ such that

(1) E has no global holomorphic sections,

(2) $c_1(E)=0$, $c_2(E)=k>0$, $c_3(E)=0$, where c_1, c_2 and c_3 denote the *Chern classes* of E, which are regarded as integers,

(3) for each general line L in $\boldsymbol{P}^3$, the restriction $E|_L$ is the trivial bundle of rank n on $L\cong\boldsymbol{P}^1$.

If $E|_L$ is not trivial, the line L is called a *jumping line* of E. These lines from an algebraic subset J of the *Grassmann variety* $\mathrm{Gr}(1,3)$ which parametrizes lines in $\boldsymbol{P}^3$.

In the case $n=2$, (1) and (2) imply that E is a stable bundle and (3) follows from them. Barth [2] has shown that in this case J is a divisor of degree $k=c_2(E)$ on $\mathrm{Gr}(1,3)$.

Our question is the following: When is E determined uniquely by the set J of its jumping lines?

For $n=2$ one has some affirmative answers by Barth [2] ($c_2(E)=1$) and Hartshorne [4] ($c_2(E)=2$). In the present article we shall state that this is true for all such bundles of any rank which come from "instantons".

I would like to thank Prof. M. Maruyama for many valuable suggestions.

1. First of all we define the term instanton. Let P be a non-trivial real analytic principal bundle on the real 4-sphere $S=S^4$ with fibre $SU(n)$, called the *gauge group*. For a real analytic connection from ω on P, the corresponding curvature from Ω is given by $\Omega=d\omega+\dfrac{1}{2}[\omega,\omega]$, and it descends to S as a 2-form with values in the Lie algebra $\mathfrak{su}(n)$. The *self-dual* (resp. *anti-self-dual*) *Yang-Mills equation* is by definition the 1st order non-linear differential equation $*\Omega=\Omega$ (resp. $*\Omega=-\Omega$) for ω, where $*$ denotes the Hodge star operator on S. The difference between self-dual and anti-self-dual is a matter of orientation of S. So we choose and fix an orientation of S so that the 2nd Chern class $c_2(P)=k$ regarded as an integer is positive, and deal only with anti-self-dual equations.