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# Some translation planes of order $11^2$ which admit SL(2, 9)

Dedicated to Professor Tosiro Tsuzuku on his 60th birthday

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## 1. Introduction

Let $G$ be a nonsolvable subgroup of the linear translation complement of a translation plane $\Pi$ of order $q^2$ with kernel $GF(q)$ where $q$ is a power of a prime $p$, and let $G_0$ be a minimal nonsolvable normal subgroup of $G$. In [5] Ostrom pointed out the following theorem which is proved by using a work of Suprunenko and Zalesskii [7].

THEOREM A. *If $G_0/Z(G_0)$ is simple and if $p>5$, then $G_0/Z(G_0)$ must be $PSL(2,5)$, $PSL(2,9)$, or $PSL(2,p^s)$ for some positive integer s.*

If $G_0/Z(G_0)$ is isomorphic to $PSL(2,p^s)$, $\Pi$ is a Desarguesian plane, a Hall plane, a Hering plane or a Schaffer plane(Walker [8], [9] and Schaffer [6]). At the case that $G_0/Z(G_0)$ is isomorphic to $PSL(2,9)$, Mason proved the following theorem in [4].

THEOREM B. *If $G_0/Z(G_0)$ is isomorphic to $A_6$, there are exactly two isomorophic classes of planes $\Pi$ with kernel $GF(7)$. If $H$ is the translation complement of $\Pi$ and $D$ the kernel of $\Pi$, then in one case we have $H/D\cong A_6$, while in the second we have $H/D\cong S_6$.*

We have studied about the case that the kernel of $\Pi$ is $GF(11)$. Our result will be described by a following theorem which is proved at the end after much preparation.

THEOREM C. *Let $\Pi$ be a translation plane of dimension 2 over its kernel and the linear translation complement $C$ has a normal subgroup $G$ such that $G/Z(G)\cong S_6$. Then there are exactly three isomorphism classes of planes $\Pi$ with kernel $GF(11)$. If $D$ is the kernel of $\Pi$, then $C=DG$.*

Notation is standard, and follows that of [2]. For a permutation group $M$ on $\Omega$, we put $M_x=\{g\in M \mid xg=x\}$ where $x$ is an element of $\Omega$, and for a group $H$, we put $Cl_H(x)=\{g^{-1}xg \mid g\in H\}$ where $x$ is an element of $H$. We write $S^{\Omega}$ and $A^{\Omega}$ for a symmetric and alternative group on $\Omega$. In Section 2 we shall study the group $G$, its representations and spreads