

# *The Holonomy Group $V$ . Weyl Space $W_4$ , First Part\**

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**Synopsis.** This paper belongs to the series of papers dealing with the holonomy group [3], [4], [5], [6]. It is concerned with the holonomy group of a Weyl space  $W_4$ . It consists of two parts, the first part being the present paper which is divided into three chapters.

In the first chapter we apply previous results to a Weyl space and, besides, we derive some auxiliary results needed later. The second chapter is devoted to general information about possible holonomy groups of a  $W_4$ . Finally, in the third chapter we display a complete classification of holonomy groups in a  $W_4$ .

The second part, to be published later, will contain finite equations of the transformations of holonomy groups of  $W_4$  and the theory of the corresponding group invariants.\*\*

## I.

**1. Previous auxiliary results.** In this section we shall summarize briefly some previous results [6] needed in subsequent considerations.

(a) *The connection*  $\Gamma_{\lambda}^{\nu}$ . There is always a positive density  $\mathfrak{G}$  of weight  $p = -2/n$  known up to a gauge transformation

$$(1.1) \quad *\mathfrak{G} = (e)^{2f}\mathfrak{G} \quad (f \text{ real}).$$

Objects invariant by (1.1) are termed  $f$ -invariant. Let  $g_{\lambda\mu}$  be a symmetric  $f$ -invariant tensor density of rank  $n$  and of weight  $p = -2/n$ . The tensor

$$(1.2) \quad g_{\lambda\mu} = g_{\lambda\mu}\mathfrak{G}^{-1}$$

transforms by (1.1) according to

$$(1.3a) \quad *g_{\lambda\mu} = (e)^{-2f}g_{\lambda\mu},$$

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\*\* The range of Greek indices consists of the first  $n$  Roman numerals. Latin indices run from 1 to  $n$ . German indices run from  $\mathfrak{1}$  to  $\mathfrak{l}$ . Possible exceptions to these rules will be explicitly mentioned. The major part of this paper, beginning with Section 4, deals with the case  $n = 4$ .