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Matching Conditions in the Einstein-Cartan Theory of Gravitation*

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Abstract. In this paper matching and junction conditions in the Einstein-Cartan theory are presented. It is shown that a Weyssenhoff fluid sphere collapses to a singularity.

Introduction

In the general relativity theory two types of singularities are of a relevant physical interest. These are the singularities of cosmology and of gravitational collapse. In the framework of the Einstein-Cartan theory [1–4], being a modification of the classical theory of gravitation, cosmological models without singularities were constructed [5–9]; the problem of singularities of the second type is not clear. To solve this problem, as the first step, we investigate conditions which gravitational fields on a star's surface should satisfy.

Initial sections of this paper have an informative character. Section I contains a brief presentation of the Einstein-Cartan theory based on Trautman's approach [3, 4]. In Section II, the investigation of discontinuities by means of differential forms is considered.

In Section III the matching conditions and their general implications are considered. We require the Einstein-Cartan equations to be satisfied in the distribution sense. The matching conditions are formulated as follows: (a) the metric tensor is continuous, (b) the spin tensor and (c) the energy-momentum tensor have at most "regular" discontinuities. Due to the previous requirement, condition (c) can be formulated in a form which is more convenient for applications: the second fundamental form with respect to the dynamical, assymetric, connection[1] and the trace of the projected defect tensor[2] are continuous. If spin vanishes,

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[1, 2] Definitions are given below.