

911): Developing a Torsion based Cosmology

In paper 88 it was shown that there is only one Bianchi identity:

$$D \wedge T := R \wedge \eta \quad - (1)$$

whose tensor formulation is:

$$D_{\mu} T_{\nu\rho}^a + D_{\rho} T_{\mu\nu}^a + D_{\nu} T_{\rho\mu}^a \\ := R_{\mu\rho\nu}^a + R_{\rho\nu\mu}^a + R_{\nu\mu\rho}^a \quad - (2)$$

A possible solution of eq. (2) is:

$$\boxed{R_{\mu\rho\nu}^a = D_{\mu} T_{\nu\rho}^a} \quad - (3)$$

et cyclicum

Now we:

$$R^{\kappa}_{\mu\rho\nu} = g^{\kappa a} R_{\mu\rho\nu}^a \quad - (4)$$

$$T^{\kappa}_{\nu\rho} = g^{\kappa a} T_{\nu\rho}^a \quad - (5)$$

and to formalize procedure:

$$D_{\mu} g^{\kappa a} = 0, \quad - (6)$$

to find

$$\boxed{R^{\kappa}_{\mu\rho\nu} = D_{\mu} T^{\kappa}_{\nu\rho}} \quad - (7)$$

2) Eq. (7) is a redefinition of the Riemann tensor in terms of the torsion tensor. Note carefully that this is a new kind of torsion tensor, whose definition is more general than that of the usual torsion tensor. This means that general relativity and cosmology can be developed with $T^a_{\mu\nu}$ or $T^{\mu\nu}$. The torsion form $T^a_{\mu\nu}$ is particularly convenient because it is a vector-valued two-form, whereas the Riemann form $R^a_{b\mu\nu}$ is tensor-valued. So a cosmology based on $T^a_{\mu\nu}$ is much simpler to work out than one based on $R^a_{b\mu\nu}$.

In order to distinguish this new type of torsion it is denoted by $S^a_{\mu\nu}$, defined by:

$$R^a_{\mu\nu\rho} = D_\mu S^a_{\nu\rho} - (8)$$

et cetera

This distinguishes it from the conventional torsion:

$$T^{\mu\nu} = \Gamma^{\mu\nu}_{\rho\sigma} - \Gamma^{\mu\nu}_{\sigma\rho} - (9)$$