

$f(Q, L_m)$ gravity: A new modified gravity

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Abstract. In this talk, I will discuss the $f(Q)$ symmetric teleparallel gravity by introducing an arbitrary coupling between the non-metricity Q and matter Lagrangian L_m in the Lagrangian density f of the theory, which thus leads to the $f(Q, L_m)$ theory. This generalisation encompasses Coincident General Relativity (CGR), and the Symmetric Teleparallel Equivalent to GR (STTEGR). Using the metric formalism, we derive the field equation of the theory, which generalizes the field equations of $f(Q)$ gravity. From the study of the covariant divergence of the field equations, it follows that the presence of the geometry-matter coupling leads to the non-conservation of the matter energy-momentum tensor. The cosmological implications of the theory are investigated in the case of a flat, homogeneous, and isotropic Friedmann-Lemaître-Robertson-Walker geometry. As a first step in this direction, we obtain the modified Friedmann equations for the $f(Q, L_m)$ gravity in a general form. Specific cosmological models are investigated for several choices of $f(Q, L_m)$, including $f(Q, L_m) = -\alpha Q + 2L_m + \beta$, and $f(Q, L_m) = -\alpha Q + (2L_m)^2$, respectively. Comparative analyses with the standard Λ CDM paradigm are carried out, and the observational implications of the models are investigated in detail.

Keywords: $f(Q, L_m)$ gravity, cosmology, observational constraints, dark energy