論　文　の　要　旨

題　目　　Cartan F(R) gravity and the time evolution of the Universe
（Cartan F(R)重力と宇宙の時間発展）

氏　名　　谷口　真彦

This paper investigates the time evolution of the Universe in Cartan F(R) gravity.
Cartan F(R) gravity is one of the modified gravity theories by the Cartan formalism. F(R) gravity is a theory that extends the Ricci scalar, R, of the Einstein-Hilbert action of general relativity to the general functional form, F(R).

Cartan formalism constructs a Riemann-Cartan spacetime using vierbein as the basis of spacetime. In Riemann-Cartan spacetime, a new curvature tensor called torsion appears. Since torsion is associated with a modification of F(R), Cartan F(R) gravity yields an equivalent scalar-tensor theory. Cartan F(R) gravity can obtain a scalar field in a single frame. The scalar fields obtained in Cartan F(R) gravity are applied to the time evolution of the Universe.

First, we consider inflation based on a slow-roll scenario. We applied power-law and logarithmic models to ensure that the observables of CMB fluctuations are consistent with the current observations. Furthermore, we find that the observed quantities are robust to small changes in model parameters.

Next, we consider the reheating process. Several models are addressed, and in all cases the reheating temperature $T_R \sim \sqrt{M_{Pl}\Gamma}$ is obtained. Although only a classical calculation, a reheating process that incorporates the interaction between spinor and scalar fields is also simulated.

Finally, we apply quintessence to the linear potential of the logarithmic model with a small coupling. Therefore, the logarithmic model gives quintessence inflation, inducing two accelerating expansions: inflation and dark energy.

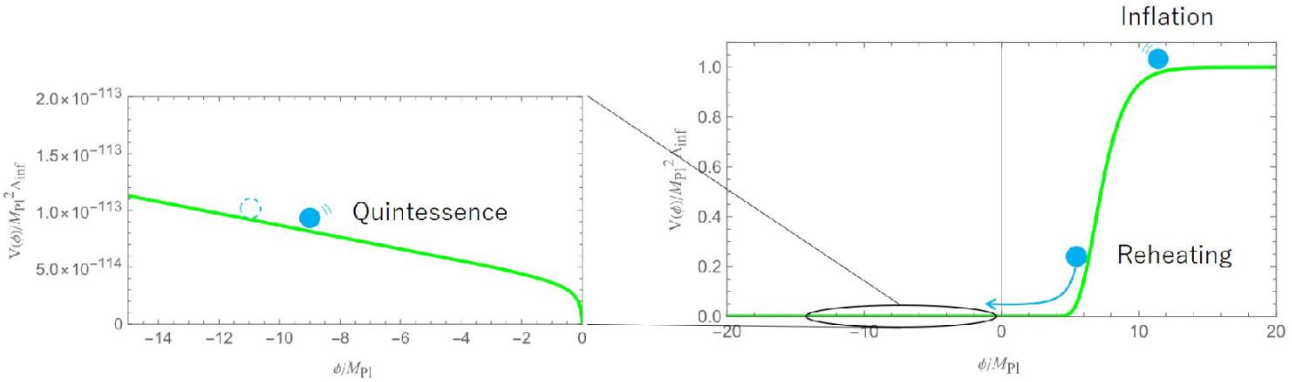

図 1　Overall view of quintessential inflation by the logarithmic model in Cartan F (R) gravity