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WIMPs in Dilatonic Einstein Gauss-Bonnet Cosmology

We use the Weakly Interacting Massive Particle (WIMP) thermal decoupling scenario to probe Cosmologies in dilatonic Einstein Gauss-Bonnet (dEGB) gravity, where the Gauss-Bonnet term is non-minimally coupled to a scalar field with vanishing potential. We put constraints on the model parameters when the ensuing modified cosmological scenario drives the WIMP annihilation cross section beyond the present bounds from DM indirect detection searches. In our analysis, we assumed WIMPs that annihilate to Standard Model particles through an s-wave process. For the class of solutions that comply with WIMP indirect detection bounds, we find that dEGB typically plays a mitigating role on the scalar field dynamics at high temperature, slowing down the speed of its evolution and reducing the enhancement of the Hubble constant compared to its standard value. For such solutions, we observe that the corresponding boundary conditions at high temperature correspond asymptotically to a vanishing deceleration parameter q, so that the effect of dEGB is to add an accelerating term that exactly cancels the deceleration predicted by General Relativity. The bounds from WIMP indirect detection are nicely complementary to late-time constraints from compact binary mergers. This suggest that it could be interesting to use other Early Cosmology processes to probe the dEGB scenario.

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Dark Matter Physics

Primary authors: BISWAS, Anirban (Department of Physics, Yonsei University); Dr KAR, Arpan (CQUeST, Sogang University); Prof. LEE, Bum-Hoon (Sogang University); LEE, Hocheol (Sogang University); Dr VELASCO-SEVILLA, Liliana (CQUeST, Sogang University); Dr YIN, Lu (APCTP, Pohang); SCOPEL, Stefano (Sogang University); LEE, Wonwoo (Center for Quantum Spacetime)

Presenter: BISWAS, Anirban (Department of Physics, Yonsei University)

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