MODIFIED EINSTEIN GRAVITY TO UNIFY UNDER- AND OVER-LUMINOUS TYPE IA SUPERNOVAE

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Type Ia supernovae (SNeIa), used as one of the standard candles in astrophysics, are believed to form when the mass of the white dwarf approaches Chandrasekhar mass limit. However, observations in last few decades detected some peculiar SNeIa, which are predicted to be originating from white dwarfs of mass much less than the Chandrasekhar mass limit or much higher than it. In this work, we, for the first time, explain this phenomenon in terms of just one property of the white dwarf which is its central density. We effectively consider higher order corrections to the Starobinsky-f(R) gravity model to reveal the unification. We show that the limiting mass of a white dwarf is ~ 0.5 solar mass for central density 10 million g/cc, while it is 2.8 solar mass for central density 100 billion g/cc under the same model parameters. We further confirm that these models are viable with respect to the solar system test. This perhaps enlightens very strongly the long standing puzzle lying with the predicted variation of progenitor mass in SNeIa.