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Violation of Chandrasekhar mass-limit in noncommutative geometry

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This abstract is primarily based on my recent paper IJMPD 30, 05 (2021) 2150034, along with arXiv: 2101.06272.

Over the past decades, various researchers have indirectly predicted at least a dozen super-Chandrasekhar white dwarfs (white dwarfs which violate the Chandrasekhar mass-limit) from the luminosity observations of type Ia supernovae. Several research groups worldwide proposed different models (such as magnetic field, rotation, modified gravity, generalized Heisenberg algebra, etc.) to explain the massive white dwarfs. However, each of these models carries some drawbacks. In my presentation, I will explain that phase space noncommutativity is one of the prominent possibilities to explain the super-Chandrasekhar limiting-mass white dwarfs. Of course, there is no observational proof of noncommutativity so far. In the semi-classical limit, I will show that the uncertainty in length scale depends both on the Planck scale and the Compton scale of the electrons, which is followed by Wigner's idea of the scale of uncertainty. Moreover, if such systems rotate following specific conditions, they can emit gravitational radiation for a long duration, which in the future, various detectors, such as LISA, BBO, DECIGO, Einstein Telescope, etc., can detect with a significant signal-to-noise ratio. Thereby it would be an indirect proof of the existence of noncommutativity.

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