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Testing Horava-Lifshitz Gravity With I-Love-Q

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Relations between the neutron star moment of inertia, tidal Love number and quadrupole moment are known to be insensitive to the nuclear equation of state (the so-called I-Love-Q relations). Such universal relations are powerful for testing general relativity and beyond in the strong-field regime with neutron star observations. Horava-Lifshitz gravity is one such alternative theory of gravity which has interesting properties such as ultraviolet completion of gravity while also inducing a preferred time direction. This theory is characterized by three coupling constants; two of them have been constrained stringently from existing neutron star observations, such as GW170817, while the remaining parameter is only weakly constrained. We thus studied how the I-Love-Q relations depend on this third parameter. We found that this sole parameter disappears from the field equations in Horava-Lifshitz gravity. Therefore, the I-Love-Q relations are universal against not only the nuclear physics uncertainty but also the gravitational physics uncertainty within Horava-Lifshitz gravity.

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