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Extended I-Love Relations for Slowly Rotating Neutron Stars PHILIPPE LANDRY, University of Chicago, JEREMIE GAGNON-BISCHOFF, University of Ottawa, STEPHEN GREEN, Max Planck Institute for Gravitational Physics (Albert Einstein Institute), NESTOR ORTIZ, Perimeter Institute for Theoretical Physics — A neutron star placed in the external gravitational field of a binary companion develops a quadrupole moment due to tidal forces. The induced quadrupole affects the orbital dynamics and imprints on the binary waveform. If the neutron star is spinning, higher multipole moments are also generated from couplings between the spin and the tidal field because of the Einstein equation's nonlinearity. For weak, slowly varying tides and slow rotation, the leading-order rotational-tidal couplings raise an octupole moment. The size of the induced octupole is measured by a rotational-tidal Love number, the analogue of the well-known tidal Love number that characterizes the induced quadrupole. Like the mass and the moment of inertia, both Love numbers are intrinsic properties of the neutron star that depend on its equation of state. Despite this dependence, a certain combination of the moment of inertia and the tidal Love number is known to be virtually equation-of-state independent. We find that so-called I-Love universality also extends to the rotational-tidal Love number: there exists a relation with the moment of inertia that is insensitive to the equation of state. These I-Love relations effectively reduce the number of tidal parameters that enter in the neutron-star binary waveform.

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