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Higher order equations to describe r-modes in Neutron Stars GIAMMARCO TURRIZIANI COLONNA, Texas tech university, BENJAMIN OWEN TEAM — The structure and composition of Neutron Stars (NS) are unknown and the most promising way to understand them is through the Gravitational Waves (GW) asteroseismology, that is the study of the oscillations of the star through GWs. Between all the possible Quasi Normal Modes, the r-modes are the most promising source of GW because they can be unstable at an arbitrary angular velocity, due to the CFS instability mechanism. Other Quasi Normal Modes either are stable, which means that their amplitude are damped, or their instability turns on at very high angular velocities. This means that these other modes would be hardly detectable./ The frequencies of r-mode oscillations of rotating NS can be useful for guiding and interpreting GW and electromagnetic (EM) observations, which makes this study of relevance to both LIGO scientists, and astrophysicists. The frequencies of slowly rotating, barotropic and non magnetic Newtonian stars are well known, but subject to various corrections. The most important one is the relativistic correction, and the second most important is the rapid rotation correction. For this reason we decided to study the Lockitch-Andersson-Friedman (LAF) equations, that describe r-mode oscillations of stars in General Relativity (GR), and we aim to extend the

Giammarco Turriziani Colonna
Texas tech university

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