Gravitational wave interactions with matter: beyond quadrupolar perturbations

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In this talk, we consider gravitational wave (GW) interactions with a matter shell for spherical harmonic modes of degree $\ell \geq 2$. We study such interactions in the context of linearised General Relativity within a Bondi-Sachs framework. By taking the matter shell to have no back-reaction onto the metric, we derive expressions for the shear tensor components for arbitrary ℓ. These expressions are used to calculate the GW damping and heating effects through the shell. The damping effects for the $\ell = 2$, 3, and 4 cases are then studied for specific scenarios relevant to binary neutron star post-mergers and core-collapse supernovae. We conclude by highlighting regimes where the $\ell = 3$ and 4 modes are almost completely damped.

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