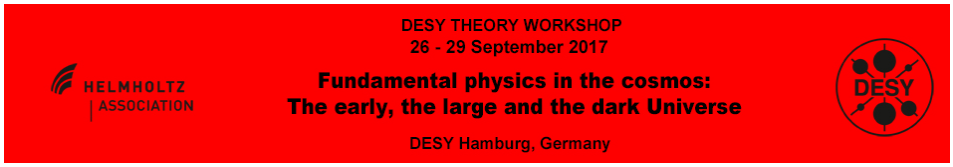

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Damping of gravitational waves by matter

Thursday 28 September 2017 17:13 (17 minutes)

We develop a unified description via the Boltzmann equation, of damping of gravitational waves by matter incorporating collisions. We identify two physically distinct damping mechanisms – collisional and Landau damping. Maximal collisional damping of a gravitational wave, independent of the details of the matter collisions is significant only when its wavelength is comparable to the size of the horizon. Thus damping by intergalactic or interstellar matter for all but primordial gravitational radiation can be neglected. Although collisions in matter lead to a shear viscosity, they also act to erase anisotropic stresses, thus suppressing the damping of gravitational waves. Damping of primordial gravitational waves remains possible. We generalize Weinberg's calculation of gravitational wave damping, now including collisions and particles of finite mass and interpret the collisionless limit in terms of Landau damping. We comment on the possible processing of primordial gravitational waves during matter domination in scenarios of ultra-light dark matter.

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