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Seminar of the theory group of APC

Mardi 28 Septembre 2021, 14 :00
APC, contact roperpol@apc.in2p3.fr for Zoom meeting details
Domaines : gr-qc

Titre : *Gravitational waves from the early-universe turbulent sources*

Orateur : **Tina Kahniashvili (Carnegie Mellon University and Ilia State University)**

Résumé : *A space-based laser interferometer, pioneered by NASA's LISA concept and now a ESA cornerstone mission, will enable direct detection of gravitational waves at lower frequencies than LIGO, without being limited by seismic noise. Perhaps the most intriguing source for LISA is the stochastic gravitational wave background produced by turbulent plasma motions in an early-universe, particularly at the electroweak energy scale. In this talk I will discuss the stochastic gravitational wave background generated from early-universe turbulence, including the effects of possible parity violation which will result in the non-zero circular polarization. Turbulent sources possibly present at the electroweak energy scales produce gravitational waves with a characteristic frequency of a millihertz, squarely in LISA's sensitivity window. I will present our recent results of direct numerical simulations to compute the net circular polarization of gravitational waves from helical (chiral) turbulent sources in the early universe for a variety of initial conditions. I will discuss the resulting gravitational wave signal assuming different turbulence genesis such as magnetically or kinetically dominant cases. Under realistic physical conditions in the early universe we have computed numerically for the first time the total polarization degree of the gravitational waves and its spectral distribution. Our major finding consists of the spectral polarization degree that strongly depends on the initial conditions. The peak of the spectral polarization degree occurs (in the wavenumber space) at twice the typical wavenumber of the source, as expected, and for the fully helical decaying turbulence, reaches its maximum (100 %) only at the peak. In addition, we have determined the temporal evolution of the turbulent sources as well as the resulting gravitational waves, showing*

that the dominant contribution to the spectral energy density happens shortly after the source activation and through prolonged (slow decay) turbulence, the increase of the gravitational wave amplitude at low frequencies can be achieved. I will readdress the constraints imposed by BBN data. I will address the detection prospects through LISA for the gravitational wave signal and its net polarization. showing that the dominant contribution to the spectral energy density happens shortly after the source activation and through prolonged (slow decay) turbulence, the increase of the gravitational wave amplitude at low frequencies can be achieved. I will readdress the constraints imposed by BBN data. I will address the detection prospects through LISA for the gravitational wave signal and its net polarization. showing that the dominant contribution to the spectral energy density happens shortly after the source activation and through prolonged (slow decay) turbulence, the increase of the gravitational wave amplitude at low frequencies can be achieved. I will readdress the constraints imposed by BBN data. I will address the detection prospects through LISA for the gravitational wave signal and its net polarization.