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Did we hear the sound of the Universe boiling? Analysis using the full fluid velocity profiles and NANOGrav 15-year data

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We analyse sound waves arising from a cosmic phase transition where the full velocity profile is taken into account as an explanation for the gravitational wave spectrum observed by multiple pulsar timing array groups. Unlike the broken power law used in the literature, in this scenario the power law after the peak depends on the macroscopic properties of the phase transition, allowing for a better fit with pulsar timing array (PTA) data. We compare the best fit with that obtained using the usual broken power law and, unsurprisingly, find a better fit with the gravitational wave (GW) spectrum that utilizes the full velocity profile. Even more importantly, the thermal parameters that produce the best fit are quite different. We then discuss models that can produce the best-fit point and complementary probes using CMB experiments and searches for light particles in DUNE, IceCUBE-Gen2, neutrinoless double $\beta-$decay, and forward physics facilities (FPF) at the LHC like FASERν, etc.

Mini Symposia (Invited Talks Only)

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