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How non-parallel flow affects the low frequency sound of supersonic heated jets MOHAMMED AFSAR, Imperial College London, ADRIAN SESCU, Mississippi State University — Experiements show that the peak noise of heated supersonic jets is lower than the peak noise associated with isothermal jets at all observation angles. Attempts to explain this reduction via acoustic analogy approaches were based on theories in which the enthalpy or momentum flux co-variance (coupling term) reduces the acoustic spectrum at small observation angles. These results, that were derived using a parallel flow assumption and determined using a low frequency asymptotic analysis, indicate that the propagator in the coupling term possesses an odd power of inverse Doppler factors that change sign at small observation angles to the jet axis for supersonic jets. This result, however, does not take into account mean flow spreading. In this study, we extend a previously developed asymptotic theory for the propagator in non-parallel flows, to heated jets. Our calculations show that, non-parallelism re-distributes the spatial structure of the propagator at small observation angles for supersonic jets. Rather than introducing cancellation in the acoustic spectrum, as parallel flow asymptotics predict, the non-parallel flow asymptotic analysis suggests that heating shifts the propagator's peak much further downstream, into regions where turbulence becomes weak.

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