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Sound production by partially premixed flames in a stagnation flow

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In the perspective of combustion noise reduction, understanding mechanisms of sound generation from combustion of non perfectly mixed reactants is a major challenge. Sound production is thus investigated for vortices impinging a flat laminar flame in a stagnation flow. Such a configuration helps to better understand sound production from turbulent flames. A study with different compositions of the main flow and surrounding gases - mixtures of nitrogen, air and methane - is carried out under the same mean flow and perturbations conditions. Time traces of radiated sound pressure and chemiluminescence emission from radical species present in the reaction zone are characterized together with detailed imaging of the flame and flow motions. Elements of classical combustion noise theory are used to identify the main noise sources when air or fuel is entrained by the vortex interacting with the flame.