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Azimuthally spinning wave modes and heat release in an annular combustor[1] HAKON NYGARD, MAREK MAZUR, JAMES R. DAWSON, NICHOLAS A. WORTH, NTNU — In order to reduce NOx emissions from aero-engines and stationary gas turbines the fuel-air mixture can be made leaner, at the risk of introducing potentially damaging thermo-acoustic instabilities. At present this phenomenon is not understood well enough to eliminate these instabilities at the design stage. Recently, the presence of different azimuthal modes in annular combustors has been demonstrated both experimentally and numerically. These naturally occurring instabilities in annular geometry have been observed to constantly switch between spinning and standing modes, making it more difficult to analyse the flame structure and dynamics. Very recently this issue was partially addressed using novel acoustic forcing to generate a standing mode. In the present study this concept has been developed further by creating an azimuthal array of loud speakers, which for the first time permits predominantly spinning modes to be set up inside the combustion chamber. The use of pressure and high speed OH* measurements enables the study of the flame dynamics and heat release rate oscillations of the combustor, which will be reported in the current paper. The ability to precisely control the azimuthal mode of oscillation greatly enhances our further understanding of the phenomenon.

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