

LadHyX Seminar – December 8, 10:45 – LadHyX Library

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**Spontaneous Symmetry Breaking of Thermo- and Aero-Acoustic Instabilities
in Hydrogen Aircraft Engines**

A key challenge in the development of tomorrow's aircraft engines, which will be fired with hydrogen, is the control of thermo- and aero-acoustic instabilities. The annular shape of the compressor, combustor and turbine typically leads to instabilities involving azimuthal modes. They are unwanted because the induced vibrations cause mechanical fatigue and sometimes even components destruction. Using an annular combustor and a cylindrical cavity, both nominally symmetric, different types of spontaneous and explicit symmetry breaking of the modes, as well as intriguing beating modes associated to heteroclinic orbits in the phase-space, have been discovered. In this talk we will present these experiments (acoustic field reconstruction, high-speed chemiluminescence and stereoscopic particle image velocimetry), and we will discuss how we modelled these complex phenomena with quaternions, coupled Langevin equations and their Fokker-Planck counterparts, and with the Navier-Stokes equations linearized around the turbulent mean swirling flow.