

## Contrats doctoraux 2026

**Titre du projet de thèse :** Theoretical study of multi-frequency-comb generation in N-dimensional resonators

**Directeur(s) de thèses :** Matteo Conforti (PhLAM) / Saliya Coulibaly (PhLAM) / Arnaud Mussot (PhLAM)

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### Résumé du projet de thèse (en 20 lignes maximum) :

Optical frequency combs are transformative light sources that have reshaped precision measurement science, as illustrated by the Nobel Prize in Physics awarded to T. W. Hänsch in 2005. Their applications span pollutant detection, autonomous-vehicle ranging, and exoplanet detection [1]. Among the various platforms capable of generating frequency combs, high-Q resonators offer key advantages for producing broadband and stable combs. Despite extensive research, the underlying dynamics governing comb formation remain insufficiently understood. Improving this understanding is essential for achieving finer control over comb characteristics relevant to the applications mentioned above. In particular, resonators supporting multiple frequency combs require targeted investigation. These systems are of central interest for dual-comb spectroscopy, optical ranging, and neuromorphic computing, yet their intrinsic multidimensional nonlinear dynamics introduce significant complexity that is not fully resolved. This PhD project will address these questions in close collaboration with an experimental PhD thesis on resonators (A. Houard, MSCA DN MATCH) and a Postdoctoral Fellowship (F. De Lucia, MSCA Marie Curie Fellowship, Microlight).

[1] T. Fortier and E. Baumann, "20 years of developments in optical frequency comb technology and applications," *Commun. Phys.* 2, 153 (2019).

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**Remarques/commentaires supplémentaires :**

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