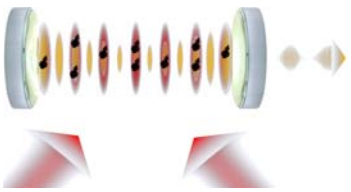
Post-doc Projet CELSIUS

Job title	Superradiance on ytterbium clock transition for frequency metrology
Job type (PhD, Post-doc, Engineer)	Post-doc
Contract duration (months)	12 guaranteed, fundings for 12/24 extra-months have been requested
Qualifications (Master, Ph.D …)	PhD
Job hours (full time/ part time)	Full Time
Employer	UBFC
Financing Institutions	EIPHI/UBFC
Host Laboratory	FEMTO-ST
URL Host Laboratory	https://www.femto-st.fr/en
Address Host Laboratory	26 rue de l'epitaphe, 25000 Besancon, France
Job description	With the advent of optical atomic clocks, precision measurements have entered a new era. Fractional frequency accuracies have reached the 18th decimal, and are now providing key insights into faint fundamental phenomena. Yet, the current limitations of traditional, "passive", optical clocks are now challenging to overcome, and new optical frequency keepers are emerging. Among them, one exciting perspective is to realize superradiant lasers. They are based on cold atoms with a narrow-linewidth optical transition coupled to a high-finesse Fabry-Perot cavity. Superradiance emerges as the constructive quantum interference between the various decay paths from a many-body fully excited state to the ground state. A superradiant laser uses directly the enhanced atomic emission inside the cavity as the ultra-stable signal. *Figure 1: Sketch of superradiant laser setup emitting pulses. Atoms will be pumped into the excited state of the clock transition and emit superradiant*  *pulses. In black: atoms, in yellow: optical cavity mode; in red: trapping lattice.* The goal of this new project is to exploit quantum coupling between atoms and cavity to observe superradiance with an ytterbium gas. Prior to an actual observation of superradiance, we will perform high-resolution spectroscopy of an ultra-cold ytterbium ensemble coupled to a single mode high finesse Fabry-Perot cavity to evaluate the influence of the cavity on the transition frequency. The next objectives will focus on the first observation of superradiance on the clock transition of ytterbium. A sketch of the experiment is indicated in Fig. 1. The metrological aspects, including frequency stability characterization and efforts towards a continuous superradiant laser will represent an important part of the project. However, fundamental aspects such as squeezing and other collective phenomena such as the effect of interactions can also be explored.
Supervisor(s)	Marion Delehaye (CNRS Researcher)

Candidate profile	We are looking for candidates with a PhD and experience in optics and atomic physics. Strong motivation is expected. Basic level in French is recommended but not mandatory.
Keywords	Time-and-frequency, atomic physics
Application deadline	15/05/2021
Application Depending on the type of position	Applications should be sent by email to marion.delehaye@femto-st.fr , including a CV, a list of publications, and the name of two people who may recommend the candidate.