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To the media representatives

PRESS RELEASE

3D printing for atomic clocks

Neuchâtel, October 18, 2016. **By using 3D-printing technology, the Laboratoire Temps-Fréquence (LTF) of University of Neuchâtel strives to reduce the weight and production cost of key components for atomic clocks. Together with its partners EPFL and the company SWISSto12, LTF coordinates a new project on this topic that will last 15 months and will be concluded in February 2018. This initiative of LTF and its partner institutions received a financial support of 250'000 CHF, in the frame of a call for proposals issued by the Swiss Space Center and the Swiss Space Office.**

With their project entitled *3-D printed microwave cavities for atomic clock applications*, the LTF and its partners aim to demonstrate the implementation of 3D-printing technology for the production of microwave cavities that are critical key components in atomic clocks. Their conventional fabrication requires high precision in machining of metals, which is challenging and cost-intensive with today's standard techniques.

3D printing of components, also known as additive manufacturing, is a key element of industry 4.0 in which Switzerland aims to defend its high-level position. It has great potential to strongly simplify the manufacturing of microwave cavities, leading to reduced production cost. "It also provides increased flexibility for the production of small series with complex geometries", explains Christoph Affolderbach, physicist at LTF and scientific project leader in the group of professor Gaetano Mileti. Furthermore, thanks to the materials used for 3D printing, these components are more lightweight than conventional ones, which is of advantage for atomic clocks intended for mobile or satellite-borne applications.

But what is the function of these components in an atomic clock? The microwave cavities produce a reference signal that allows obtaining an ultrastable frequency, which in turn enables the desired long-term stability and precision of the atomic clock. "Due to their relatively complicated shape, these microwave cavities are ideal examples where one can profit from the advantages of 3D printing", states Christoph Affolderbach.

With its long-standing expertise in the development of rubidium atomic clocks, LTF will assume the coordination of the project. The Neuchâtel laboratory will also be in charge of demonstrating the proper operation of the new microwave cavity in an experimental atomic clock system. The manufacturing of the microwave cavities by 3D printing will be carried out by the company SWISSto12 SA that has previously established novel 3D-printing technologies allowing production of high-performance radiofrequency components. The EPFL-LEMA group, specialized in microwave technologies and long-standing partner of LTF, will conduct numerical simulations and the characterization of the cavities.

University of Neuchâtel is also a partner of the newly founded *Centre de recherche en micro-fabrication - M2C,* (http://m2c.epfl.ch/) developing novel fabrication methods in Neuchâtel. The M2C center is a joint undertaking of EPFL, CSEM, HE-Arc, and UniNE..

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Antenne micro-onde produite par impression 3D
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