New generation of ultra-small and high-precision lasers emerges

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Ultra fast, robust, stable, and high precision: these are some of the characteristics of a new laser developed by an international research team. This ultra-small laser paves the way for a new generation of highly powerful, ultra-stable integrated lasers. Professor Roberto Morandotti and his team at the INRS University's Énergie Matériaux Télécommunications Research Centre played a leading role in the design of this versatile laser that recently made the front page of the prestigious scientific journal *Nature Communications*.

"We advanced a new approach to develop a laser that boasts as yet unparalleled stability and precision, allowing us to conduct new experiments and open up new realms of research," said Professor Morandotti, who was elected a fellow by the Optical Society of America and by the International Society for Optics and Photonics (SPIE). "Plus, a multitude of applications may be created in biology, medicine, materials processing, IT, high speed communications, and metrology."

Flexible and effective, this ultra-small laser stands out for its mode of operation. The researchers developed a ring resonator (a key laser key component) that has the unique feature of playing a dual role by acting both as a filter and a non-linear element. This is the first time researchers have successfully integrated a resonator and a micro-ring in the laser component that makes it possible to better control the light source. It is manufactured using a special glass capable of harnessing the nonlinear optical properties central to laser operation.

For the first time, the researchers tested the filter-driven four-wave mixing method, which presents a number of advantages. Notably the method makes it possible to increase the laser's stability and resistance to external disruptions, increase the amplitude of light pulses while reducing their duration, and emit extremely high quality, high-repetition-rate pulses of up to 200 gigahertz or more, while maintaining a very narrow spectral bandwidth.

Working on Professor Roberto Morandotti's team at INRS, researchers Marco Peccianti and Alessia Pasquazi helped design the operating schematics of the new laser and amplifier, and helped build the prototype. Digital simulations were performed by Pasquazi.

More information: The article is available at www.nature.com/ncomms/journal/ … full/ncomms1762.html

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