New method to achieve ultra-narrow laser linewidth

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Chinese researchers have discovered a new method to highly compress laser linewidth based on Rayleigh backscattering.

Dr. Tao Zhu and his team of researchers from Chongqing University, Southwest China, have discovered a new method to highly compress laser linewidth based on Rayleigh backscattering. Using their new method, Rayleigh backscattering can be collected in any waveguide structure and all wave bands to effectively compress a laser linewidth to merely hundreds of hertz, which could have a revolutionary impact on the field of laser technology. This makes it possible for portable laser devices to achieve an ultra-narrow linewidth at room temperature, which until now only a high Rayleigh scattering structure under strictly quiet, stable underground conditions could achieve, according to their paper published online in *Chinese Science Bulletin*.

"Using this mechanism, many types of lasers can now be developed towards narrow linewidth. It can be used to synthesize more complex optical signals, even the THz (trillion Hz) signal and microwave signals. And it can also provide technical support for precision sensing fields such as high resolution laser spectroscopy, optical atomic clocks, gravitational wave detection, and low noise microwave signal generation," says Zhu.

When the young scientist, a returnee from University of Ottawa, where he completed his postdoc, started out with his team in 2010, their goal was to use optical fiber to monitor pipelines by sensing optical signals. In

the process, however, they discovered something more interesting: that RS (Rayleigh scattering) has the ability to compress laser linewidth. After a few years of gradual progress, in 2014, they eventually established an RBS (Rayleigh backscattering) linewidth compression model (RBSLCM), achieving a single-longitudinal mode fiber ring laser with a 130-Hz linewidth using self-injection feedback structure at normal atmospheric temperature. Due to his outstanding research achievements such as this one, Zhu obtained professorship at an exceptionally young age from Chongqing University.

Devices using this mechanism have been developed for their lab use, and Chongqing University is in the process of patenting them, Zhu acknowledges.

More information: Tao Zhu, Shihong Huang, Leilei Shi, Wei Huang, Min Liu, Kinseng Chiang, "Rayleigh backscattering: a method to highly compress laser linewidth", *Chinese Science Bulletin* (2014), 59(33) 4631-4636. link.springer.com/article/10.1 … 07/s11434-014-0603-0 . www.scibull.com:8080/EN/abstra … abstract509460.shtml

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