Scientists develop device to enable improved global data transmission

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Researchers have developed a new data transmission system that could substantially improve the transmission capacity and energy efficiency of the world's optical communication networks.

Transmission of data through optical networks is currently limited by 'phase noise' from optical amplifiers and 'cross talk' induced by interaction of the signal with the many other signals (each at a different wavelength) simultaneously circulating through the network. 'Phase noise' is the rapid, short-term, random fluctuations in the phase of a signal, which affects the quality of the information sent and results in data transmission errors. 'Cross talk' refers to any signal unintentionally affecting another signal.

Now, researchers working on the EU-funded FP7 PHASORS project, led by the University of Southampton's Optoelectronics Research Centre (ORC), have announced a major advance in the potential elimination of this interference.

Traditionally optical data has been sent as a sequence of bits that were coded in the amplitude of the light beam, a system that was simple and practical but inefficient in its use of bandwidth. Until recent years, this wasn't a problem given the enormous data-carrying capacity of an optical fibre. However, the introduction of bandwidth-hungry video applications, such as YouTube, and the continued growth of the internet itself have led to increasing interest in finding more efficient data signalling formats - in particular, schemes that code data in the phase

rather than amplitude of an optical beam.

In a paper published this week in the journal Nature Photonics, scientists on the PHASORS project announced the development of the first practical phase sensitive amplifier and phase regenerator for high-speed binary phase encoded signals. This device, unlike others developed in the past, eliminates the phase noise directly without the need for conversion to an electronic signal, which would inevitably slow the speeds achievable.

The device takes an incoming noisy data signal and restores its quality by reducing the build up of phase noise and also any amplitude noise at the same time.

ORC Deputy Director and PHASORS Director, Professor David Richardson comments: "This result is an important first step towards the practical implementation of all-optical signal processing of phase encoded signals, which are now being exploited commercially due to their improved data carrying capacity relative to conventional amplitude coding schemes.

"Our regenerator can clean noise from incoming data signals and should allow for systems of extended physical length and capacity. In order to achieve this result, a major goal of the PHASORS project, has required significant advances in both optical fibre and semiconductor laser technology across the consortium. We believe this device and associated component technology will have significant applications across a range of disciplines beyond telecommunications - including optical sensing, metrology, as well as many other basic test and measurement applications in science and engineering."

The PHASORS project, which started in 2008, was tasked with developing new technology and components to substantially improve the

transmission capacity and energy efficiency of today's optical communication networks.

The project combines the world-leading expertise of research teams from the ORC, Chalmers University of Technology (Sweden), The Tyndall National Institute at University College Cork (Ireland), the National and Kapodestrian University of Athens (Greece), and leading industrial partners Onefive GmbH (Switzerland), Eblana Photonics (Ireland) and OFS (Denmark).

Provided by University of Southampton