UNIVERSITÉ LIBRE DE BRUXELLES

ULB

DÉPARTEMENT DE LA COMMUNICATION ET DES RELATIONS EXTÉRIEURES

[COMMUNIQUÉ DE PRESSE]

Cavity solitons for random number generation

Publication in Nature Photonics: a team of researchers from the Université libre de Bruxelles demonstrates that cavity solitons can be forced to twice their carrier frequency, allowing the generation of random numbers.

Service Communication – Communication Recherche com.recherche@ulb.be

T : +32 (0)2 650 48 50 - GSM : + 32 (0)473 97 22 56

Cavity solitons are optical pulses that propagate indefinitely in nonlinear resonators. By letting out a part of their energy at each roundtrip, they form a pulse train at the output of the resonator. In the frequency domain, an optical pulse train corresponds to an optical frequency comb, whose inventors were awarded the Nobel Prize in 2005. These combs are composed of a set of equally spaced teeth where each tooth corresponds to a frequency. Used as rulers, they can be used to measure an optical frequency with a very high precision. This allows, among other things, measuring the variations of the Earth-Moon distance with a precision equivalent to the size of a hair! Until now, these cavity solitons have been generated using a driving laser whose frequency corresponds to the carrier frequency of the solitons. However, non-linear systems can also be forced in a parametric way. This configuration consists in driving the system by varying one of its parameters.

"*Imagine that you are on a swing. If someone pushes you, it has to do it at the same frequency as you are swinging: this is external driving. However, if you are alone, you must bend your legs at twice that frequency. In this case, the driving is parametric*", explains Nicolas Englebert, researcher at Opera-Photonics.

The Opera-Photonics team - Ecole polytechnique de Bruxelles, Université libre de Bruxelles - has demonstrated that cavity solitons can also be forced to twice their carrier frequency. To achieve this, they used an all-fiber optical parametric oscillator that possesses both second and third order nonlinearity. This feature gives a completely random character to the sign of the amplitude of the generated cavity soliton.

"*The measurement of this sign allows the generation of a binary random number, opening the way to a new type of all-optical computer*", explains Nicolas Englebert.

Englebert, N., De Lucia, F., Parra-Rivas, P. et al. Parametrically driven Kerr cavity solitons. Nat. Photon. **15**, 857–861 (2021). https://doi.org/10.1038/s41566-021-00858-z

.

Englebert, N., De Lucia, F., Parra-Rivas, P. et al. Parametrically driven Kerr cavity solitons. Nat. Photon. **15**, 857–861 (2021). https://doi.org/10.1038/s41566-021-00858-z

Contact presse :

Service Communication – Communication Recherche com.recherche@ulb.be T : +32 (0)2 650 48 50 - GSM : + 32 (0)473 97 22 56