

Field experiment optical chaos communication @ 10Gb/s demonstrating electro-optic phase chaos principles

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Electro-optic nonlinear delay dynamics are one of the main alternative approach to external cavity semiconductor lasers, in the context of experimental optical chaos communications setups [1]. In the frame of a recently accomplished European project (PICASSO, FP6-IST-2006-34551), we have demonstrated state of the art performances with a novel electro-optic approach involving the generation of chaotic optical phase broadband carrier from delayed nonlinear non-local feedback oscillator, capable of high quality distant chaos synchronization over a bandwidth exceeding 15 GHz [2]. Our latest investigations were concerned by the demonstration of unprecedented 10Gb/s field experiment of optical chaos communication [3], by the investigation of the critical dispersion issues in broadband electro-optic optical chaos [4], and by the implementation of flexible and reliable physical key-components based security, as well as by the study of the enhanced robustness versus time delay identification for the non-local phase chaos dynamics driven by a pseudo random bit sequence.

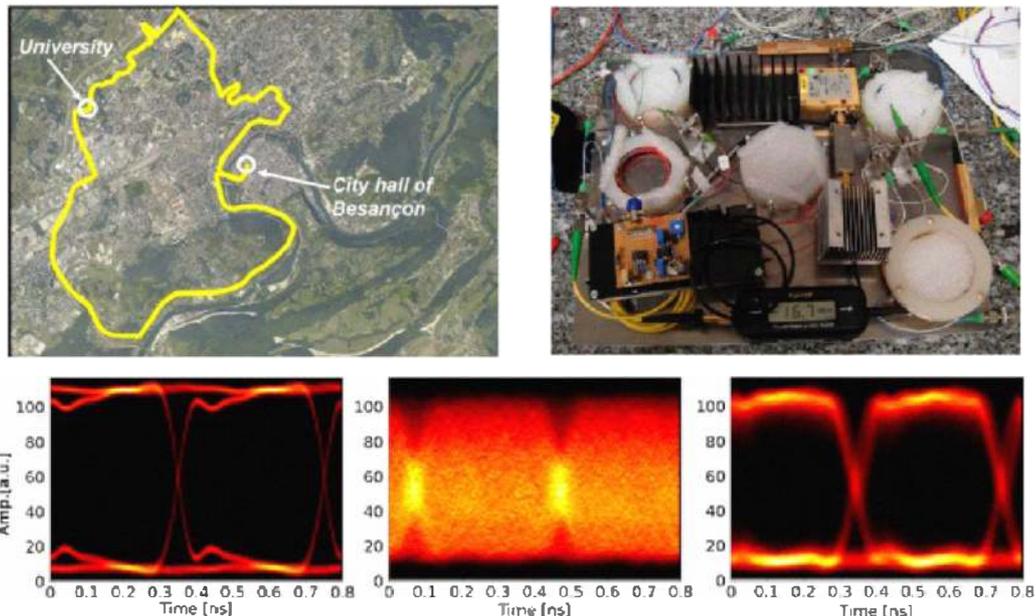


Fig. 1 Electro-optic phase chaos: satellite view of the “Lumière brothers” ring network in the city of Besançon used for the first 10Gb/s field experiment (upper left); a picture of the phase chaos setup mounted on an A4-alumini breadboard (upper right); original, encoded, and error free recovered 3Gb/s eye diagram with a customized hardware consisting of a 3-wave interferometer (lower).

We will report on the conditions under which we have obtained for the first time 10Gb/s optical chaos communications over an installed network (see Fig.1, upper left), with bit error rates better than 10^{-7} over more than 100km (2nd field experiment in Athens, over part of the metropolitan fiber network), thanks to the design of a compact and transportable emitter and receiver setup (see Fig.1, upper right picture). We have also investigated additional attractive confidentiality features of our approach, through the use of flexible and reliable physical-key defined custom device consisting in an imbalanced 3-wave interferometer as the key nonlinear non-local phase to intensity converter ruling the chaotic motion, and thus also required for the synchronization and the decoding (see Fig.1, lower picture, error free transmission at 3Gb/s).

References

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