

SOE 18: Invited Talk Kathy Lüdge (joint session DY/SOE)

Time: Friday 9:30–10:00

Location: H19

Invited Talk

SOE 18.1 Fri 9:30 H19

Photonic Reservoir Computing: Analytic insights and possibilities for optimization — LINA JAURIGUE¹, FELIX KÖSTER², and KATHY LÜDGE¹ — ¹Institute of Physics, Technische Univ. Ilmenau, Weimarer Str. 25, 98684 Ilmenau — ²Institute of Theoretical Physics, Technische Univ. Berlin, Hardenbergstr. 36, 10623 Berlin

Reservoir computing has gained a lot of attention because its relatively simple setup that can be easily implemented in hardware, specifically with optical devices. Using one nonlinear node, i.e., a laser with an optical feedback loop and time-multiplexed input, already allows to solve complex time-series prediction tasks after a proper training via linear regression. Nevertheless, the performance depends on properly

adjusted timescales and not every physical system is suitable for a given task [1].

We present ways to improve the computing performance of delay-based photonic reservoir computing systems using delay-time tuning, and we discuss to what extent delay-coupled laser-networks with more than one optical element can be beneficial to improve the overall performance. Furthermore, we discuss analytic insights into the information processing capacity of a reservoir computing system and its correlation to the linear system response of the reservoir as well as to the series expansion of a chosen task.

[1] T. Hülser, F. Köster, L. C. Jaurigue, and K. Lüdge, *Opt. Mater. Express* 12, 1214 (2022).