Neuromorphic Polariton Accelerator (PolArt)
dr hab. Barbara Piętka, prof. UW
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Exciton-polaritons, hybrid light-matter particles, have recently come into the spotlight for their peculiar properties (sizable interaction, small mass, long coherence, etc.) leading to spectacular effects such as phase transitions, superfluidity, bistability, ultra-efficient fourwave-mixing, and quantum blockade. On the other hand, polaritons have also been proposed for different kinds of devices (including optical switches, transistors, low threshold lasers and simulators), with beautiful experiments showing proofs-of-principle. However, it is only recently that polaritons have been operating efficiently at room temperature, giving the promise of a real technological impact in the future. In a recent work, made by some of the theoretical and experimental partners of this proposal, we could demonstrate that such hybrid state of matter, when used for realising artificial neural networks, shows extremely interesting performances in terms of speed and success rate.
Given the strong interest in the realisation of hardware-based (not simulated) artificial neural networks, the goal of PolArt is to demonstrate a new way to build artificial intelligence-dedicated circuits using polariton neural networks as optical accelerators. Thanks to this new concept device, complex applications related to neural-like processing, will be efficiently implemented, therefore enabling neuromorphic computation to be done in small devices that cannot rely on remote, large bandwidth connection. This proposal benefits from the contribution of several complementary partners coming from many different research areas (material science, physics, optics, chemistry, genetics) and industrial participants that assure the interdisciplinarity and technological oriented target.