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Device-independent certification of quantum technologies

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With the development of quantum technologies, it is pivotal to discern devices exploiting quantum phenomena from faulty ones. This essential task is elusive, since eventual imperfections may go unnoticed to a direct verification. A solution to this deadlock exploits the discrepancies between classical and quantum causal predictions, which can detect nonclassical correlations, with no assumptions on the apparatus (device-independently). This talk will present two demonstrations of this approach, applied to instrumental processes and experimentally implemented on photonic platforms. Firstly, nonclassical correlations will be revealed through the violation of an inequality constraint and used to bound the randomness of a bit string. Then, a novel and more general approach will be adopted, exploiting the quantification of causal influence between two variables.

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