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Coherent Correlation Imaging: unveiling new space and time information in dynamical mesoscopic systems. CLAUDIO MAZZOLI, Brookhaven National Laboratory

In experiments, time and space resolutions are typically antagonist as a certain number of particles (used as probes during a measurement, e.g. photons) can be typically used for increasing only one or the other of the two. Here we report a new method exploiting the detected particles by partially classifying the results obtained, instead of limiting the statistical improvement to blind averaging. Indeed, informed averaging (by classification) allows the resolution in time AND space to be improved. The idea behind is simple, and we report a specific application to soft x-ray holography in magnetic thin films as an example. However, we prove that the generalization to other techniques, probes and sample is trivial. Moreover, the implementation of this method naturally allows to retrieve a complete map of states explored by the sample during the measurement, together with their transitions. In short, the connectivity network of states is revealed, thus uncovering new and original information typically inaccessible by blind averaging. This opens up new possibilities in the investigation of the intimate behavior of dynamic systems at the mesoscopic scales. Some applications and implications are sketched, together with their potential impact in crucial and forefront scientific areas.