

Cognitive ability process at the molecular level

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Titre Cognitive ability process at the molecular level

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Mots-clés azo-polymer film [6], cognitive ability [7], cooperative effects [8], molecular self-assembly [9], nanotechnology [10], photoactive materials [11], polymer thin films [12], self-organisation [13], SRGs [14], surface relief gratings [15]

Résumé en anglais
In the standard SRG formation in azo-dye containing photoactive polymers, the photoactive molecules are excited by a coherent illumination pattern. The highly reactive molecules move in a non-uniform way, inducing a mass transport from the bright regions to the neighbouring dark regions. The maximum heights of the light induced SRG correspond to light intensity minima. We show that a well-defined surface relief grating is induced in an azo-polymer film by the combination of one low power coherent laser beam with another high power incoherent and unpolarised beam. The information brought by the coherent signal beam has been transmitted to peripheral incoherent regions by the molecular self-assembling process: i.e., the organised molecules communicate non-local information about photo-induced structural organisation to the non organised neighbouring ones. They communicate by exchanging light through surface relief variations. In this way, we see that a totally incoherent beam can provide the movement which is necessary to induce a well-defined SRG. We find in this way one of the simplest systems allowing to figure out the minimal requirements to organise disordered materials into well organised structures. We verify experimentally that random motion plus information exchange lead to self-organisation. Our experiment shows that complex behaviour can be experimented using simple systems: weak coherent light can serve as a seed to create information into a polymer film in such a way that molecules powered by incoherent light will build and transmit well defined complex structures.

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