

**Helical nanostructures:
PT violation & (quantum) cooperative dichroism signatures**

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Helical systems break space reversal symmetry. They represent non-linear systems with electromagnetic response functions that depend on a magnetic-field vector. That is, their response function has spatial dispersion and a (magnetic) anisotropy. For these reasons, helical structures, naturally occurring or artificially made, have kept to ignite research interest within the scientific community.

Here we present some of the intriguing properties of periodic ensembles of artificially made nanohelices with feature sizes in the sub-100 nm regime. This comprises the detection of the long sought after Faraday chiral anisotropy, the emergence of a (quantum) cooperative enhancement of the circular dichroism as well as theoretically possible spin-selective charge transport anisotropies. Also, the discussed cases will demonstrate that the interplay of simultaneous symmetry breaking of space and time reversal symmetry, the sources of excitations and the material the nanohelices are made of are determining factors for the emergence of the phenomena.