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The electric dance of cholesteric colloids

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Dispersions of colloidal particles in liquid crystals are nowadays a subject of
intensive studies due to their potential as novel and versatile metamaterials with
important applicative avenues such as digital-ink technologies,
biosensors and optical devices.
In this talk I will report theoretical results, based on lattice Boltzmann simulations,
on a novel method to manipulate the spatial arrangements of colloids in cholesteric liquid crystals .
By controlling the amplitude and shape of a time-dependent electric field, I will show that the system can be
reproducibly driven out of equilibrium through different kinetic pathways and
navigated through a glassy-like free energy landscape encompassing many competing metastable
equilibria. Such states range from simple Saturn rings to complex structures
featuring amorphous defect networks, or stacks of disclination loops.
In particular, by using suitable non-equilibrium electric pulses, one can drive colloids from planar to
linear, rope-like configurations and vice-versa.
These results can stimulate the development of new (e.g. non equilibrium) experimental procedures to control
the three-dimensional patterning and self-assembly of colloidal particles suspended in complex fluids
as well as prompt the design of new types of switching devices with tunable elastic and electro-optic properties.

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