Cellulose nanocrystal films only selectively reflect left circularly polarized (LCP) light, while being transparent to right circularly polarized (RCP) light. This effect is due to the particular way in which chiral cellulose nanorods self-assemble. Now, taking inspiration from the cuticle of the beetle Plusiotis resplendens, Fernandes et al. have designed a new photonic structure in which these chiral cellulose nanocrystals are capable of reflecting both LCP and RCP light.

This photonic structure is made by sandwiching an anisotropic nematic liquid crystal layer made of 4-cyano-4'-pentylbiphenyl into a microgap between two left-handed cholesteric nanocellulose domains with similar pitches. The nematic layer acts as a half-wave retardation plate, transforming RCP into LCP light and vice versa. In this way, the RCP light can also be reflected back efficiently.

The researchers also show that, due to the reversible transition of the anisotropic liquid crystal layer from nematic to isotropic, the RCP light reflection can be controlled by varying the temperature or applying an electric field.

For instance, at a temperature above the nematic-to-isotropic transition temperature, all the RCP light is transmitted (colourless reflection) due to the loss of the retardation plate effect, while the LCP light is still reflected, but with a higher wavelength, owing to the decrease of the material refractive index and the increase of the pitch of the cholesteric chiral phases.