Supplementary Information

Samples fabrication. The gammadions arrays were fabricated by e-beam lithography and etching. First, continuous films were grown with combined electron beam (Co, Ti) and thermal (Au) evaporation. Then, a 100 nm thick layer of electron sensitive negative resist (AR-N7500.08) was spin-coated on top of the metallic films and the chiral crosses were patterned in areas of 400x400 μm^2. After development, the pattern was transferred to the metal layers by Ar milling and the remaining resist was removed by using O_2 reactive ion etching.

Optical characterization. Circular dichroism (CD), both pure optical and magnetic CD (MCD) has been measured in the spectral range 450nm-1100nm using a photoelastic modulator and locking amplifier techniques. The polarization state of a linear polarized monochromatic light was modulated at 42 kHz by a photoelastic modulator and, after traversing the sample, analysed by a linear polarizer mounted on a rotation stage and detected by a photomultiplier or a GaInAs diode. The transmission spectra were measured at normal incidence. With this experimental set-up we obtained the real and imaginary part of t_{sp}/t_{ss} (or t_{ps}/t_{pp}), where t_{ss} (t_{pp}) are the transmission coefficients of the structure for s (p) -polarized light and t_{sp} (t_{ps}) the polarization conversion factors. At normal incidence, and for small values of t_{ps} ,the imaginary part of t_{sp}/t_{pp} , denoted ellipticity, ε, is related to CD as: $2\varepsilon = \frac{I^{RCP}-I^{LCP}}{I^{RCP}+I^{LCP}}$. For determining MCD, the magnetic field was applied perpendicular to the sample plane using permanent magnets. The magnets were mounted on translational and rotational stages, which allowed controlling the intensity and direction of the applied magnetic field. Following the procedure described above, CD for the magnetization applied in one sense and for reversed magnetization can be obtained, and from that the magnetic circular dichroism is calculated, MCD = CD(+M) – CD (-M).

Theoretical calculations. The theoretical CD spectra and field distributions were computed using the finite elements commercial software COMSOL Multiphysics. Regarding the materials properties, the permittivities of the metals used in the calculations were obtained from ellipsometric measurements of Au and Co continuous films, while the glass substrate refractive index was set to be 1.5. For the Au/Co gammadion we average the multilayer out so that the 12 Au/Co bilayers were replaced in the simulation by one gammadion-shaped layered of 84 nm height with an average effective dielectric tensor $\varepsilon_{eff} = (6*\varepsilon_{Au} + 1*\varepsilon_{Co})/7$.

Electromagnetic field distributions

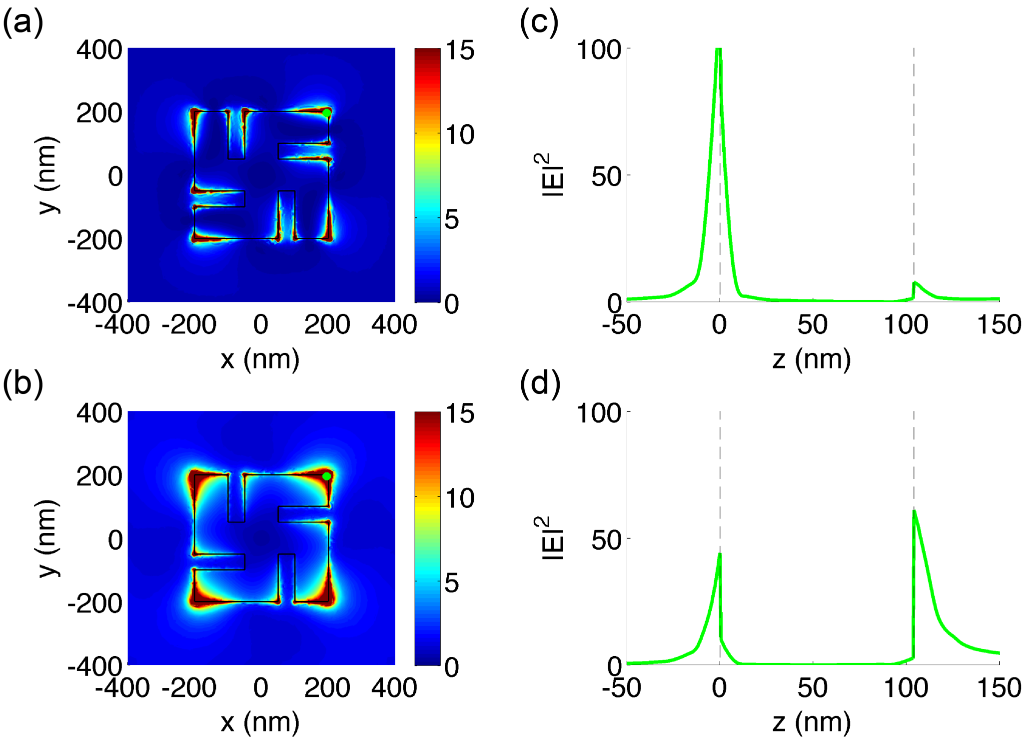

Figure SI-1: (a) In-plane electromagnetic field distribution calculated at 5nm below the substrate/gammadion interface for a wavelength of 650 nm the substrate (b) In-plane electromagnetic field distribution calculated at 5nm above the gammadion/air interface for a wavelength of 850 nm the substrate. z-dependence calculated at the green point for 650 nm (c) and 850 nm (d) (z=0 corresponds to the substrate/gammadion interface).

Spectral evolution of the electromagnetic field inside the gammadions

The spectral dependence of the modulus of E_p*E_s integrated to all the Co layers is much larger in the region corresponding to the high energy feature than in that related to the low energy one. This explains the larger MCD in the high energy region. The value of MCD is proportional to this product, convoluted by the spectral dependence of the modulus of ε_{MO}, which modifies slightly the overall spectral dependence of MCD.

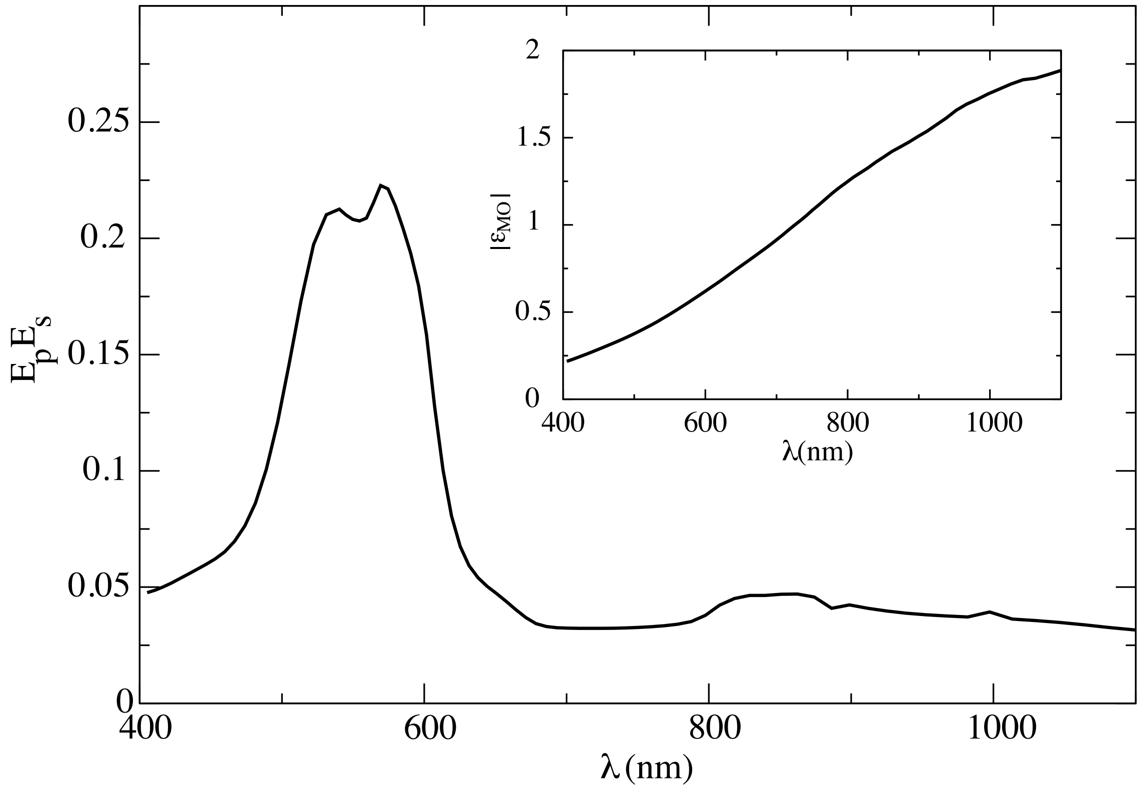

Figure SI-2: Spectral dependence of the modulus of E_pE_s integrated over all the Co layers. The inset shows the spectral dependence of the modulus of the magneto-optical constant (ε_{MO}) of Co.

Optical chirality at the high energy resonance, 650 nm

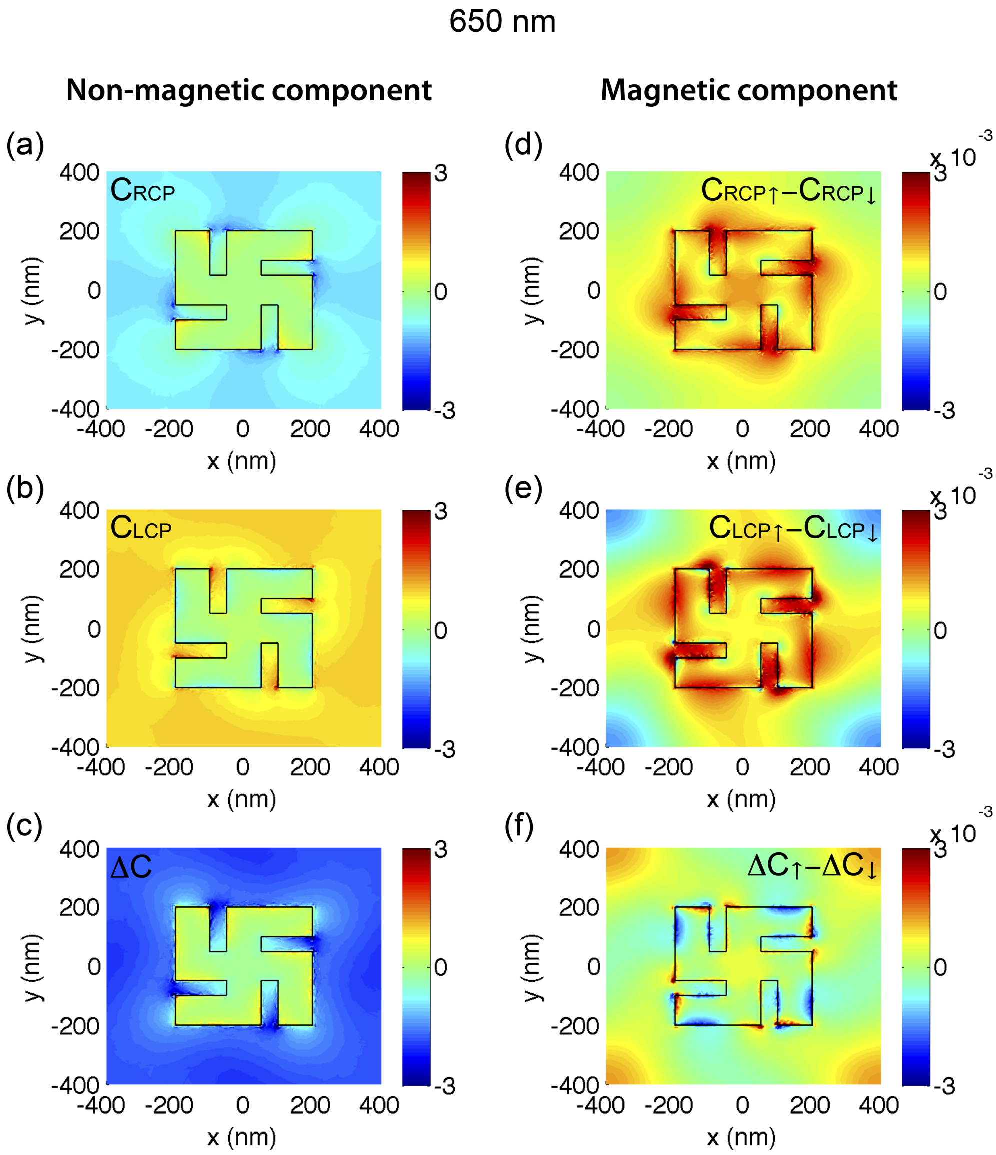

Figure SI-3 (Left column) Calculated optical chirality plots calculated at 650nm and at 5 nm above the gammadions surface when they are illuminated with: (a) right-handed circularly polarized light, (b) left right-handed circularly polarized light, (c) difference between the optical chirality in plots a and b. (Right column) Difference between the optical chirality when the structures are magnetized along the positive and negative direction of the z-axis, respectively, for illumination with (d) right-handed circularly polarized light, (e) left right-handed circularly polarized light. (f) Depicts the magnetic component of the optical chirality depicted in (c).