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Giant circular dichroism in individual carbon nanotubes

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We report on the observation of giant circular dichroism in individual single-walled carbon nanotubes. The nanotubes are suspended over trenches on Si substrates, and helicity dependent absorption is detected through photoluminescence collected using a home-built microspectroscopy system [1]. The degree of polarization reaches a value as high as 65%, an unforeseen level of circular dichroism for single nanomaterials in the absence of magnetic fields. Surprisingly, we find that the signal is strongly dependent on the angle of incidence, changing its sign and vanishing at certain angles. We interpret the observed dichroism in terms of a peculiar polarization conversion that occurs as a result of field-induced charge distribution at the surface of the substrate. By integrating individual nanotubes into silicon photonics [2], it should be possible to use the dichroism for polarization manipulation on a chip. In addition, such a giant circular dichroism at the nanoscale may find applications novel metamaterial designs.

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