Chiral light detection via a chiral organic semiconductor transistor

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Supplementary information

Figure S1: Circular dichroism (CD) spectra of the (+)- and (-)-1-aza[6]helicene enantiomers in dichloromethane (2.0 × 10^{-4} M), with a cuvette path length of 2 mm at room temperature.

Figure S2: Absolute absorption spectrum of (+)-1-aza[6]helicene in dichloromethane (10 μM).

Figure S3: Absolute absorption spectrum of the (+)-1-aza[6]helicene thin films as used for the OFETs.
Figure S4: (a) Output characteristics of an annealed device (recorded at gate voltages $V_G$ between 0 V and -80 V) and (b) transfer characteristics (recorded at a drain voltage $V_D = -60$ V) of fresh (red squares) and annealed (black squares) (-)-1-aza[6]helicene OFETs.

Figure S5: Output characteristics of (a) (+)-1-aza[6]helicene OFET under right-handed CP exposure and (c) (-)-1-aza[6]helicene OFET under left-handed CP exposure (recorded at gate voltages $V_G$ between 10 V and -80 V).
Figure S6: Transfer characteristics (at a drain voltage $V_D = -60$ V) of an annealed racemic 1-aza[6]helicene OFET under left-handed (black squares), right-handed (blue circles), and in the absence of (red triangles) CP illumination.

Figure S7: Transfer characteristics (recorded at a drain voltage $V_D = -60$ V) of an annealed (+)-1-aza[6]helicene OFET under UV illumination at different intensities up to 10 mW/cm$^2$. 
Figure S8: Transfer characteristics of a helicene OFET showing $I_D$ vs $V_G$ (black squares) and $\sqrt{I_{\text{DSAT}}} vs V_G$ (blue squares). Line (dashed red) is fit of $\sqrt{I_{\text{DSAT}}} vs V_G$ data to Equation (SE2) below. Arrow indicates value of $V_T$ for this transistor.

**Extraction of the device mobility and threshold voltage in the saturation regime**

In the saturation regime ($V_D > (V_G - V_T)$):

$$I_{\text{DSAT}} = \frac{W\mu_{\text{SAT}} C_i}{2L} (V_G - V_T)^2 \quad \text{(SE1)}$$

where $V_D$, $V_G$, $V_T$, $I_{\text{DSAT}}$, $\mu_{\text{SAT}}$ and $C_i$ are the drain voltage, gate voltage, threshold voltage, saturation regime drain current, saturation regime mobility and insulator capacitance per unit area, respectively. Therefore:

$$\sqrt{I_{\text{DSAT}}} = \sqrt{\mu_{\text{SAT}}} \sqrt{\frac{WC_i}{2L}} (V_G - V_T) \quad \text{(SE2)}$$

The mobility $\mu_{\text{SAT}}$ can be extracted from the slope of a plot of $\sqrt{I_{\text{DSAT}}}$ vs $V_G$ using:

$$\mu_{\text{SAT}} = \left( \frac{\partial \sqrt{I_{\text{DSAT}}}}{\partial V_G} \right)^2 \frac{2L}{WC_i} \quad \text{(SE3)}$$

$V_T$ can be found from the intercept with the $V_G$ axis. This is illustrated in Figure S8.