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Weak Measurements of Light Chirality with a Plasmonic Slit

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We examine, both experimentally and theoretically, an interaction of tightly focused polarized light with a slit on a metal surface supporting plasmon-polariton modes. Remarkably, this simple system can be highly sensitive to the polarization of the incident light and offers a perfect quantum-weak-measurement tool with a built-in post-selection in the plasmon-polariton mode. We observe the plasmonic spin Hall effect in both coordinate and momentum spaces which is interpreted as weak measurements of the helicity of light with real and imaginary weak values determined by the input polarization. Our experiment combines advantages of (i) quantum weak measurements, (ii) near-field plasmonic systems, and (iii) high-numerical aperture microscopy in employing spin-orbit interaction of light and probing light chirality.

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