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Efficient directional excitation of surface plasmons by a single-element nanoantenna WENJIE YAO, SHANG LIU, HUIMIN LIAO, ZHI LI, CHENGWEI SUN, JIANJUN CHEN, QIHUANG GONG, Peking University — Directional light scattering is important in basic research and real applications. This area has been successfully downscaled to wavelength and subwavelength scales with the development of optical antennas, especially single-element nanoantennas. Here we show, by adding an auxiliary resonant structure to a single-element plasmonic nanoantenna, the highly efficient lowest-order antenna mode can be effectively transferred into inactive higher-order modes. Based on this mode conversion, scattered optical fields can be well manipulated by utilizing the interference between different antenna modes. Both broadband directional excitation of surface plasmon polaritons (SPPs) and inversion of SPP launching direction at different wavelengths are experimentally demonstrated as typical examples. The proposed strategy based on mode conversion and mode interference provides new opportunities for the design of nanoscale optical devices, especially directional nanoantennas.

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