Research data for

All-optical multichannel logic based on coherent perfect absorption in a plasmonic metamaterial

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This research data description should be read and understood in the context of the corresponding manuscript. The figure numbers correspond to the figure numbers of the manuscript.

Image file: Fig2_sample_SEM_image.tif

Description: Scanning electron microscope image showing part of the metasurface. Grey corresponds to gold and black corresponds to apertures.

A cropped section of this image is shown in the manuscript.

Excel file: Fig2_sample_spectra.xlsx

Description: Reflection R, transmission T and absorption A spectra of the fabricated metasurface for illumination of its front and back.

Image files: Fig3_darkscan.tif,
Fig3a_beamA.tif,
Fig3b_beamB.tif,
Fig3c_CohTrans.tif,
Fig3d_CohAbs.tif

Description: Tif image files captured by the CCD camera for all cases corresponding to figure 3 of the manuscript. In all cases, the horizontal axis corresponds to the x-axis. Each image corresponds to 164µm x 164µm on the metasurface sample plane.

The images show the metasurface illuminated by (a) beam A only, (b) beam B only, and (c-d) both beams A and B. Different relative phases of beams A and B correspond to (c) destructive interference on the metasurface, i.e. coherent transparency and (d) constructive interference on the metasurface, i.e. coherent absorption.

In the manuscript, the background noise (darkscan) has been subtracted from the plotted images and the pixel count has been translated to the equivalent µm-scale on the sample plane (512 x 512 pixels, each 16µm x 16µm in size on the CCD, demagnified 50x by the imaging optics) and is centered around and limited to the imposed profiles. Therefore, the x and y axes shown in the manuscript span from -30 to 30 µm.

Excel file: Fig3e_cross-sections.xlsx

Description: Intensity cross-sections taken from the .tif images for Fig. 3a-d after the background noise (darkscan) has been subtracted. In all cases, first column corresponds to the CCD pixel number on the x-axis. The image cross-sections are marked in Fig. 3a-d of the manuscript. The physical size of each pixel is 16µm x 16µm on the CCD camera, corresponding to 320 nm x 320nm on the metamaterial sample plane due to 50x demagnification by the imaging optics. The 512 pixel cross-section corresponds to 164µm on the metasurface sample plane.

In the manuscript, the pixel count has been translated to the equivalent µm-scale on the sample plane and is centered around and limited to the imposed profiles. Therefore, the x-axis shown in the manuscript spans from -30 to 30 µm.

Image files: Fig4_darkscan.tif,
                Fig4a_beamA.tif, Fig4a_beamB.tif, Fig4a_CohTrans.tif, Fig4a_CohAbs.tif,
                Fig4b_beamA.tif, Fig4b_beamB.tif, Fig4b_CohTrans.tif, Fig4b_CohAbs.tif,
                Fig4c_beamA.tif, Fig4c_beamB.tif, Fig4c_CohTrans.tif, Fig4c_CohAbs.tif

Description: Tif image files captured by the CCD camera for all cases corresponding to figure 4 of the manuscript. In all cases, the horizontal axis corresponds to the x-axis. Each image corresponds to 164µm x 164µm on the metasurface sample plane.

The images show the metasurface illuminated by a pattern of 5 spots (beamA) representing simulated optical data channels and (a-c) selected spots (beamB) representing selected data channels for different optical phase differences between beam A and beam B resulting in destructive interference on the metasurface (Coherent Transparency - CohTrans) and constructive interference on the metasurface (Coherent Absorption - CohAbs).

In the manuscript, the background noise (darkscan) has been subtracted from the plotted images and the pixel count has been translated to the equivalent µm-scale on the sample plane (512 x 512 pixels, each 16µm x 16µm in size on the CCD, demagnified 50x by the imaging optics) and is centered around and limited to the imposed profiles. Therefore, the x and y axes shown in the manuscript span from -30 to 30 µm.

Excel file: Fig4_cross-sections.xlsx

Description: Intensity cross-sections taken from the .tif images for Fig. 4a-c after the background noise (darkscan) has been subtracted. In cases a and c, the first column corresponds to the CCD pixel number on the x-axis. In case b, it corresponds to the CCD pixel number on the y-axis. The image cross-sections are marked in Fig. 4a-c of the manuscript. The physical size of each pixel is 16µm x 16µm on the CCD camera, corresponding to 320 nm x 320nm on the metamaterial sample plane due to 50x demagnification by the imaging optics. The 512 pixel cross-section corresponds to 164µm on the metasurface sample plane.

In the manuscript, the pixel count has been translated to the equivalent µm-scale on the sample plane and is centered around and limited to the imposed profiles. Therefore, the x and y axes shown in the manuscript span from -30 to 30 µm.