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A new class of optical structures: Supersymmetric mode converters SIMON STÜTZER, Institute of Applied Physics, Abbe School of Photonics, Friedrich-Schiller-University, MATTHIAS HEINRICH, MOHAMMAD-ALI MIRI, CREOL/College of Optics, University of Central Florida, RAMY EL-GANAINY, Max Planck Institute for the Physics of Complex Systems, Dresden, STEFAN NOLTE, Institute of Applied Physics, Abbe School of Photonics, Friedrich-Schiller-University, DEMETRIOS N. CHRISTODOULIDES, CREOL/College of Optics, University of Central Florida, ALEXANDER SZAMEIT, Institute of Applied Physics, Abbe School of Photonics, Friedrich-Schiller-University — Originally developed in the area of quantum field theory, the concept of supersymmetry (SUSY) can be exploited to systematically design a new class of mode converters. In our work, we show for the first time how supersymmetric optical structures can be utilized to control the flow of light for mode division multiplexing applications. Optical potentials and their superpartner configurations are experimentally realized in coupled waveguide arrays using the direct laser-writing technology. This key method allows a flexible and precise tuning of coupling and propagation constants in our optical network. Fluorescence microscopy is used for a direct observation of light dynamics in such systems. In our experiments we show that the fundamental mode of a multimode optical structure can be removed, while establishing global phase matching conditions for the remaining set of modes. SUSY may serve as a promising platform for a new generation of versatile optical components with novel properties and functionalities or even synthesize artificial optical structures that exhibit properties not found in nature.

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