Paderborn Photonics Lecture

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Towards Ultrafast Broadband Optical Switching Inspired by Bound States in the Continuum (BIC)

Prof. Dr.-Ing. Patrick Görrn
Bergische Universität Wuppertal
Fakultät für Elektrotechnik,
Informationstechnik und Medientechnik
Lehrstuhl für Großflächige Optoelektronik

The interaction of light with a photonic structure can be influenced by permittivity changes in optical resonators to enable optical sensors, modulators, and switches. In this context, loss-free dielectric BICs are among the most promising candidates because of their outstanding performance (intensity change per permittivity change). However, due to their singular nature in both energy and momentum, fast and local optical switching based on BICs remains challenging. Here, two ways are introduced to meet this challenge. Firstly, hybrid photonic-plasmonic BICs are introduced that exhibit a largely increased performance compared to purely dielectric ones. In the second step, a broadband phenomenon inspired by BICs is demonstrated. The combination of a continuum of waveguide modes and a quantized set of film modes makes it possible to continuously control the interaction of light with a photonic structure between zero interaction, forming a bound continuum, and maximized interaction over a broad spectral range. This phenomenon enables ultrafast as well as local control of broadband light trapping with application potential ranging from optical switching over laser displays to solar concentrators.

Contact: Prof. Thomas Zentgraf

CeOPP
Center for Optoelectronics and Photonics Paderborn

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