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Extreme confinement and propagation regimes of Terahertz surface waves on planar metallic waveguides

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Research on surface waves supported by metals at THz frequencies is experiencing a tremendous growth due to their potential for imaging, biological sensing and high-speed electronic circuits. For such applications, it has become essential to develop waveguides with low transmission loss, strong electric field confinement, and small group velocity dispersion. Various types of on-chip waveguides have been studied in the THz frequency range and many design strategies have been introduced to achieve these requirements. Among them, single metal stripe deposited on a flat dielectric slab, known as planar Goubau line, is particularly promising because of its very simple geometry adapted for complex integrated schemes with high functionalities. Despite this apparent simplicity, planar Goubau lines are difficult to design because their properties depend on several parameters that have conflicting effects on the mode as the frequency varies. Our study provides evidences that shrinking the transverse size of the single metal wire leads to solutions with extreme field confinement (~lambda/130 at 1 THz). We further demonstrate that this approach is still valid for any generic metallic structure, which is very attractive for future developments in THz science and technology. Moreover, using a combination of numerical simulations and time-resolved experiments, we show that the complex behavior of planar Goubau lines is governed by three possible propagation regimes that depend on the ratio between thickness and operation wavelength in the slab. We provide a description of these regimes and discuss how these findings can be used to tailor the propagation of broadband THz pulses along planar Goubau lines.

Biography

Juliette Mangeney did her PhD at University Paris-Sud 11 and at CNET (France Télécom) and one year Postdoctoral studies from University Paris-Sud 11. In 2001, she joined CNRS as member of staff of Laboratory IEF at University Paris-Sud 11 and in 2009 she headed the research group on THz optoelectronic at Lab. IEF. In 2012, she joined the THz group in Laboratoire Pierre Aigrain at Ecole Normale Supérieure (France). She coordinated and participated in numerous national and European research contracts. She is the author of 50 publications in peer-reviewed journals and 17 invited talks and holds 3 patents.

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