Discontinuous Galerkin Time Domain Methods for Nonlocal Dispersion Models and Electron Beam Modeling in the Context of Nanoplasmonics

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This contribution consists of two main parts: non-local dispersion models and the numerical modeling of single electron beams. Both subjects are discussed in the context of computational nanophotonics for metallic nano-structures.

Non-local dispersion models take into account the non-local nature of mutual electron interaction in the electron gas for metallic nano-structures. Contrary to local models (Drude, Drude-Lorentz,...), non-local models allow additional solutions such as electron density waves that can travel inside the metal bulk [1, 2]. However, these effects only appear for structures at the size of 2 nm to 25 nm.

Electron beams traveling in the vicinity or inside metallic nano structures excite plasmons. Microscopy techniques like Electron Energy Loss Spectroscopy (EELS) and Cathodoluminescence (CL) are examples of applications. These technologies exploit the electron-plasmon interaction in order to measure plasmonic mode patterns [3].

Both physical aspects are numerically modeled in 3D discontinuous Galerkin time domain (DGTD) framework in order to provide a deeper understanding of the underlying physics.

References

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