The Beams and Applications Seminar Series

Metamaterial-loaded Waveguides for Accelerator Applications

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Bldg. 401, Rm. B2100
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Host: John Power, HEP

Abstract: *Material properties are central to the field of accelerator physics. One area of advanced accelerator research is to investigate novel materials and structures and their potential use in extending capabilities of accelerator components. Within the past decade a new type of artificially constructed material (metamaterial, MTM) having the unique property of simultaneously negative permittivity and permeability has been realized, and is under intense investigation, primarily by the optical physics and microwave engineering communities. Metamaterials can be customized to have the permittivity and permeability desired for a particular application. Some unusual effects can be demonstrated in metamaterials, like negative refraction and backward Cherenkov radiation. An investigation of metamaterials in the context of accelerator physics is being carried out by IIT and the Argonne Wakefield Accelerator Facility. Artificial materials have potential applications in active and passive devices at millimeter waves and at much higher frequencies. Waveguides loaded with metamaterials are of interest because the metamaterials can change the dispersion relation of the waveguide significantly. For example, slow backward waves can be produced in a MTM-loaded waveguide without having corrugations. The dispersion relation of a MTM-loaded waveguide has several interesting frequency bands. Wakefield calculations are presented for such structures.*

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