

Metamaterials: Physics and applications of “artificial atoms”

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Metamaterials is a young subject born in the 21st century. It is concerned with artificial materials which can have electrical and magnetic properties difficult or impossible to find in nature. The building blocks in most cases are resonant elements much smaller than the wavelength of the electromagnetic wave. Microscopic properties of these structures are governed by near field coupling between individual elements. Novel applications include possibilities of designing miniaturised subwavelength waveguide components and near-field lenses in a wide range of frequencies, from radio frequencies, with a potential for medical applications in MRI, to the IR and visible range, aiming at fast signal processing. This lecture reviews contributions that led to the birth of the subject, describes recent advances in the field and discusses the underlining physics.