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Metamaterials and their applications for astrophysical and medical domains

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Abstract

Metamaterials, also called left handed materials (LHM), are periodic metal resonant structure which an exhibit both negative permittivity and permeability. They have firstly been theoretically introduced by Veselago in 1968 but it took yet another thirty years for that Pendry proposes the building blocks allowing their realization. Thanks to their outstanding properties, these new materials have been increasing interest in recent years and this has given rise to multiple applications unthinkable until now. Here, I will present their applications in two completely different areas such as astrophysics and medical. In the first case, a planar polarimeter operating at 90GHz should be performed to detect the cosmic microwave background. Metamaterials are used here to reduce the size of millimeter components and keep the same bandwidth. The results concerning a coupler realized with metamaterial will be done. In the second case, metamaterials represent a solution to improve the performance of radio frequency coil used in magnetic resonance imaging (MRI). Indeed, if this RF coil allows performing high resolution images with sufficient signal to noise ratio, the presence of samples with high permittivity and conductivity detunes the RF coil and decreases its quality factor. Different configurations of RF coil coupled with metamaterials will be shown.

Biography

Frederique Gadot obtained her Ph.D in 1999 from the University of South Paris, UMR CNRS 8622, in France on the calculation, conception and fabrication of photonic crystals in the microwave domain. Since 1999, she works as associate professor at the University of West Paris and carries her research activities at the University of South Paris IEF on metamaterials, from microwave to infrared domain. Since 2009, she is the leader of two themes that are the application of metamaterials for astrophysics and medical. She obtained her HDR (Habilitation à Diriger des Recherches) in 2010. She has published more than 20 papers in reputed journals and has participated in 40 international conferences.