

Metamaterials in Time — The New Frontier

John B. Pendry

Imperial College London, UK

Abstract— Metamaterials have found many and diverse applications but the frontier moves on with development of materials that change in time faster than the period of the radiation. This presents new challenges to theorists with violation of energy conservation, and to experimentalists. I shall highlight some of the recent progress.

Sir John Pendry is Chair in Theoretical Solid State Physics at Imperial College London. He is generally regarded as the founder of the field of metamaterials, completely novel materials with properties not found in nature that owe their properties to internal structure rather than chemical composition. These materials can have remarkable properties such as negative refractive index and lenses that break the diffraction limit, enabling the realisation of a prototype cloaking device, so-called “invisibility cloaks”. His most recent work — META4D — adds the dimension of time to their structure.



Elected a Fellow of the Royal Society in 1984, Professor Sir John

Pendry has been Member of Council in 1992–1994, and Editor of the Proceedings A in 1996–2002. He was elected a Member of Council of the Institute of Physics (IOP) and Chairman of Institute of Physics Publishing in 2007–2011 and an Honorary Fellow of IOP in 2016. He was also named Fellow or Foreign Member in several professional organizations including the Optical Society of America, the American Academy of Arts and Sciences, US National Academy of Sciences, the Norwegian Academy of Science and Letters and the American Physical Society. He has received numerous honours and awards recognizing his contributions, culminating in his knighthood for services to science in 2004, and the Royal Medal of the Royal Society in 2006. He was also awarded the Isaac Newton Medal in 2013, the Kavli Prize in 2014, the Dan David Prize and Ugo Fano Gold Medal in 2016, the John Howard Dellinger Medal in 2017 and the SPIE Mozi Award in 2019. In 2024 he received the Kyoto Prize. He was Awarded the Copley Medal by the Royal Society in August 2025.