

Cosmology in the laboratory

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Transformation optics has been inspired by concepts taken from general relativity, showing that ideas from general relativity can be put to practical use for engineering problems. For example, invisibility cloaking relies on optical transformations of space that are related to coordinate transformations. Such transformations are implemented with suitable optical materials, using the idea that optical materials behave like space-time geometries. The coordinate invariance of general relativity guarantees that the transformation - the optical illusion - remains undetectable, at least in principle, making a perfect cloaking device. The lecture asks the question whether this debt to general relativity can be repaid. What can general relativity learn from transformation optics? Two examples are discussed: Hawking radiation of black holes and the enigma of dark energy.