Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Asymmetric Invisibility Cloaking Theory Based on the Concept of Effective Electromagnetic Fields for Photons[1] TOMO AMEMIYA, Tokyo Inst. of Tech., MASATO TAKI, RIKEN Nishina Center for Accelerator-Based Science, TORU KANAZAWA, SHIGEHISA ARAI, Tokyo Inst. of Tech. — The asymmetric invisibility cloak is a special cloak with unidirectional transparency; that is, a person in the cloak should not be seen from the outside but should be able to see the outside. Existing theories of designing invisibility cloaks cannot be used for asymmetric cloaking because they are based on the transformation optics that uses Riemannian metric tensor independent of direction. To overcome this problem, we propose introducing directionality into invisibility cloaking. Our theory is based on "the theory of effective magnetic field for photons" proposed by Stanford University.[2] To realize asymmetric cloaking, we have extended the Stanford's theory to add the concept of "effective electric field for photons." The effective electric and the magnetic field can be generated using a photonc resonator lattice, which is a kind of metamaterial. The Hamiltonian for photons in these fields has a similar form to that of the Hamiltonian for a charged particle in an electromagnetic field. An incident photon therefore experiences a "Lorentz-like" and a "Coulomb-like" force and shows asymmetric movement depending of its travelling direction.We show the procedure of designing actual invisibility cloaks using the photonc resonator lattice and confirm their operation with the aid of computer simulation.

[1]This work was supported in part by the MEXT; JSPS KAKENHI Grant Numbers #24246061, #24656046, #25420321, #25420322.
[2]K. Fang *et al.*, Nature Photon. **6**, 782 (2012).

Tomohiro Amemiya
Tokyo Inst. of Tech.

Date submitted: 15 Nov 2013 Electronic form version 1.4