

Light questions

Try to answer the following questions;

1. Invisibility cloaking and the inverse scattering problem.

An invisibility cloak, popularized by Harry Potter and John Pendry, renders whatever it covers invisible. Pendry's scheme was to use 'transformation optics' which identifies the coordinate transform required for cloaking with the impedance matched permittivity and permeability. This suggests that a plane wave passing through a cloaked object remains as undisturbed in the far field region. On the other hand, the inverse scattering problem, determining characteristics of an object based on scattering data, and uniqueness of the solution to inverse scattering problem seems to suggest that no scattering means only an empty space and there cannot be a true invisibility cloaking. What is the correct understanding?

2. Can light travel faster than c ?

Light is known to travel with speed $c=299792458$ m/s (exact since 1 m is defined in this way). Special relativity sets c as the limit of any physical speed v and claims that $v>c$ violates causality. Is this really true? Try to answer this question with various cases of physical systems both classical and quantum.