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The effect of electrostatic shielding using invisibility cloak

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The effect of electrostatic shielding for a spherical invisibility cloak with arbitrary charges inside is investigated. Our result reveals that the charge inside the cloak is a crucial factor to determine the detection. When charged bodies are placed inside the cloak with an arbitrary distribution, the electric fields outside are purely determined by the total charges just as the fields of a point charge at the center of the cloak. As the total charges reduce to zero, the bodies can not be detected. On the other hand, if the total charges are nonzero, the electrostatic potential inside an ideal cloak tends to infinity. For unideal cloaks, this embarrassment is overcome, while they still have good behaviors of shielding. In addition, the potential across the inner surface of an ideal cloak is discontinuous due to the infinite polarization of the dielectric, however it can be alternatively interpreted as the dual Meissner effect of a dual superconductive layer with a surface magnetic current.

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