REVISITING THE IMAGE OF A MAGNETIC DIPOLE IN FRONT OF A SUPERCONDUCTING SPHERE

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The method of images to solve certain electrostatic boundary-value problems is taught worldwide in undergraduate-level physics courses. Though it is also possible to employ this technique for solving the magnetostatic boundary value problems, examples of this usage are not commonly found in textbooks, or in physics pedagogy literature. In particular, the problem of finding the field due to a magnetic dipole kept in front of a superconducting sphere is an interesting one, because (i) it helps the students to compare with the grounded conducting sphere image problem in electrostatics, (ii) offers a greater degree of difficulty since the source is a dipole (vector), rather than an electric charge (scalar). The problem has been solved using the method of images in the traditional research journal (Qiong-Gui, 2006) by first examining the pattern of the image of a magnetic monopole, and then by superimposing the images of closely spaced monopoles. In the present work we are presenting, however, we demonstrate a simple but instructive method of solving the problem. The case in which the source dipole is oriented with respect to the centre of the sphere is solved with a single dipole image. In our presentation, we will also make general comments on the case where the dipole is oriented transversely with respect to the centre and corresponding boundary conditions.

REFERENCE
Qiong-Gui L. (2006). Theoretical development of the image method for a general magnetic source in the presence of a superconducting sphere or a long superconducting cylinder. *Physical Review B, 74*(2):024510.