

An Inverse Obstacle Problem: A Uniqueness Theorem for Spheres

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Abstract

In the scattering of time-harmonic acoustic or electromagnetic waves, whether an impenetrable *sound-soft* obstacle Ω can be completely determined by the scattering amplitude (or the far field pattern) $A_\Omega(\xi, k)$ given for $|\xi|^2 = |k|^2$ at fixed wave number $|k|$ and fixed incident plane wave direction k is still a question. In this paper, we show that any sphere in $\mathbf{R}^n (n \geq 3)$ can be uniquely determined by its scattering amplitude $A_\Omega(\cdot, k)$ given at two linearly independent incident directions \hat{k}_1 and \hat{k}_2 with one fixed wave number $|k|$. We also show that two spheres in $\mathbf{R}^n (n \geq 2)$ with same scattering amplitude $A_\Omega(\cdot, k)$ at only one fixed $k \in \mathbf{R}^n$ must coincide.

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