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# Journey to the Center of the Earth

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We survey some results on travel time tomography. The question is whether we can determine the anisotropic index of refraction of a medium by measuring the travel times of waves going through the medium. This can be recast as geometry problems, the boundary rigidity problem and the lens rigidity problem. The boundary rigidity problem is whether we can determine a Riemannian metric of a compact Riemannian manifold with boundary by measuring the distance function between boundary points. The lens rigidity problem is to determine a Riemannian metric of a Riemannian manifold with boundary by measuring for every point and direction of entrance of a geodesic the point of exit and direction of exit and its length. The linearization of these two problems is tensor tomography. The question is whether one can determine a symmetric two-tensor from its integrals along geodesics. We emphasize recent results on boundary and lens rigidity and in tensor tomography in the partial data case.

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