On the non-linear inverse problem of polarization tomography

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Abstract

The polarization tomography problem consists of recovering a matrix function f from the fundamental matrix of the equation $D\eta/dt = \pi_{\dot\gamma} f \eta$ known for every geodesic γ of a given Riemannian metric. Here $\pi_{\dot\gamma}$ is the orthogonal projection onto the hyperplane $\dot\gamma^\perp$. The problem arises in optical tomography of slightly anisotropic media. The local uniqueness theorem is proved: a C^1-small function f can be recovered from the data uniquely up to a natural obstruction. A partial global result is obtained in the case of the Euclidean metric on $\mathbb{R}^3$.