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Relative Index Paring and Odd Index Theorem for Even Dimensional Manifolds

The Atiyah–Patodi–Singer twisted index theorem for trivialized flat bundles over odd dimensional manifolds holds for an arbitrary pair of isomorphic bundles. The goal of this talk is to prove an analogue of the theorem for even dimensional manifolds and to obtain explicit formulas for the odd relative index pairing. More specifically, if Y is a closed even dimensional spin manifold and $(U_s)_{0\leq s\leq 1}$ is a smooth path of unitaries over Y, then there is a natural path of lifted projection $(e_s)_{0\leq s\leq 1}$ over $\mathbb{S}^1\times Y$. Our analogue of Atiyah–Patodi–Singer twisted index theorem takes the following form:

$$\int_0^1 \frac{1}{2}\frac{d}{ds}\eta(e_sDe_s)\,ds = \int_Y \hat{A}(Y)\wedge \mathrm{tch}_\bullet(U_s).$$