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On the Inner Product of Certain Automorphic Forms and Applications

Let $\Gamma \subset \mathrm{SL}_2(\mathbb{R})$ be a discrete subgroup such that the quotient $\Gamma\backslash\mathrm{SL}_2(\mathbb{R})$ has a finite volume. In this paper we compute the Petersson inner product of automorphic cuspidal forms with Poincaré series constructed out of matrix coefficients of a holomorphic discrete series of lowest weight $m \geq 3$. We apply the result to give new and representation-theoretic proofs of previous results, some of which were known to Petersson, and are anyway not surprising to experts.

Keywords: Fuchsian groups, automorphic forms, modular forms, Poincare series.

MSC: 11F70, 11F20