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Section:

7. Lie Groups and Lie Algebras

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Quaternionic representations
Let G be a simply connected, simple Lie group with maximal compact subgroup K such that the symmetric space G/K has a G-invariant quaternionic structure, that is, K contains a normal subgroup S isomorphic to $SU(2)$ which acts on $\mathfrak{p}_0$ (the tangent space of G/K at eK) by left quaternionic multiplication. In this case K decomposes as a product $K = S \times M$ where M is a compact, connected subgroup of G. Let $U(1) \subset S$ and set $L = U(1) \times M \subset K$. Consider the generalized Verma modules $N(\lambda) = U(\mathfrak{g}) \otimes_{U(\mathfrak{q})} F(\lambda)$ where $F(\lambda)$ is an arbitrary irreducible finite dimensional representation of $L = U(1) \times M$, $\mathfrak{g}$ is the complexification of the Lie algebra of G and $\mathfrak{q}$ is a canonically defined parabolic subalgebra of $\mathfrak{g}$. Let $L(\lambda)$ denote the unique irreducible quotient of $N(\lambda)$. By applying the Zuckerman functor $(\Gamma_L^K)^1$ to $L(\lambda)$ we obtain a nonzero $(\mathfrak{g}, K)$-module $\Gamma^1 L(\lambda)$ which admits a nondegenerate $(\mathfrak{g}, K)$-invariant Hermitian form. We study the parameters λ for which the corresponding Hermitian form is positive definite and obtain some generalizations of the results in [G-W].
Reference: [G-W] B. H. Gross and N. R. Wallach, *On quaternionic discrete series representations and their continuations*, J. reine angew. Math. **481** (1996), 73–123.