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Matvei Libine* (mllibine@indiana.edu). *Quaternionic Analysis, Representation Theory and Physics*.

This is a joint work with Igor Frenkel.

I will describe our new developments of quaternionic analysis using representation theory of various real forms of the conformal group. We show that the counterparts of Cauchy and Poisson formulas solve the problem of separation of the discrete and continuous series for $SL(2, \mathbb{R})$ and the imaginary Lobachevski space $SL(2, \mathbb{C})/SL(2, \mathbb{R})$. We also obtain a surprising formula for the Plancherel measure on $SL(2, \mathbb{R})$ in terms of the Poisson integral on the split quaternions.

Along the way we discover striking new connections between quaternionic analysis and mathematical physics. In particular, the quaternionic counterpart of the Cauchy formula for the second order pole are the Maxwell equations. We find a representation-theoretic meaning of the polarization of vacuum and one-loop Feynman integrals. Finally, we show that the massless singular functions of four-dimensional quantum field theory are nothing but the kernels of projectors onto the discrete and continuous series on the imaginary Lobachevski space.

The talk is based on two recent papers "Quaternionic Analysis, Representation Theory and Physics" (published in Adv in Math 2008) and "Split Quaternionic Analysis and Separation of the Series for $SL(2, \mathbb{R})$ and $SL(2, \mathbb{C})/SL(2, \mathbb{R})$ " (submitted). (Received September 13, 2010)