Spherical analysis on homogeneous vector bundles of the three-dimensional euclidean motion group

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The poster presents an explicit description of the spherical functions associated with a particular strong Gelfand pair. It is motivated by the problem of having a simultaneous diagonalization of certain operators over functional spaces (most naturally occurring from differential equations).

In fact, let G be a Lie group, K a compact subgroup of G and fix a homogeneous vector bundle on G/K. The main goal is to study the set of bounded linear operators over its sections that commute with the action of G. From the Schwartz kernel theorem, each such operator can be represented in a unique way as a convolution operator. The composition of two of such operators coincides with the convolution of their kernels. In order to change these operators simultaneously into multiplicative ones we need the condition about the commutativity of their kernels with respect to the convolution product. This motivates the generalization of the notion of Gelfand pair.

In this poster we specifically present the harmonic analysis over sections of each SO(3)-homogeneous vector bundle over the three-dimensional euclidean space. We compute the set of spherical functions in this context in three different ways and we obtain an explicit formula for Fourier spherical transform (which transforms convolution operators into multiplicative operators).

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