Mathematics > Differential Geometry

Integral geometry of complex space forms

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We show how Alesker's theory of valuations on manifolds gives rise to an algebraic picture of the integral geometry of any Riemannian isotropic space. We then apply this method to give a thorough account of the integral geometry of the complex space forms, i.e. complex projective space, complex hyperbolic space and complex euclidean space. In particular, we compute the family of kinematic formulas for invariant valuations and invariant curvature measures in these spaces. In addition to new and more efficient framings of the tube formulas of Gray and the kinematic formulas of Shifrin, this approach yields a new formula expressing the volumes of the tubes about a totally real submanifold in terms of its intrinsic Riemannian structure. We also show by direct calculation that the Lipschitz-Killing valuations stabilize the subspace of invariant angular curvature measures, suggesting the possibility that a similar phenomenon holds for all Riemannian manifolds. We conclude with a number of open questions and conjectures.

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