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BULLETIN (New Series) OF THE
AMERICAN MATHEMATICAL SOCIETY
Volume 23, Number 2, October 1990

0273-0979/90 $1.00 + $.25 per page

Harmonic analysis of spherical functions on real reductive groups, by R. Gangolli and V. S. Varadarajan. Ergebnisse der Mathematik und ihrer Grenzgebiete, vol. 101, Springer-Verlag, Berlin, Heidelberg, and New York, 1988, xiv+365 pp., $110.00. ISBN 3-540-18302-7

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Let $\mathscr{X}$ be a locally compact Hausdorff space endowed with a transitive action of a locally compact group G. Then $\mathscr{X} = G/K$ for a closed subgroup K. If $\mathscr{X}$ also admits an invariant measure, then G acts on $L^2(\mathscr{X})$ by unitary transformations by the formula

$$L_{\mathscr{X}}(g)f(x) = f(g^{-1}x). \tag{1.1}$$

The study of the decomposition of this representation into a "direct integral" of irreducible components is usually known as harmonic analysis on homogeneous spaces.

Assume that $\mathscr{X} = G/K$ is Riemannian symmetric. A special role is played by $C_c(G//K)$, the space of continuous compactly supported functions on G which are K-invariant under the regular representation $(g_1, g_2) \cdot f(x) = f(g_1^{-1}xg_2)$. Gel'fand [Ge], observed that under convolution, $L^1(G//K)$ is an abelian Banach