Spectrum of the Laplacian on homogeneous spaces

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We will start with an introduction and stating general results on the spectral properties of the Laplacian before we investigate the restriction to manifolds which are symmetric. We consider the difference of spectral properties of manifolds which admit different kinds of isometric Lie group actions (transitive, non transitive, free, non free actions) and give as an example the work of Beekman on surfaces of revolutions and the different kinds of ellipsoids. Next, we consider homogeneous and symmetric spaces and describe the techniques to compute the spectrum here. This finalizes in author results on the spectrum of the Aloff-Wallach spaces, the techniques used and the latest results. This course is structured in 4 sessions:

1. Introduction to spectral geometry (motivation, general properties of spectrum and eigenfunctions, isospectral vs isometric, eigenvalue estimates, Hodge-Laplace Operator)
2. Spectrum on manifolds with a certain symmetry (bases on my master thesis (transitive, non transitive, free non free actions), my minor thesis (Laplacian on ellipsoids), results of Beekmann: spectrum on surfaces of revolution)
3. Spectrum on homogeneous spaces and symmetric spaces
4. Spectrum on Aloff-Wallach Spaces, methods, theory, latest results