Covering spaces and covering groups

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Abstract. Homology of groups is where representation theory encounter algebraic topology. With this mini–course we offer a panoramic view on covering spaces and covering groups, which provides an instance of the elegant interaction between geometry and algebra. Thus, we focus on algebraic topology first, recalling several interesting facts about covering spaces, the homotopy and homology groups, the theorems of Hurewicz, the Eilenberg–Maclane complexes and, finally, the Hopf formula. Then we move to the viewpoint of abstract algebra, with emphasis on Schur's theory on projective representation. We recall the motivating problem in representation theory, and so we encounter the Schur multiplier and few elements of the theory of group extensions. In conclusion, we gather the above material to see how covering groups carry beautiful geometries into group homology.