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**Ivan Dimitrov\*** ([dimitrov@mast.queensu.ca](mailto:dimitrov@mast.queensu.ca)), Department of Mathematics and Statistics, Jeffery Hall, Kingston, Ontario K7L 3N6, Canada, and **Ivan Penkov**, International University Bremen. *Borel-Weil-Bott theorem for diagonal direct limits of algebraic groups*. Preliminary report.

We study the cohomology groups of homogeneous line bundles over  $G/B$ , where  $G$  is a diagonal direct limit of simple algebraic groups and  $B$  is a Borel subgroup of  $G$ . The main difficulty in studying this problem is that the naive definition of the Weyl group of  $G$  produces elements of infinite length only, yet there are homogeneous line bundles with nonzero higher cohomology groups. We introduce the appropriate notion of a Weyl group and prove the analog of the classical Borel-Weil-Bott theorem. (Received March 07, 2006)