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ABSTRACT. Let $G = \mathbb{S}^1$ act freely on a finitistic space X with mod 2 cohomology ring isomorphic to the product of two projective spaces. In this paper, we determine the possible cohomology algebra of the orbit space X/G when G acts freely on the product of two real projective spaces. We also show that the group G cannot act freely on the product of two complex projective spaces.

1. INTRODUCTION

Let G be a topological group acting continuously on a topological space X . An intricate problem associated with the transformation group (G, X) is to determine the topological or the homotopy type of the orbit space X/G . The first such question was raised by H. Hopf in 1925-26, for the orbit spaces of free actions of finite cyclic groups on spheres. Because of the complexity in resolving such problems P. A. Smith [7] introduced the study of homological relationships among the space X , the fixed point set X^G , and the orbit space X/G of a periodic homeomorphism on X . Since then, several authors have contributed to such problems. For instance, Ronald M. Dotzel et al. [3] determined the cohomology algebra of the orbit spaces of free circle group action on finitistic spaces having mod \mathbb{Q} cohomology algebra of the product of two spheres. More recently, in [5] the possible mod p cohomology algebra of the orbit space of any free circle group action on a finitistic space having mod p cohomology algebra of a lens space or $\mathbb{S}^1 \times \mathbb{C}P^m$ has been investigated. Continuing this thread of research, in this paper we study free $G = \mathbb{S}^1$ action on a finitistic space

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