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ELLIPTIC SPACES II

by Yves FELIX, Stephen HALPERIN¹⁾ and Jean-Claude THOMAS²⁾

ABSTRACT. A simply connected finite *CW* complex X is *elliptic* if the homology of its loop space (coefficients in any field) grows at most polynomially. We show that in all other cases the loop space homology grows at least semi-exponentially, and we exhibit a number of geometrically interesting classes of spaces as elliptic, including: H spaces, homogeneous spaces, Poincaré duality complexes whose mod p cohomology is doubly generated (any p) and Dupin hypersurfaces in S^{n+1} .

1. INTRODUCTION

Let X be a simply connected finite *CW* complex, with loop space ΩX , and denote by \mathbf{F}_p , the prime field of characteristic p , p prime or zero. Our first main result asserts a dichotomy for the size of the loop space homology $H_*(\Omega X; \mathbf{F}_p)$:

THEOREM A. *Let X be a simply connected finite *CW* complex. For each p (prime or zero) there are exactly two possibilities: either*

(i) *There are constants $C > 0$ and $r \in \mathbf{N}$ such that*

$$\sum_{i=0}^n \dim H_i(\Omega X; \mathbf{F}_p) \leq C n^r, \quad n \geq 1,$$

Key words: loop space homology, depth, polynomial growth, Poincaré complex, elliptic, Dupin hypersurface.

AMS Mathematical subject classification: 55P35, 57P10, 57T25, 57S25, 53C25.

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