STELLAR AND GAS DYNAMICS OF INTERACTING RING GALAXIES

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ABSTRACT

The development of ring and arc structure due to the collision of a spherical galaxy normal to the plane of a disk galaxy is studied with analytic and numerical models. In the numerical model, the disk contains one-tenth of its mass in gas and the hydrodynamics equations are solved using the method of Smoothed Particle Hydrodynamics.

It is found that axisymmetric collisions between equal mass galaxies produce a strong expanding ring with a complex three-dimensional structure. Density and velocity profiles for the disk are given. Off-center collisions produce greater gas density enhancements in the non-nuclear portion of the disk when compared to the axisymmetric case. Strong gas interactions in the off-center collisions cause the stellar and gaseous flows to follow separate trajectories. If star formation is associated with the strongest gas shocks and greatest gas densities, the morphology of ring galaxies is strongly dependent on a proper treatment of gas dynamical processes. A Rayleigh-Taylor instability is believed to be present in the strong shock regions, which could contribute to the knotty structure observed in ring galaxies.

To my wife, Nancy

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Table of Contents

List of Tables ix

List of Figures x

Chapter 1. Introduction 1

1.1. Galaxies 2

1.2. Colliding Galaxies 5

1.3. Star Formation in Interacting Galaxies 8

1.4. Ring Galaxies 11

1.4.1. Kinematics of Ring Formation 12

1.4.2. Observations of Ring Galaxies 14

1.4.3. Previous Theoretical Investigations 17

1.5. Objectives of This Investigation 20

Chapter 2. Analytic Models 22

2.1. Introduction 22

2.2. Analytic Model 23

2.2.1. Solution for Velocity Impulses 24

2.2.2. Response to the Impulse 26

2.2.3. Surface Density 29

2.3. Kinematic Response of the Disk 30

2.3.1. A Survey of Forms 30

2.3.2. Lifetimes of Features 36

2.4. Summary 37

Chapter 3. Computational Models 38

3.1. Numerical Techniques 39

3.1.1. Particle Mesh N-Body Technique 39

3.1.2. Smoothed Particle Hydrodynamics 42

3.1.2.1. Basic concepts 43

3.1.2.2. SPH equations of motion 45

3.1.2.3. Shocks in SPH 46

3.2. Construction of Initial Models 47

3.2.1. King Model 49

3.2.2. Halo 52

3.2.3. Three-Dimensional Disk Construction 53

3.2.4. Disk Gas Distribution 58

3.3. Scaling and Resolution 60

3.4. Steady State Initial Model Galaxy 62

Chapter 4. Results of Numerical Calculations 69

4.1. Axisymmetric Ring Formation 69

4.1.1. Results 70

4.1.1.1. Morphology 70

4.1.1.2. Quantitative results 84

4.1.1.3. Non-axisymmetric structure 106

4.1.2. Discussion 106

4.1.3. Summary 112

4.2. Off Center Collisions 114

4.2.1. Morphology 115

4.2.2. Density 161

4.2.3. Discussion 163

4.2.4. Summary 169

4.3. Comparison of a Model with the Galaxy Arp 147 170

4.3.1. An Off-Center Collision Model 171

4.3.2. Results 172

4.3.3. Discussion and Conclusions 176

4.4. Comparison of Analytic and Numerical Models 178

4.4.1. A Weak Collision 178

4.4.1.1. Kinematic Response 179

4.4.1.2. Dynamic Response 180

4.4.2. Strong Off-Center Collisions 186

4.4.3. Summary 189

Chapter 5. Summary 193

References 196

Curriculum Vitae 204

List of Tables

Table 3.2.1. King model parameters 52

Table 3.2.2. Halo model parameters 54

Table 3.2.3. Stellar disk model parameters 59

Table 3.2.4. Gas disk model parameters 60

Table 3.3.1. Scaling 61

Table 3.3.2. Some computational parameters 61

List of Figures

Figure 1.2.1. Interacting galaxies 6

Figure 1.4.1. Radial oscillations 13

Figure 2.2.1. Impulse approximation geometry 25

Figure 2.3.1. Analytic model morphology 32

Figure 3.2.1. Standard galaxy parameters 57

Figure 3.4.1. Halo density 63

Figure 3.4.2. Unperturbed disk evolution 65

Figure 3.4.3. Surface density evolution of isolated disk 67

Figure 3.4.4. Velocity evolution of isolated disk 68

Figure 4.1.1. Shock structure of disk 72

Figure 4.1.2. Edge on view of axisymmetric collision 74

Figure 4.1.3. Face on view of axisymmetric collision 76

Figure 4.1.4. An apparent off-center nucleus 84

Figure 4.1.5. Surface densities for axisymmetric collision 86

Figure 4.1.6. Mass fraction in the ring 88

Figure 4.1.7. Stellar radial velocities 94

Figure 4.1.8. Gas radial velocity 98

Figure 4.1.9. Gas rotational velocity 102

Figure 4.2.1. Edge on view of RING1 118

Figure 4.2.2. Face on view of RING1 120

Figure 4.2.3. Edge on view of RING2 129

Figure 4.2.4. Face on view of RING2 131

Figure 4.2.5. Face on view of RING3 140

Figure 4.2.6. Face on view of RING3 142

Figure 4.2.7. Edge on view of RING4 151

Figure 4.2.8. Face on view of RING4 153

Figure 4.2.9. Maximum gas density 162

Figure 4.2.10. Vela ring galaxy 165

Figure 4.2.11. The ring galaxy AM 0644-741 166

Figure 4.2.12. Arp 118 168

Figure 4.3.1. Model similar to Arp 147 173

Figure 4.3.2. Observation of Arp 147 174

Figure 4.4.1. A weak collision 184

Figure 4.4.2. Initially circular rings 186

Figure 4.4.3. Analytic comparison to RING2 189

Figure 4.4.4. Analytic comparison to RING3 190

Figure 4.4.5. Analytic comparison to RING4 191