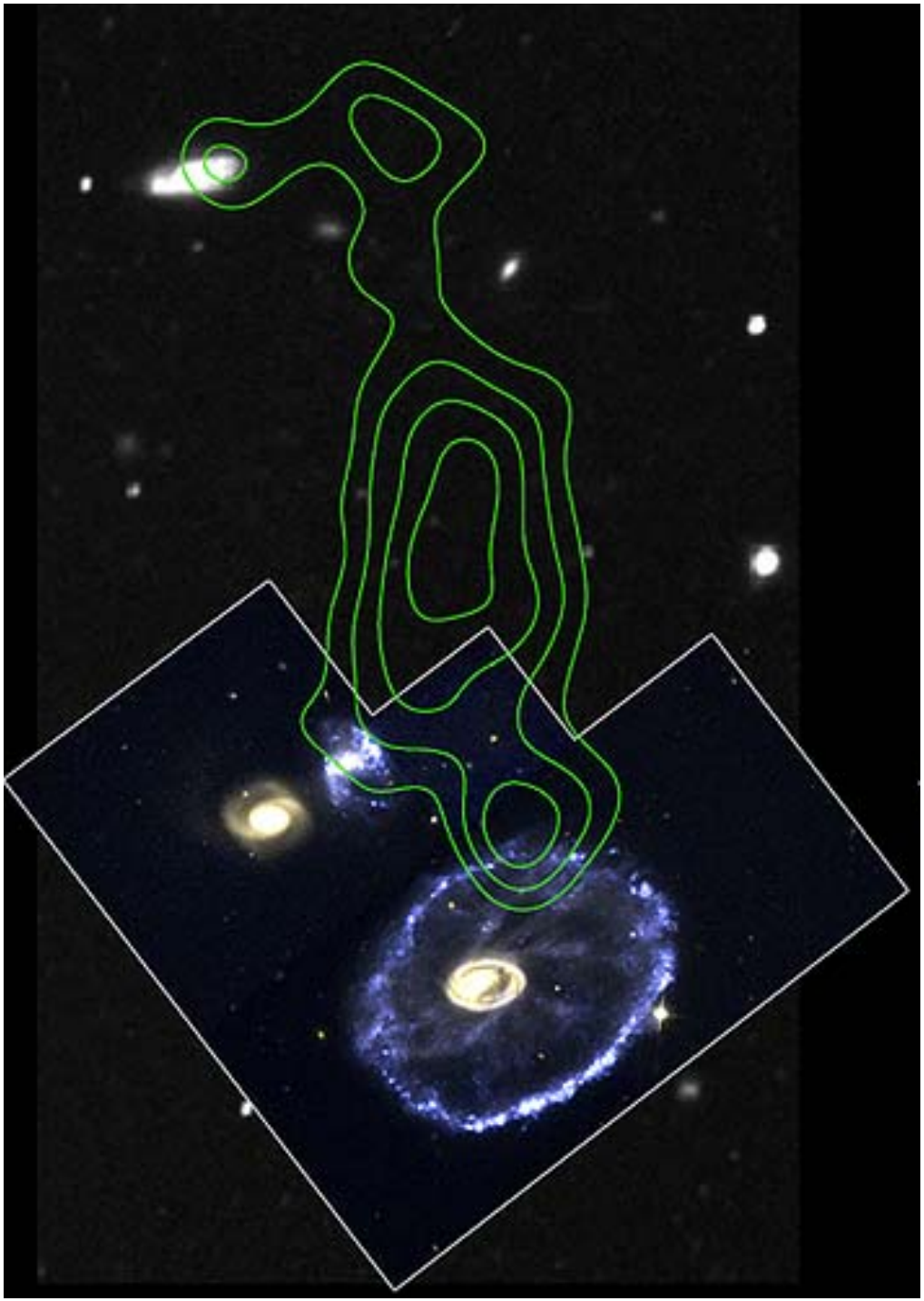
Cartwheel Galaxy Collision


arnierosner.com

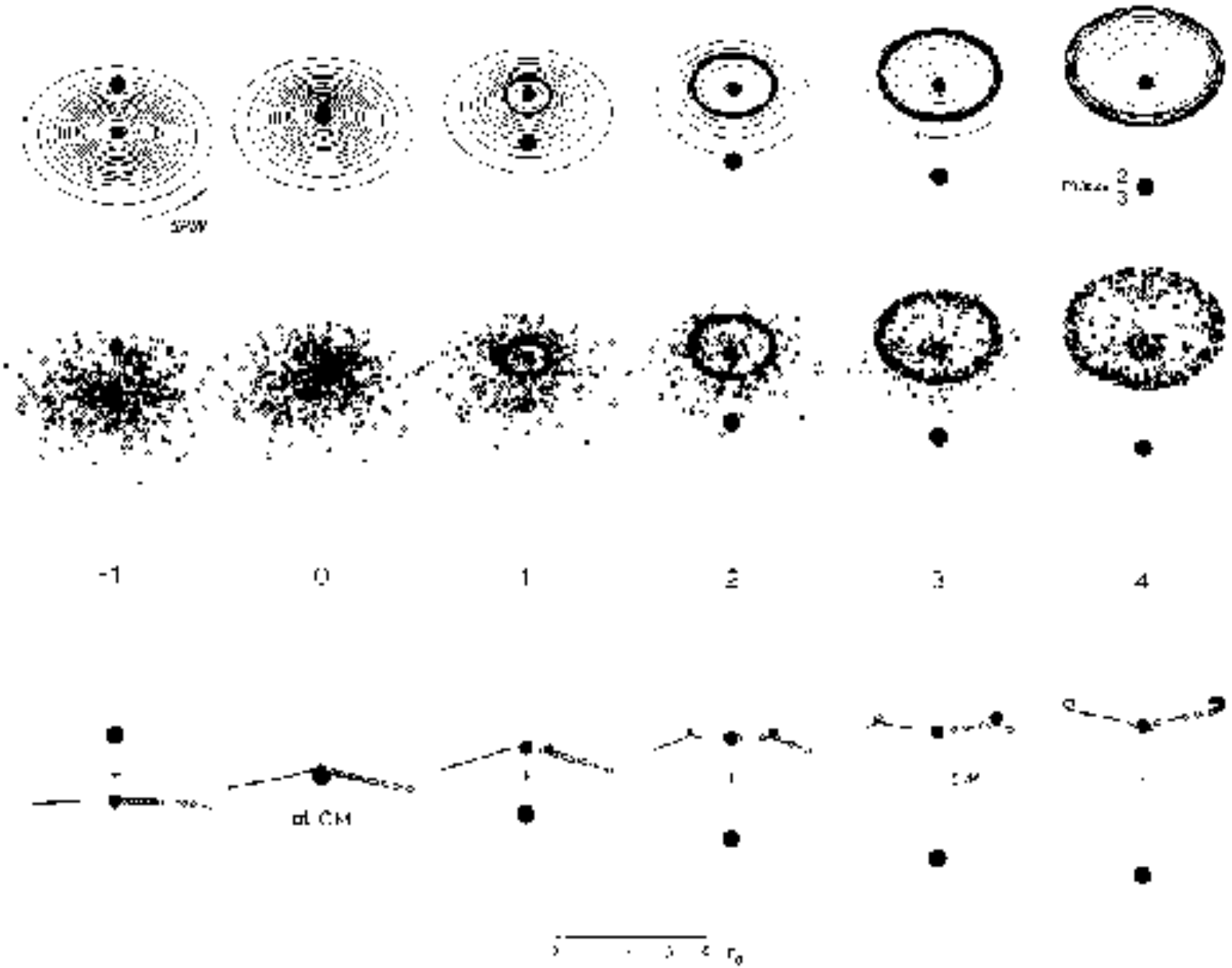


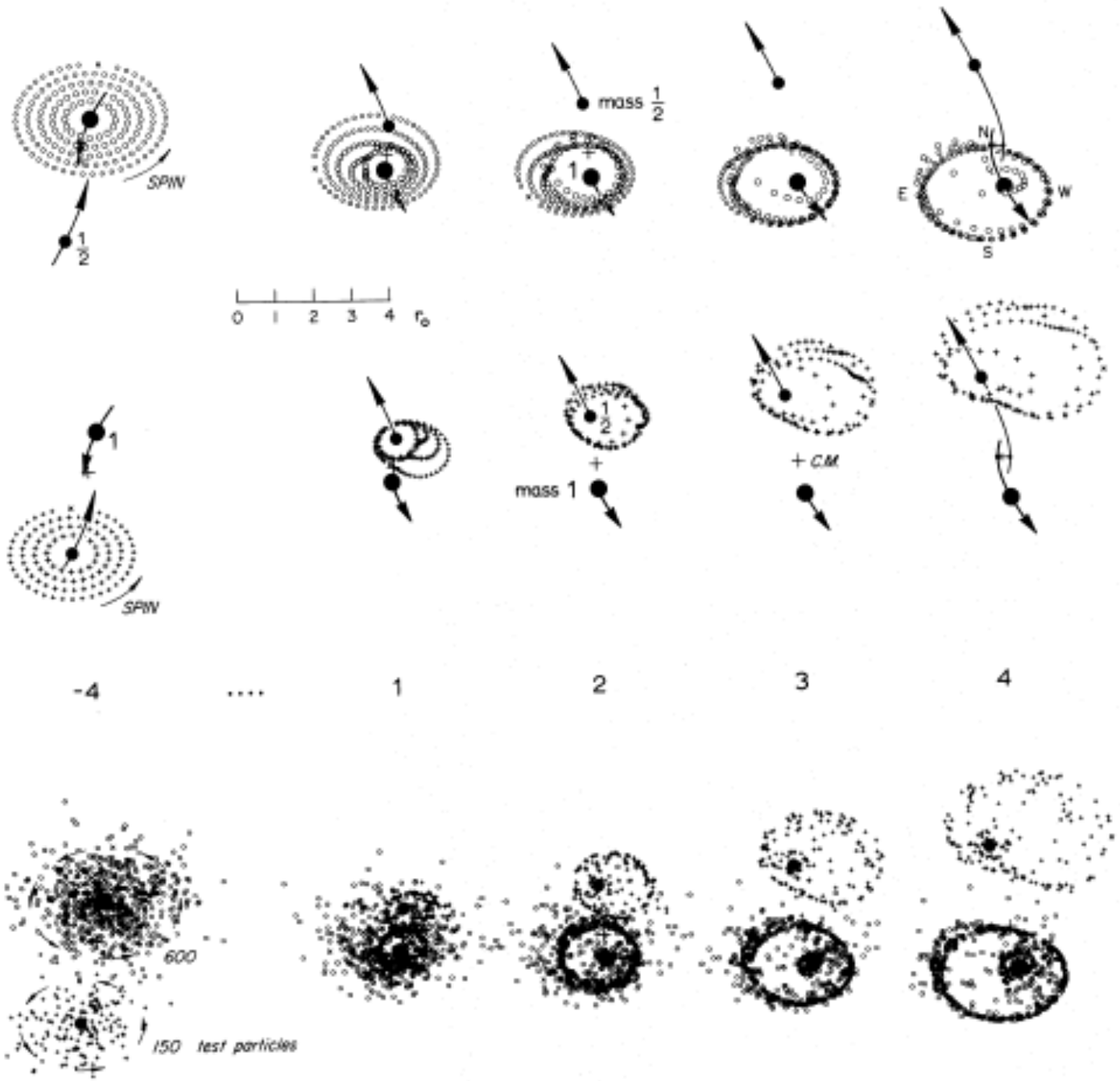
Ring Galaxies

- Ring Galaxy modeled as head-on collision
- Unbound collision (high velocity)
- Almost dead center (Only 1 in 5000 collisions)
- Ring caused by rapid fluctuation in effective potential as incoming galaxy speeds through

Lynds and Toomre (1976)

- First to model collision
- Used concentric rings of massless particles and also a random gaussian distribution of particles
- Infalling mass is 2/3 of target galaxy mass
- Softening length is $r_0/3$ to $r_0/2$, where density falls of as $\exp(-r^2/2r_0^2)$


-1
0
1
2
3
4
at CM


SPIN
1/2
mass 1/2
N
E
W
S
0 1 2 3 4 r_0
1
SPIN
mass 1
+ C.M.
-4
....
1
2
3
4
600
150 test particles

Our 1st Simulations

- Purely head-on collision
- Central mass: Mass of Milky Way
- KE >> PE (KE about 2*PE)
- Used nearly massless tracer particles
- Concentric Rings – Below
- Concentric Rings – Perspective
- Random – Z
- Random - Projectile, Iso
- Psychedelic (Bound)

Hyperbolic Collisions

- Same masses and energy as 1st simulation
- Eccentricity >> 1
- Pericenters that produced rings were less than 5 parsecs
- Concentric Rings – Perspective
- Random - Target, Iso
- Random - Target, Z
- Random - Projectile, Iso (Render 2)

Off-axis Collisions

- Same masses and energy as 1st 2 simulations
- Direct head-on collision
- Angle of impact > 45o off the vertical stopped producing rings
- 30 degree – Iso
- 30 degree – Z (Render 2)
- 45 degree – Z
- 60 degree – Z (Render 2), (Side)

2-Ring Collisions

- Added nearly massless particles in the projectile galaxy
- Repeated simulations of head-on collisions and hyperbolic collisions
- Random - Head-On, Iso, (Render 2)
- Random - Head-On, Side
- Random - Hyperbolic, Iso, (Render 2)
- Random - Hyperbolic, Side