Orbiting Polytropes and Gravitational Wave Analysis

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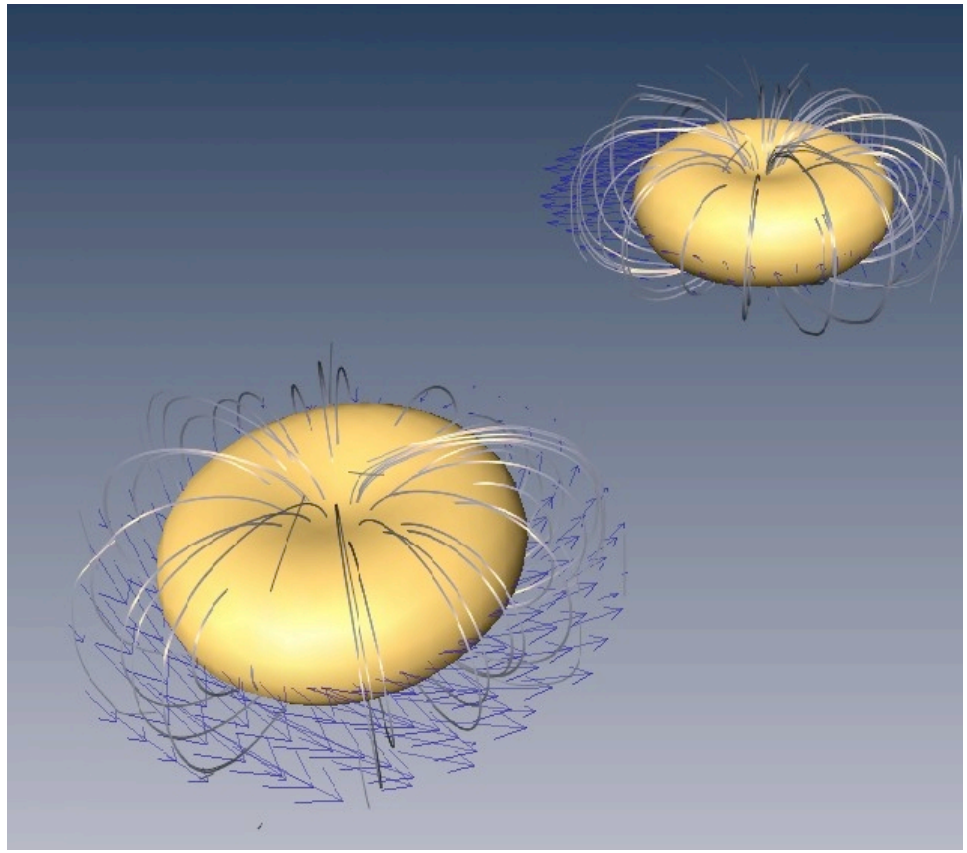
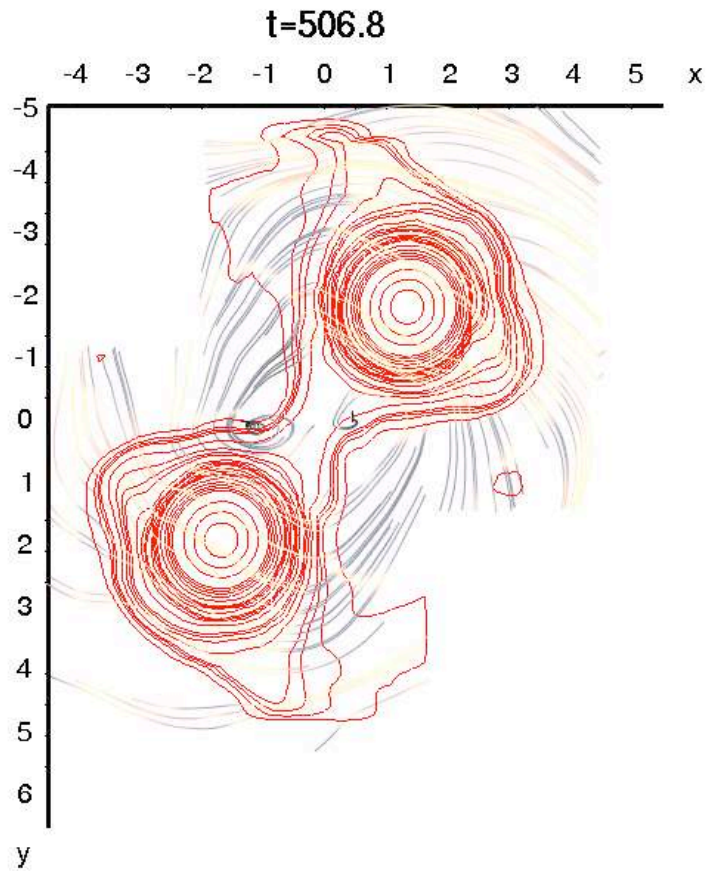
Overview

- Motivation
- Distributed AMR
- Orbiting polytropes without magnetic field
- Orbiting polytropes with magnetic field
- Future Work



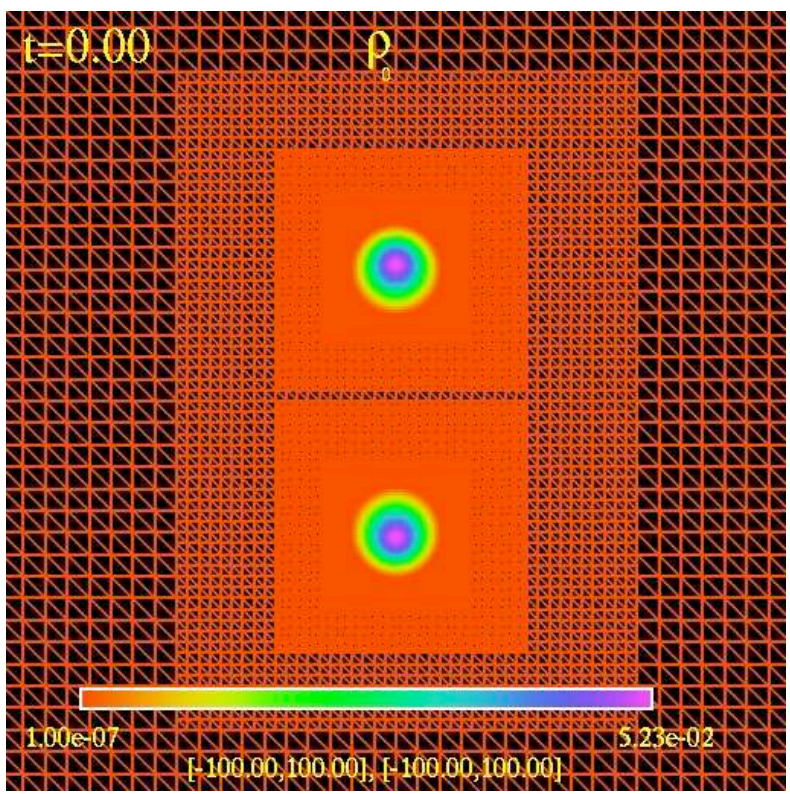
Motivation

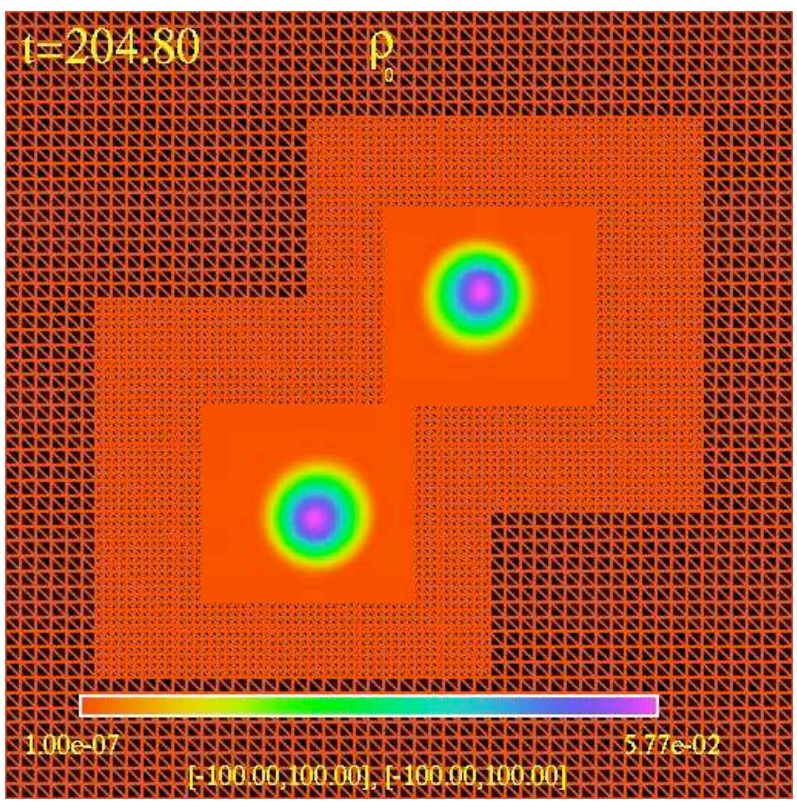
- Explore gravitational wave signals from binary neutron star systems
- Work towards simulations describing gamma ray bursts
- Relax symmetry considerations
- Examine the influence of boundaries



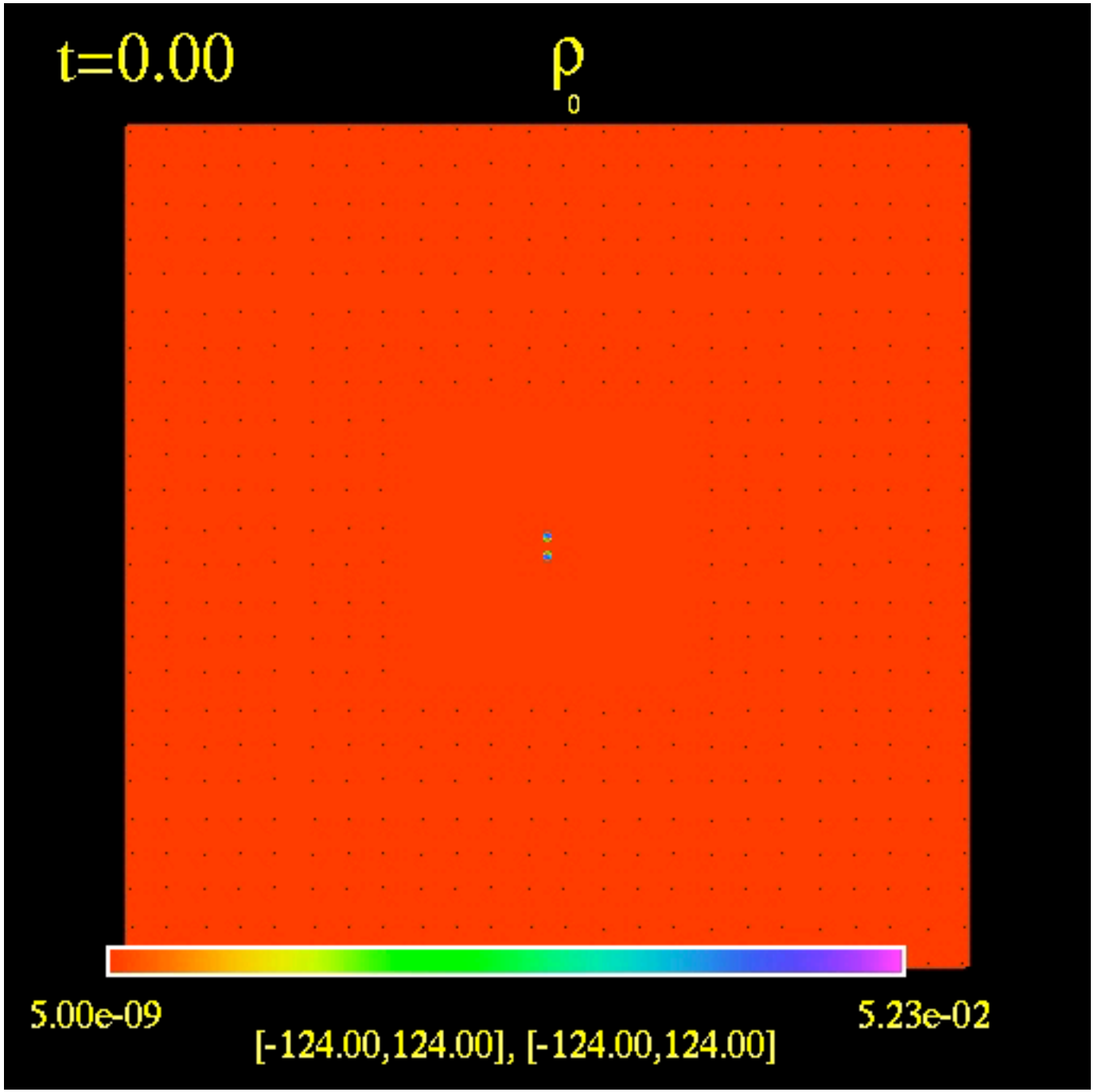
Distributed AMR

- Vertex centered AMR in HAD
- full adaptivity in space & time
- choice of shadow hierarchy or user-defined refinement criteria for error estimation
- Details at: http://relativity.phys.lsu.edu/~matt/had.php





collapse to black hole



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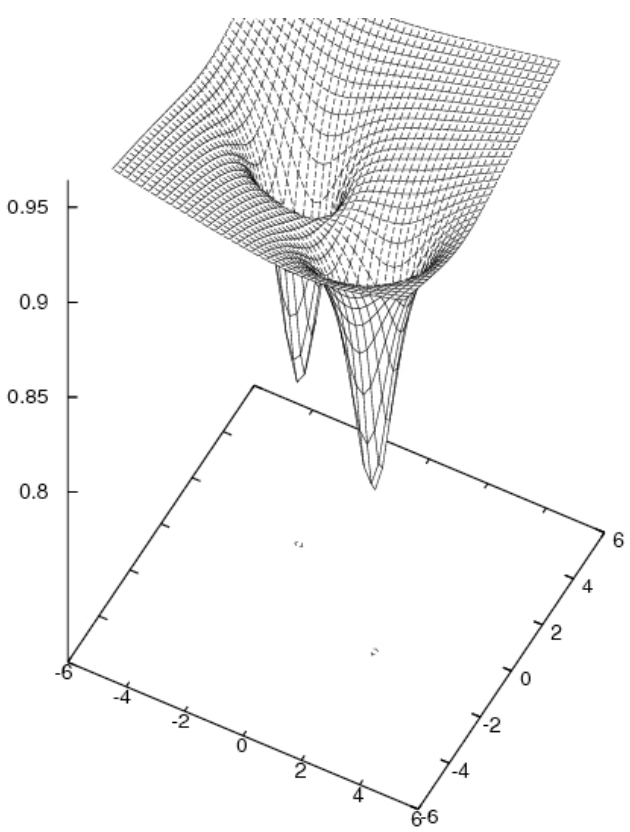

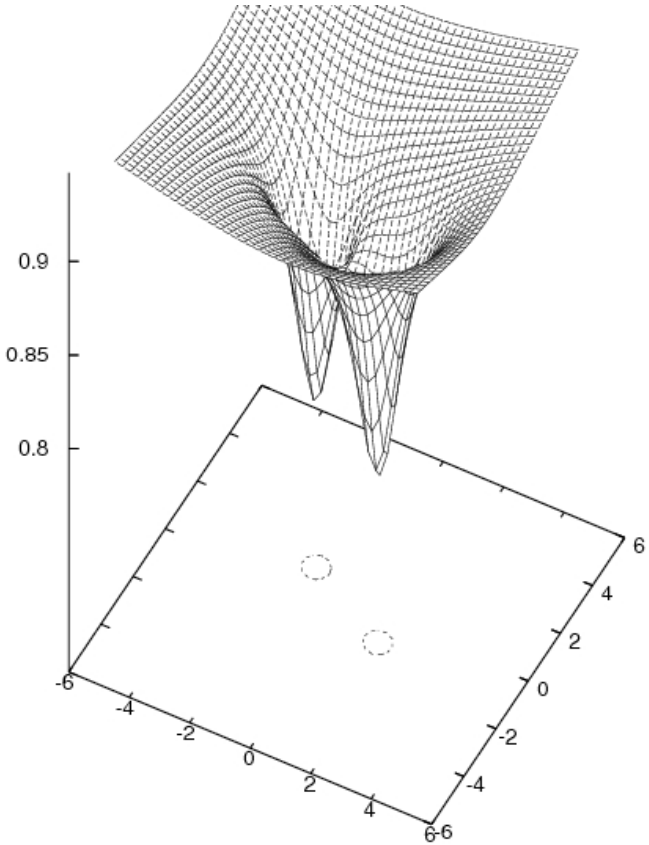

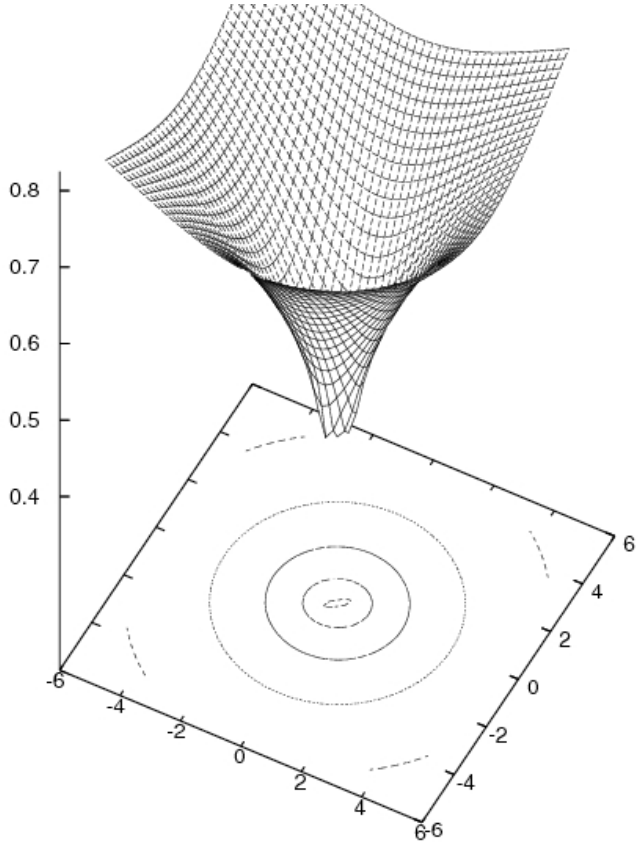

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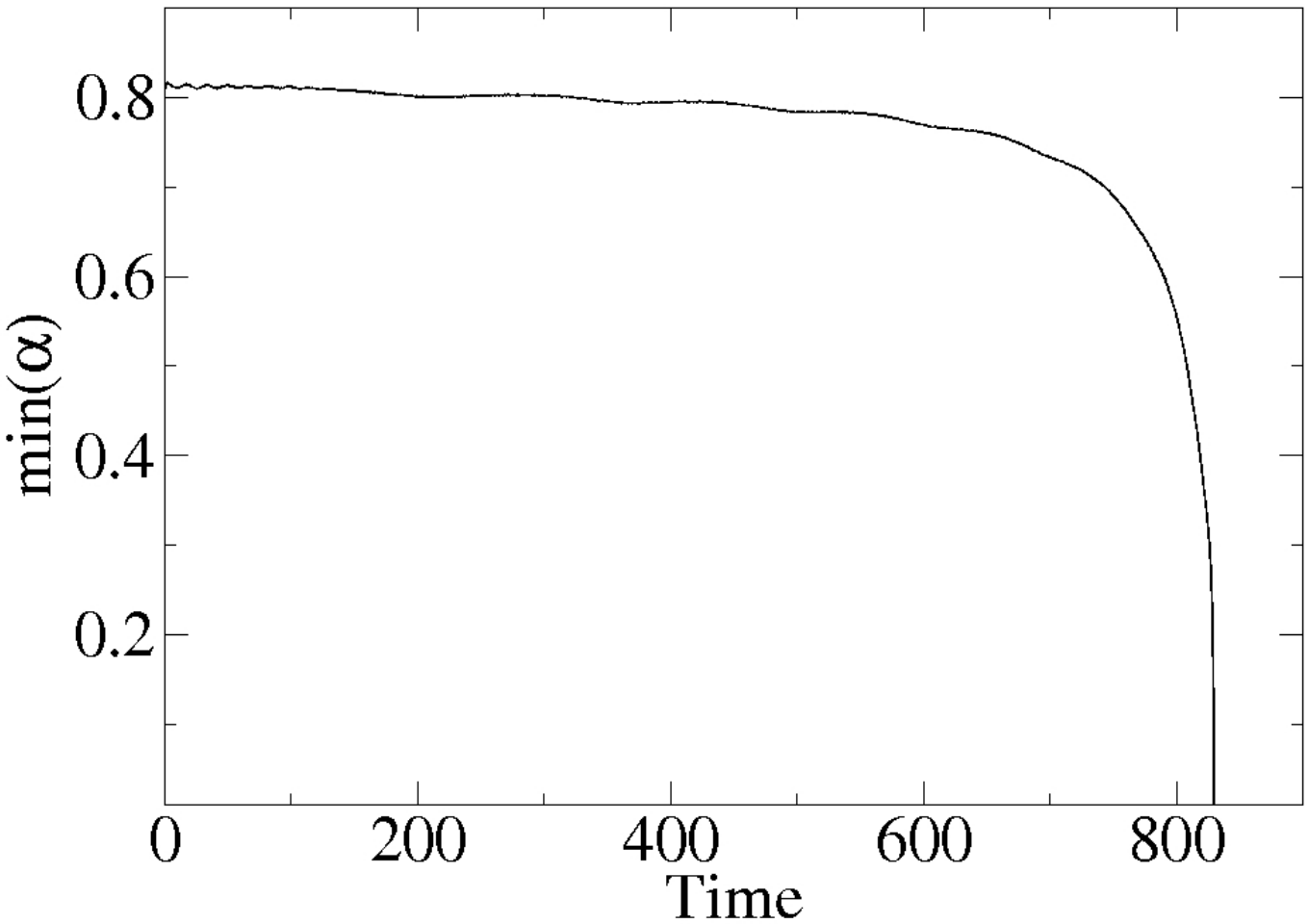

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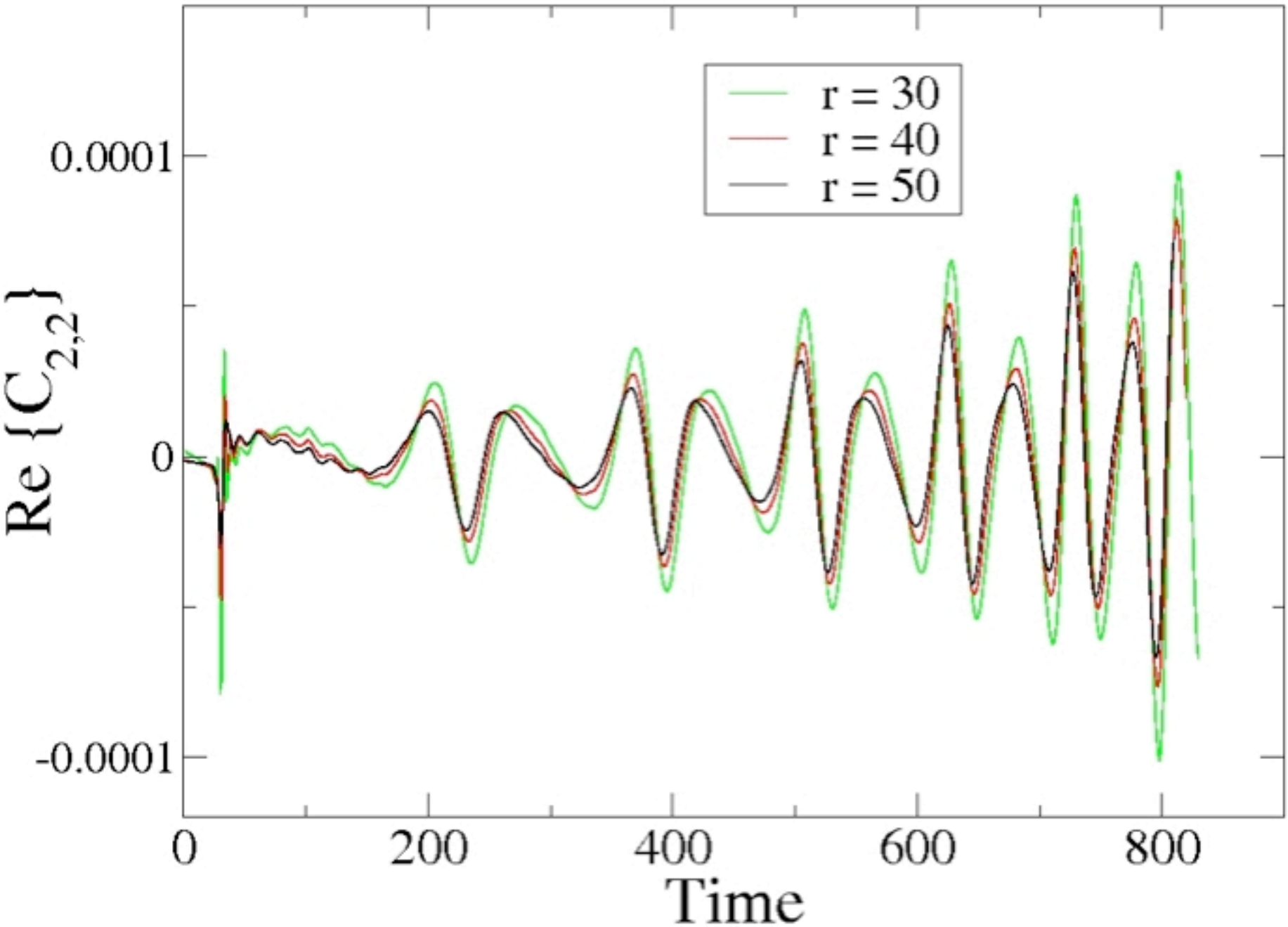

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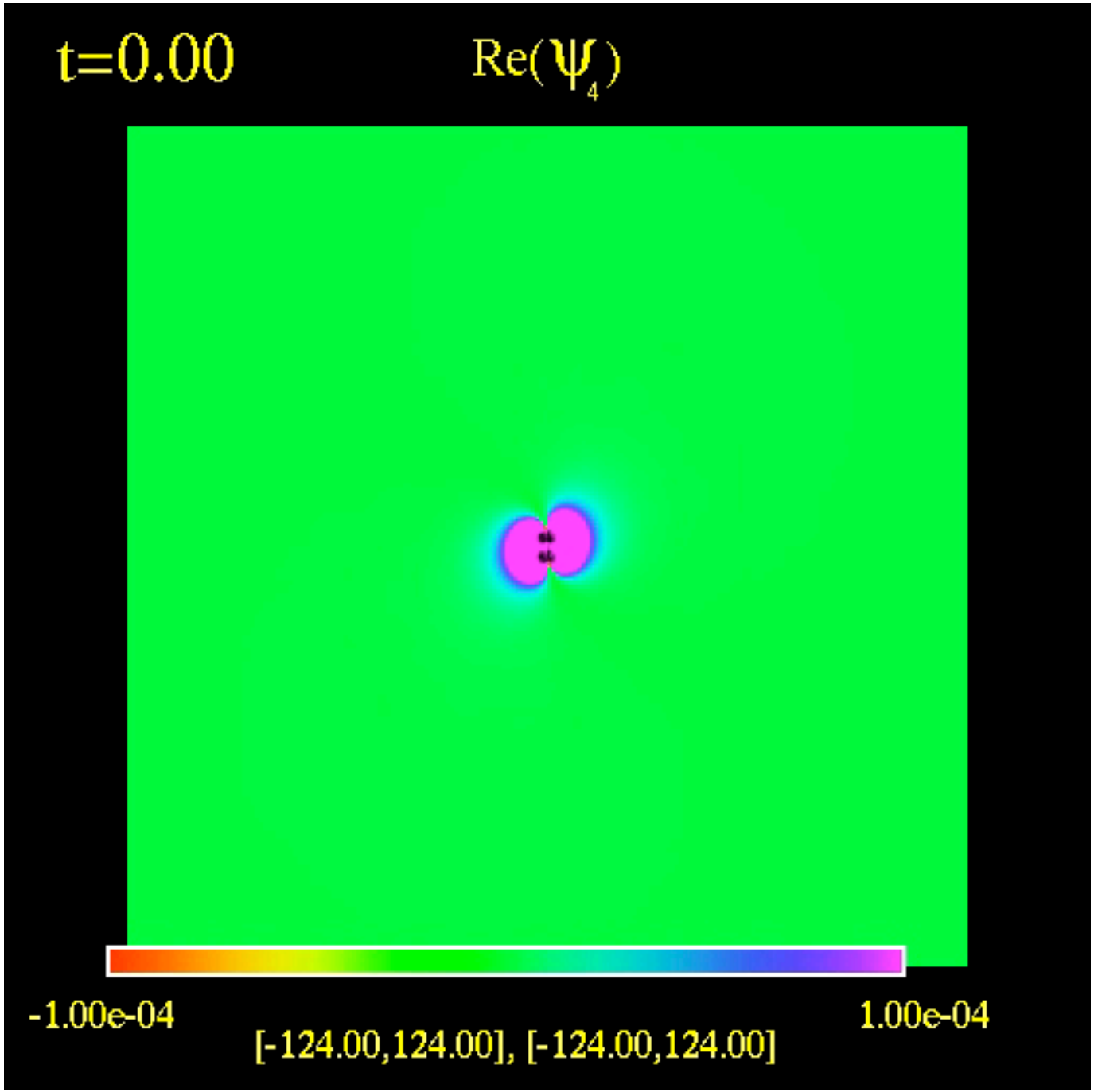
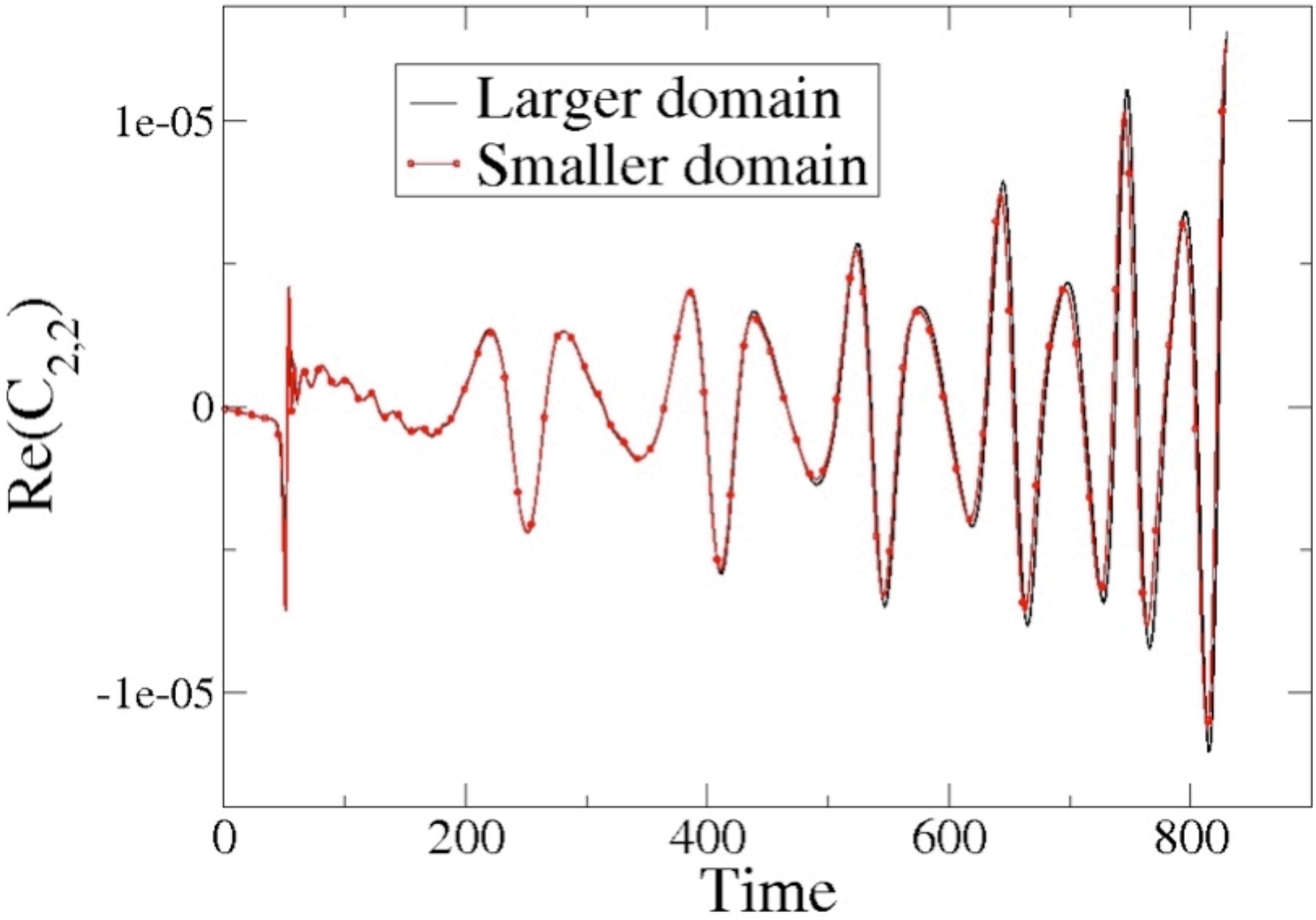


Influence of boundaries



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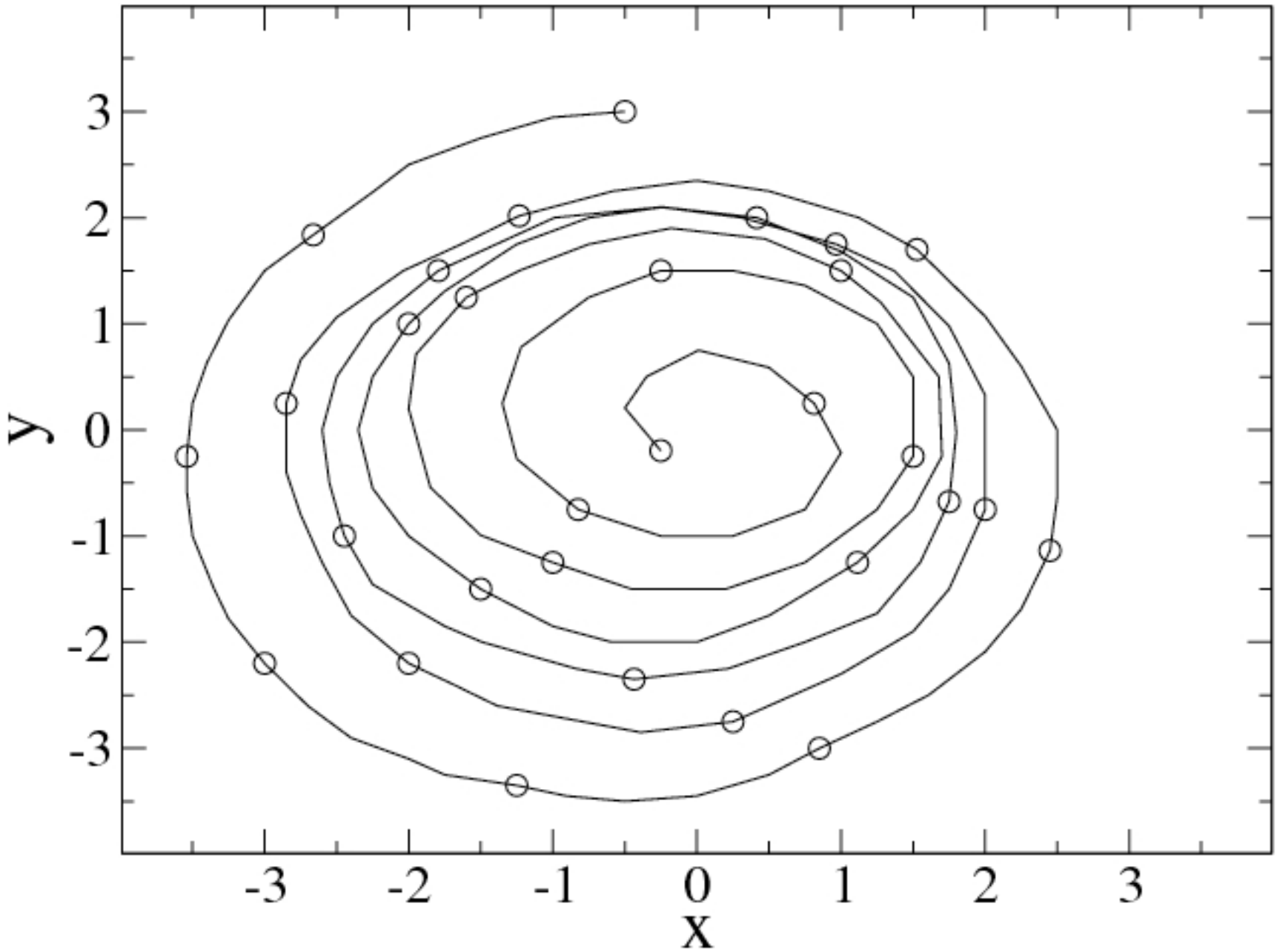
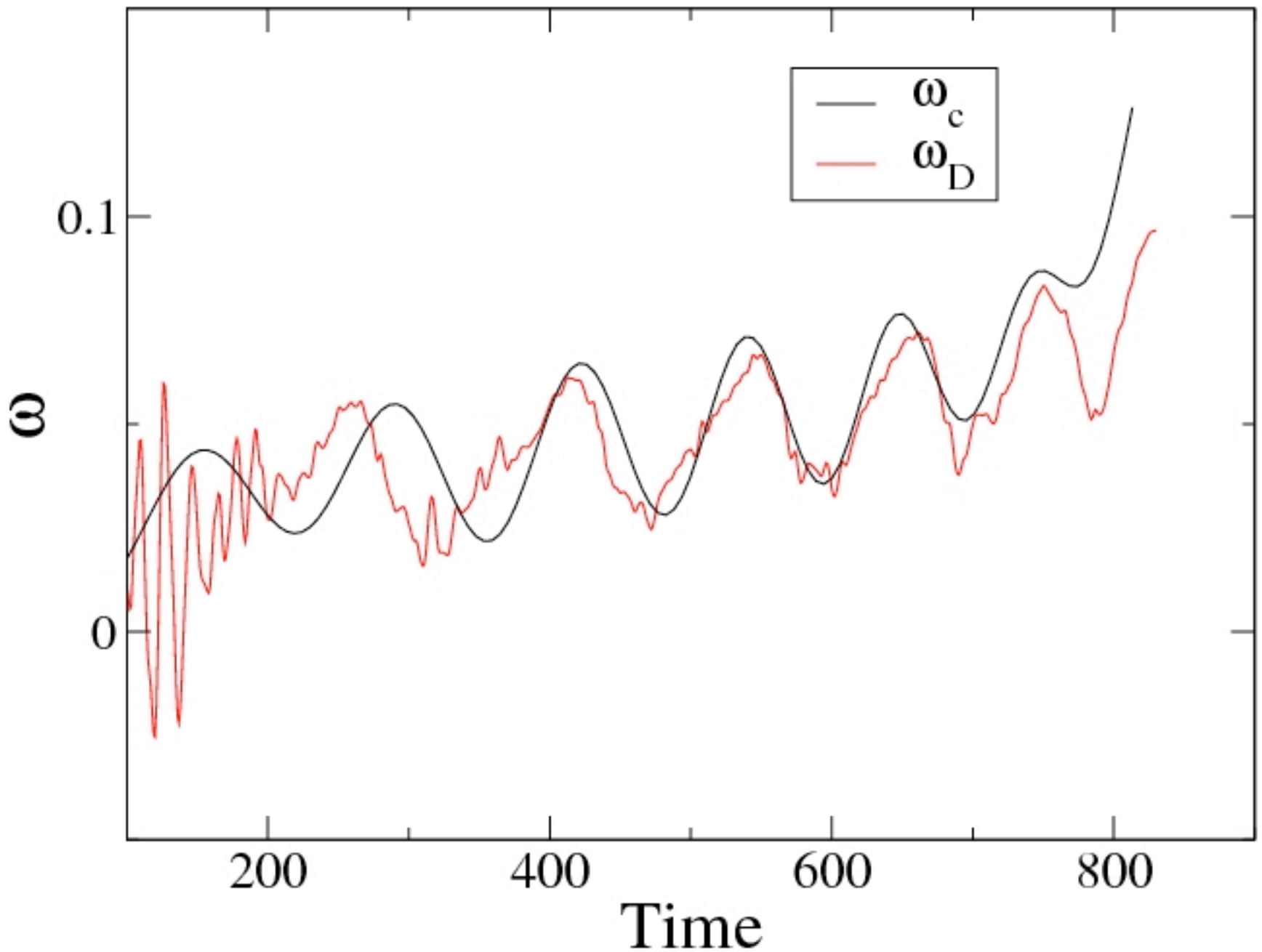
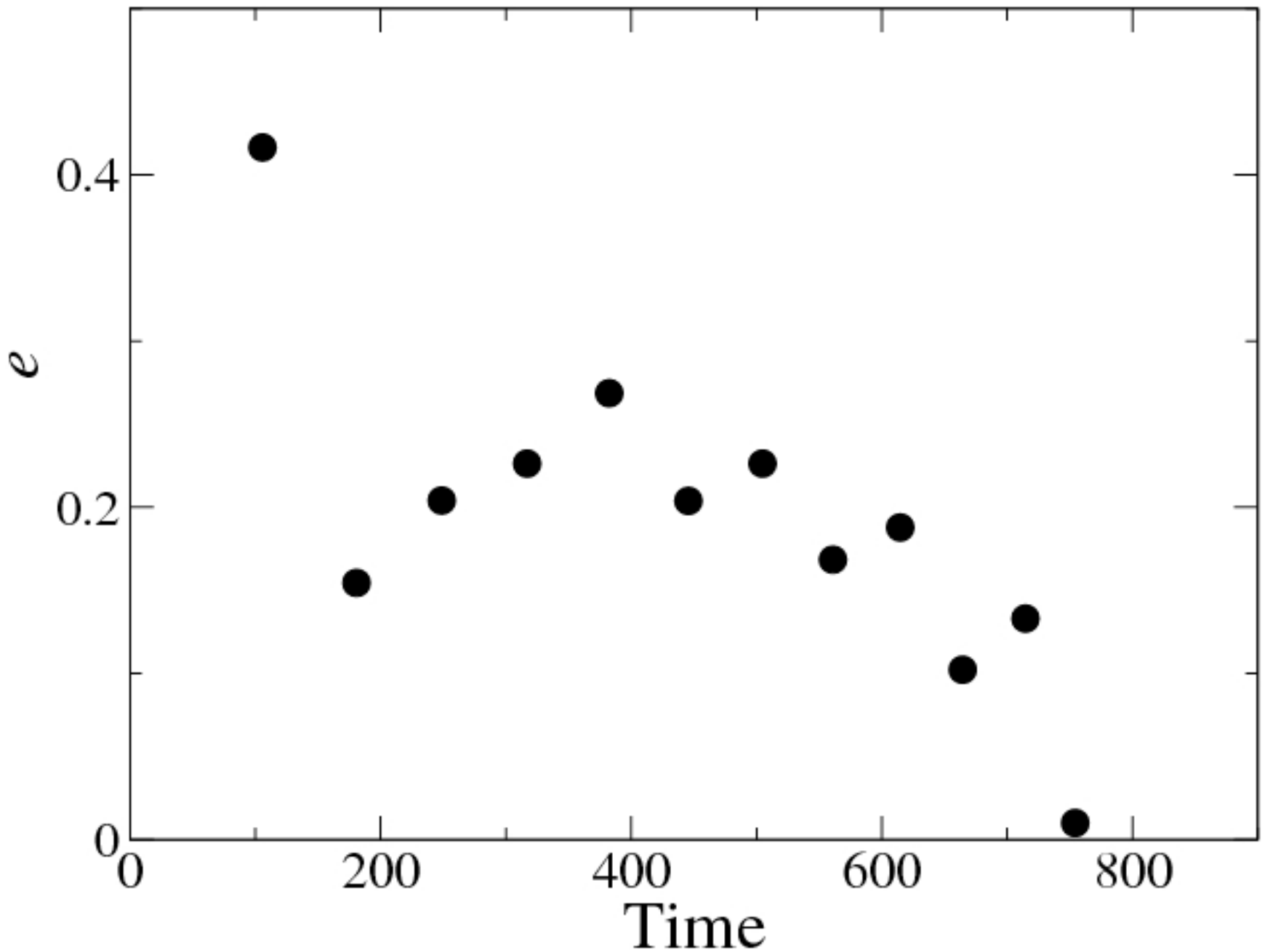


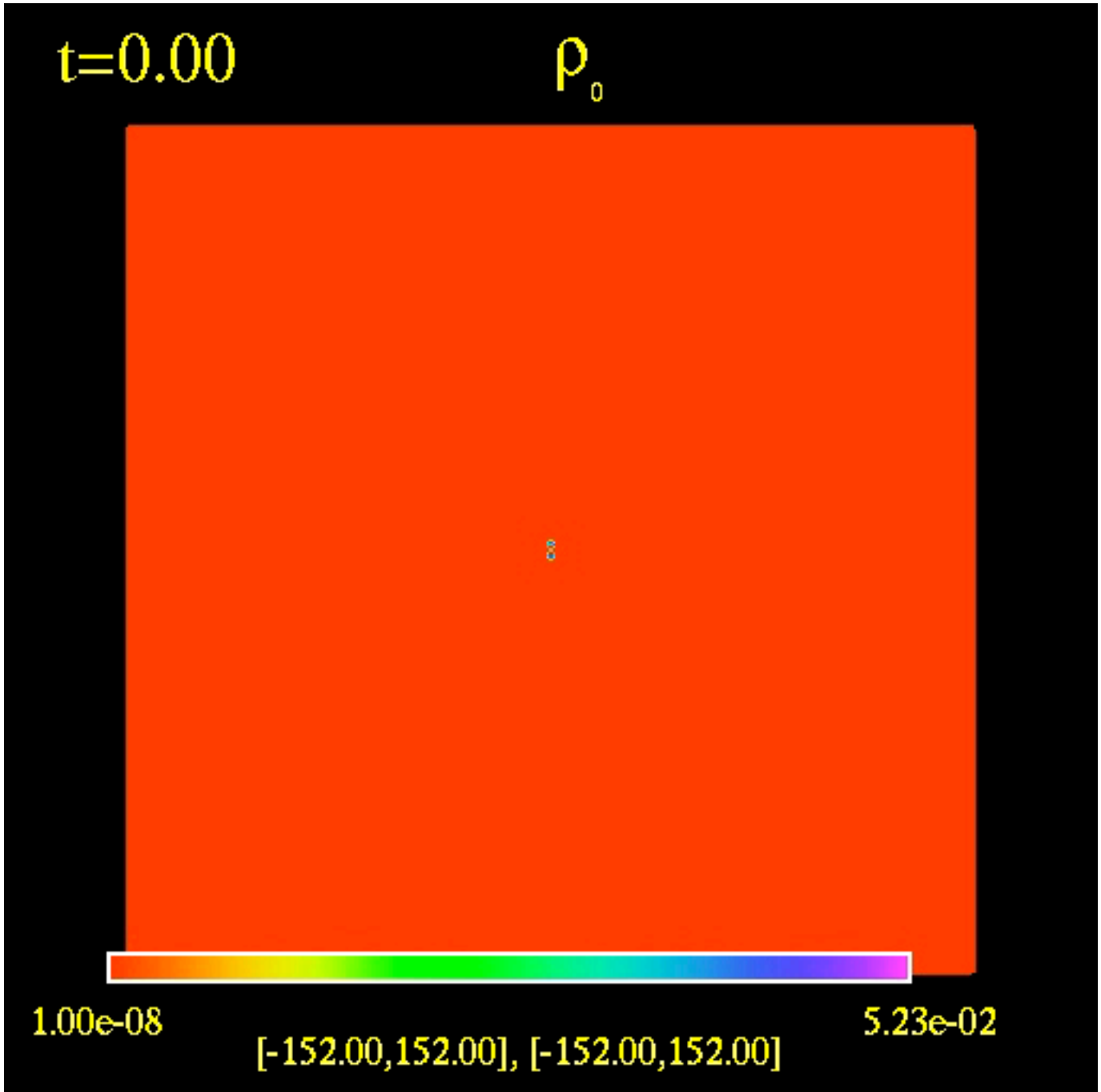
Orbital frequencies

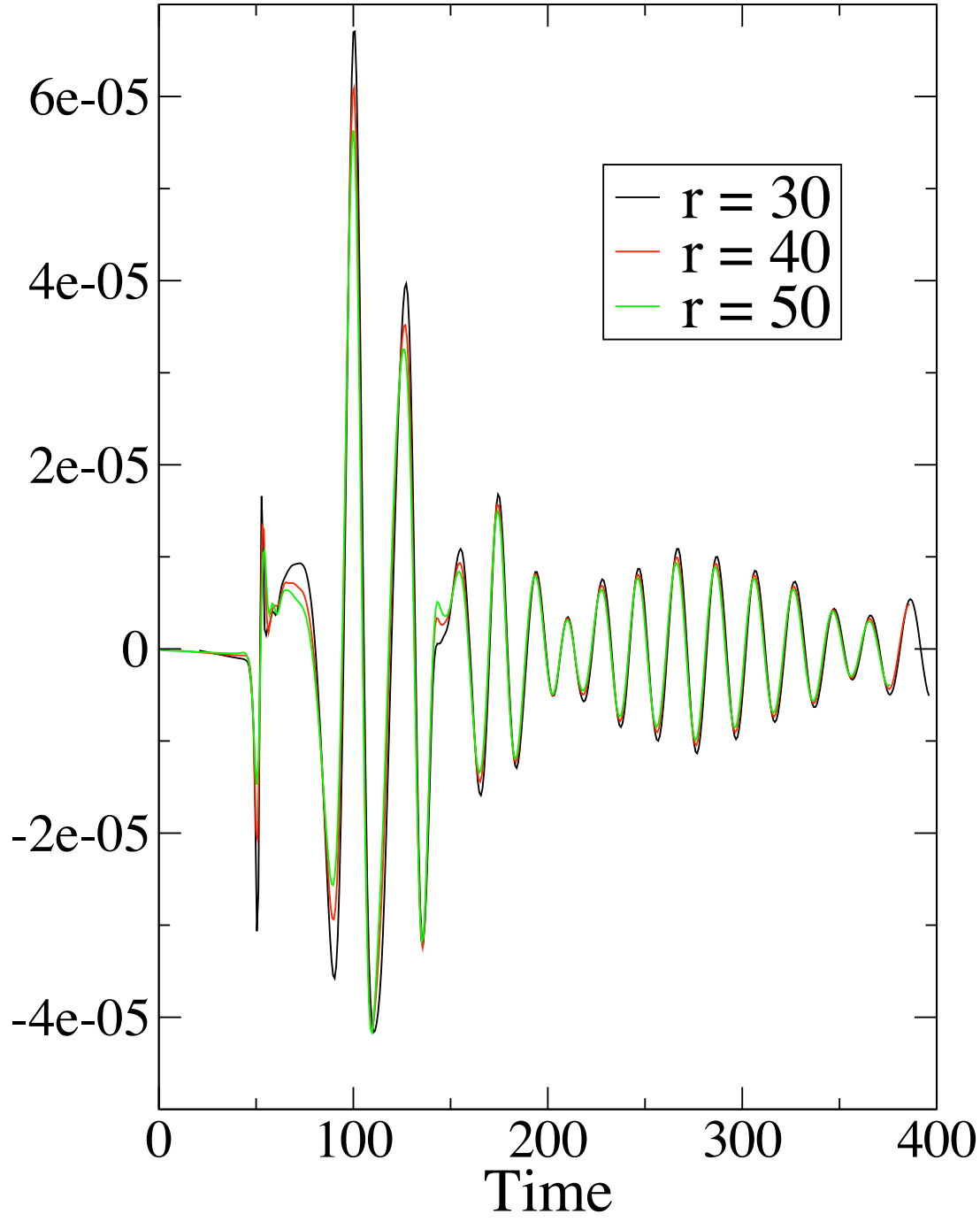


Eccentricity

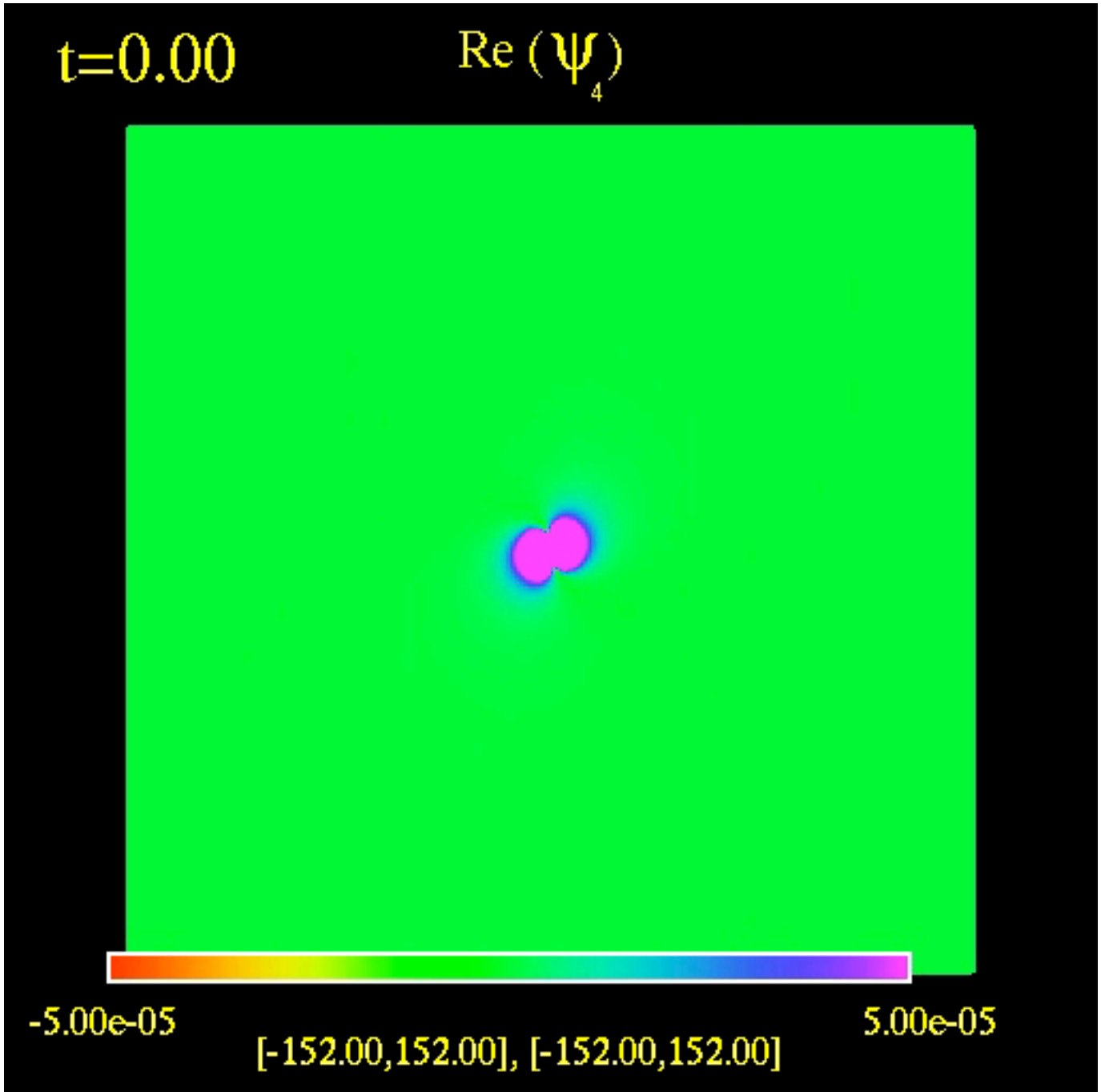


Merger to new star

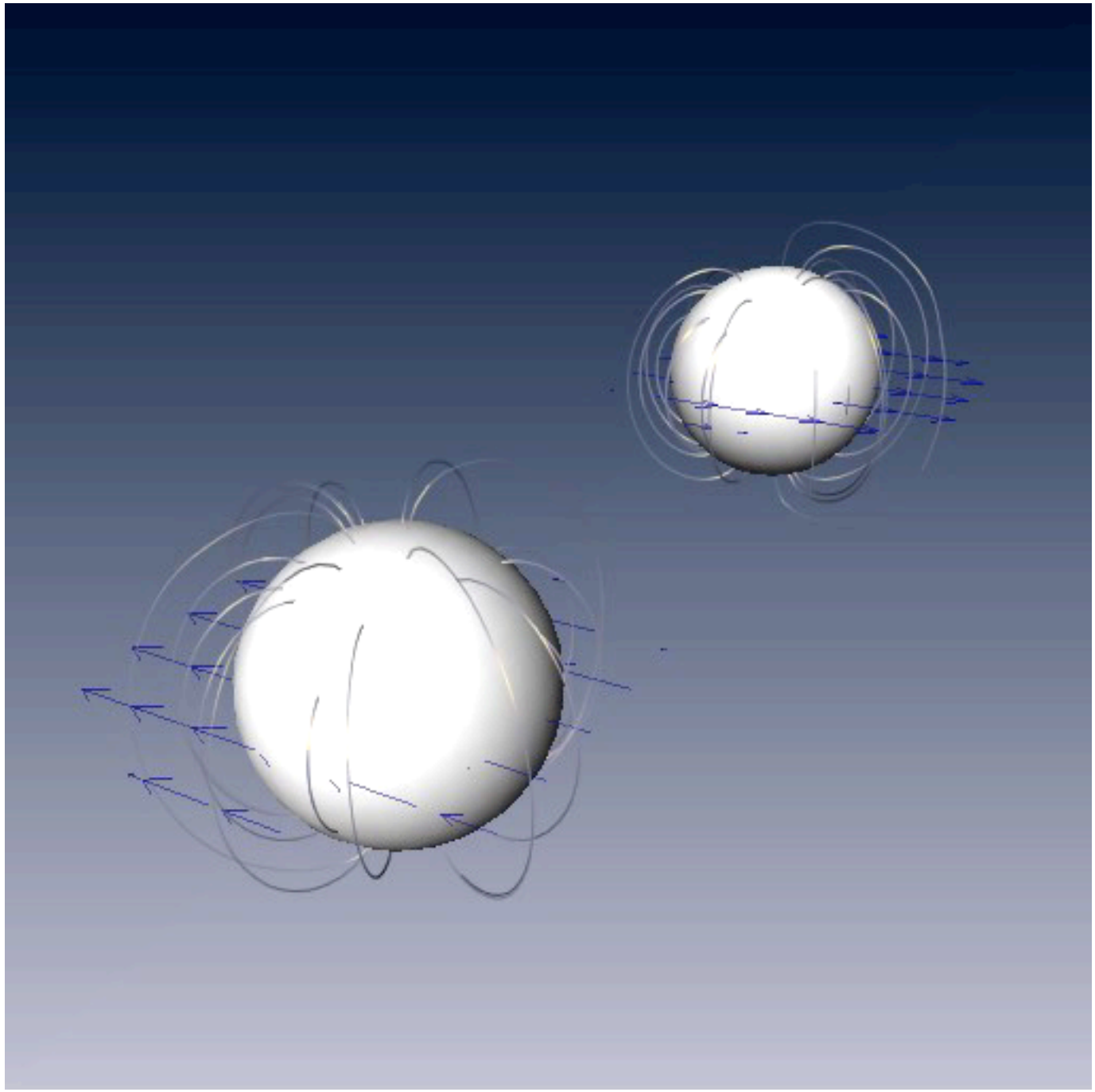



6e-05
4e-05
2e-05
0
-2e-05
-4e-05
0
100
200
300
400
Time
r = 30
r = 40
r = 50

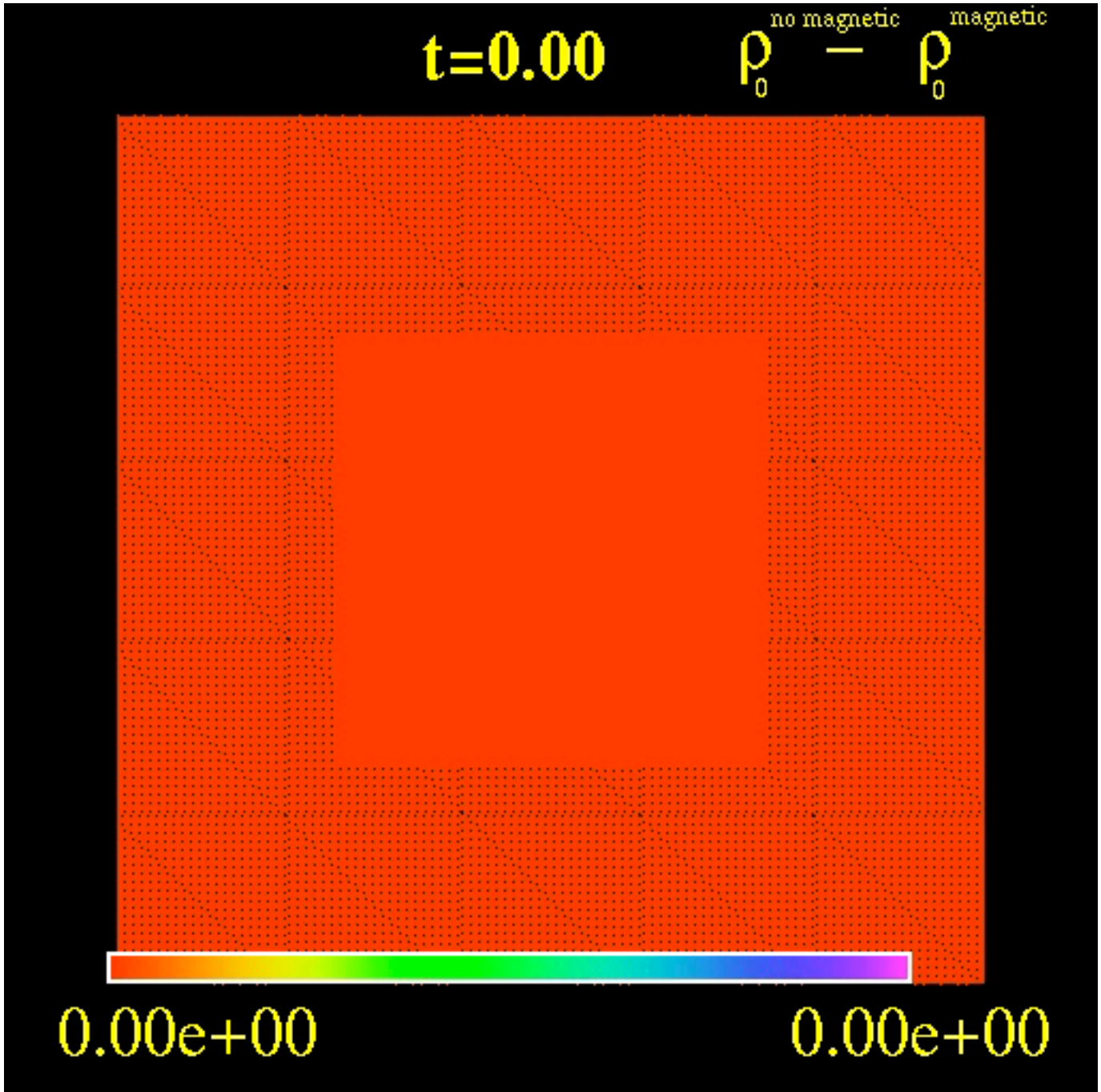
Merger to new star



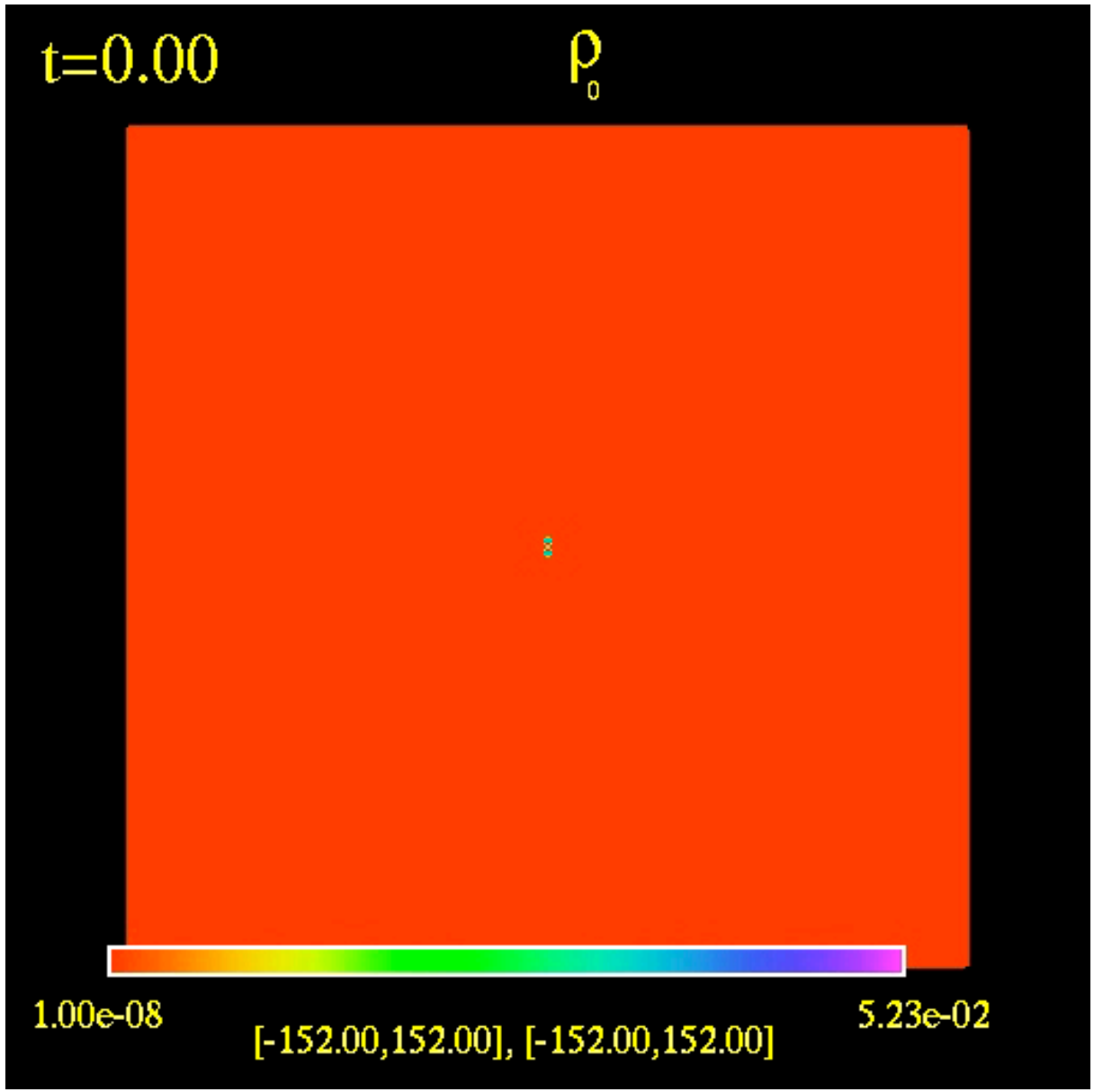
Magnetic collision



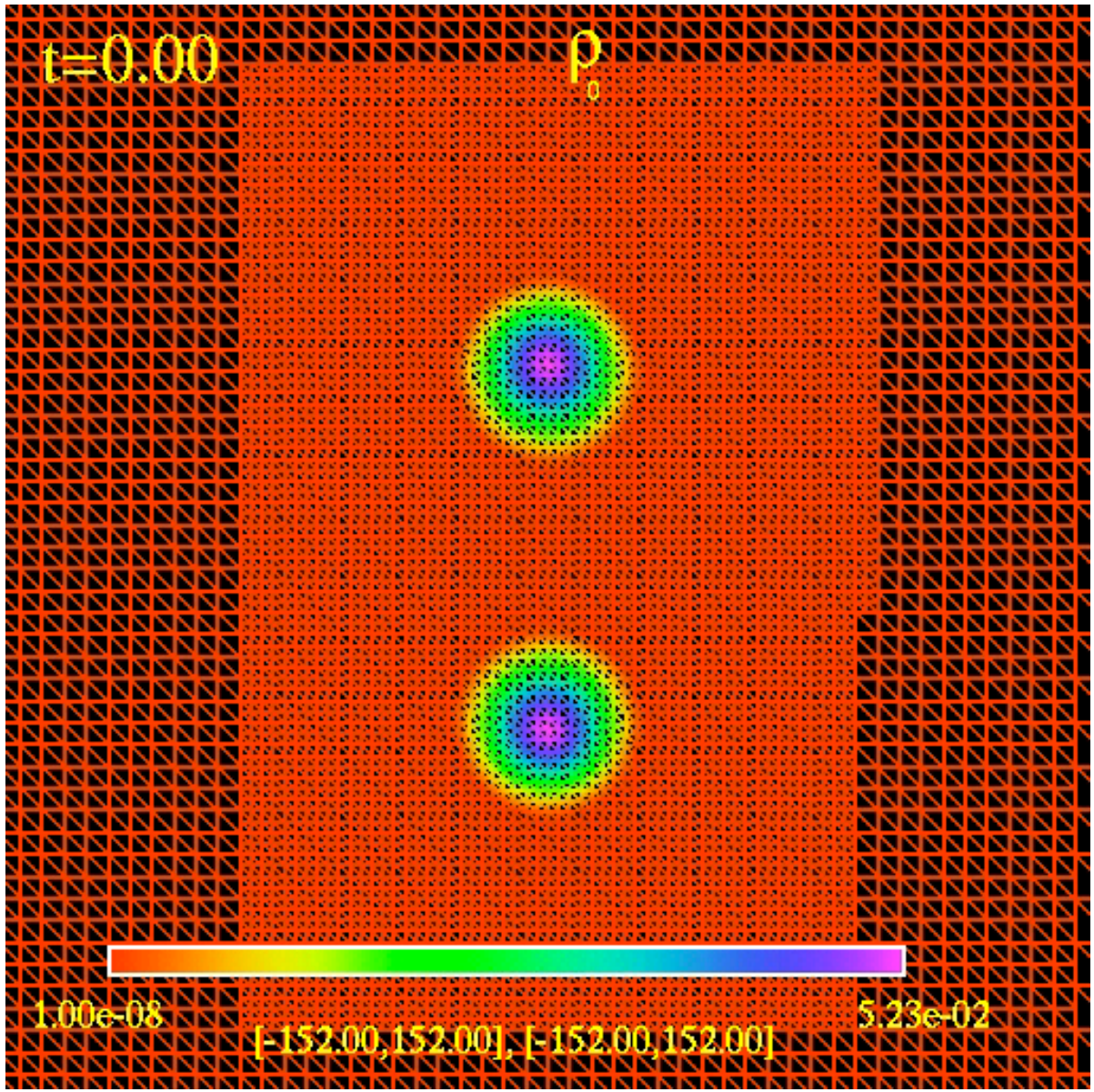
Magnetic vs No Magnetic collision

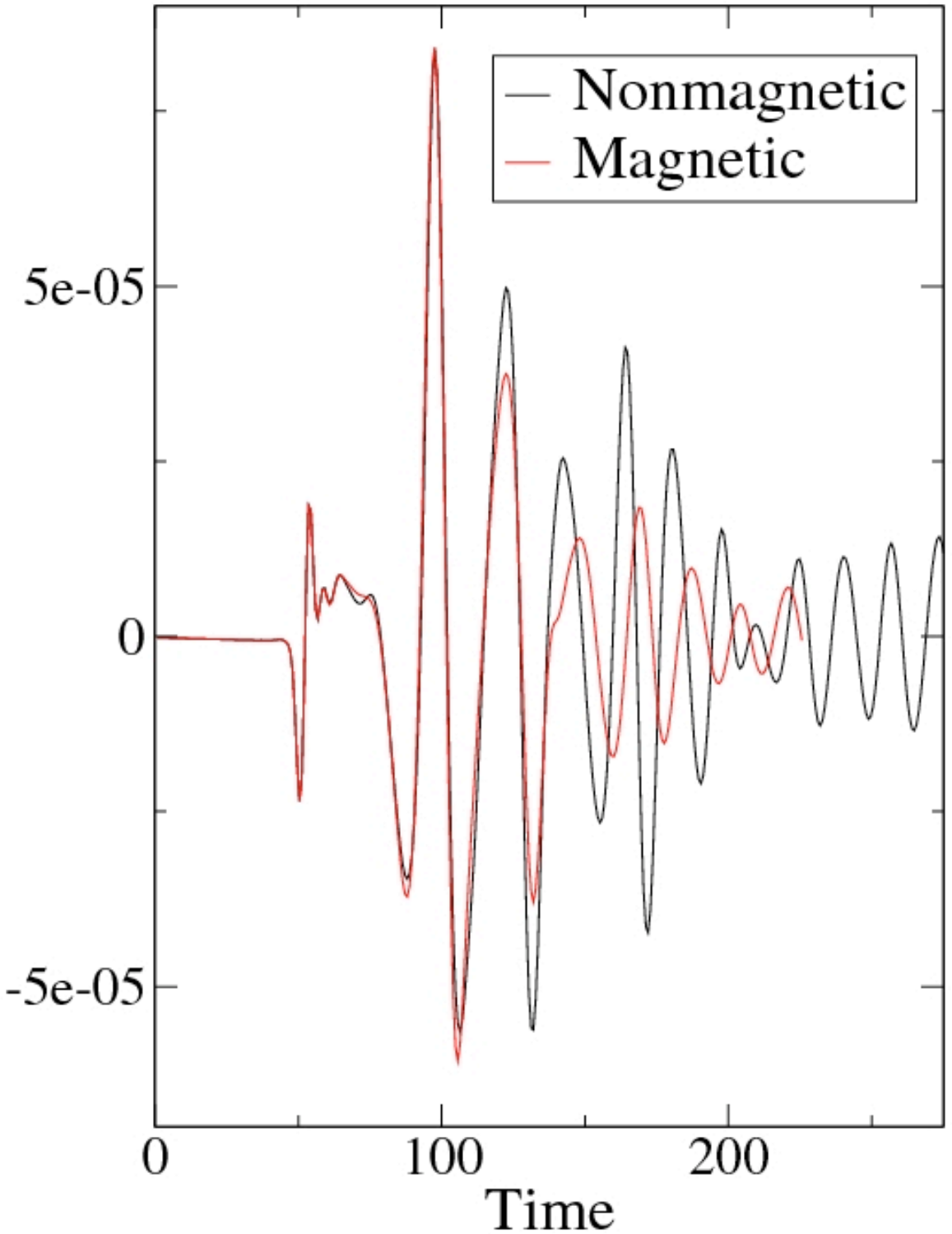


Collision with differential rotation: no magnetic field



Collision with differential rotation: magnetic field




Nonmagnetic
Magnetic
5e-05
0
-5e-05
0
100
200
Time

Future Work

- Initial data induced by Post-Newtonian
- BH--neutron star collisions
- Explore spin configurations
- Larger initial magnetic fields