Gravitational collapse in 5 dimensional space-time

- Numerical Evolution of Spheroidal / Ring objects -

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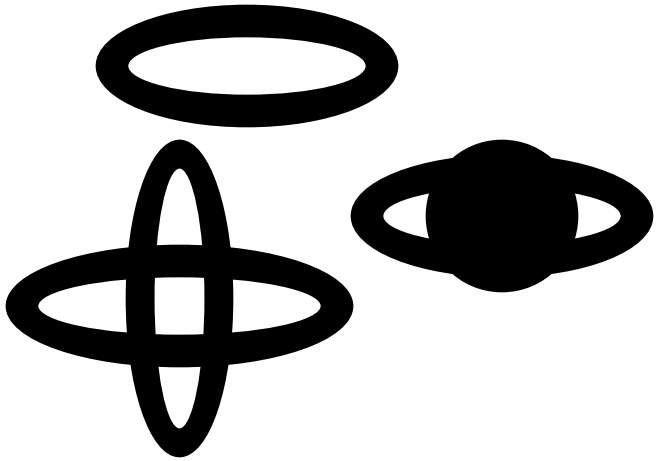
Higher dimensional black-holes have rich structures !

Black hole
Black ring (Emparan, Reall)
Black di-rings
Orthogonal di-rings
Black saturn



Black Objects

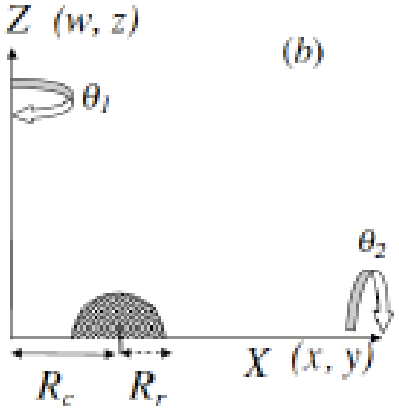
☆ Unsolved outstanding issues

Formation Process ?
Dynamical features ?
Stability ?

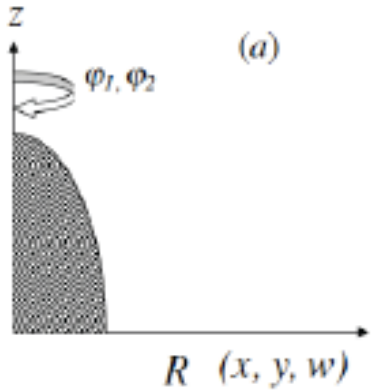
Numerical relativity

Two configurations

Ring configuration



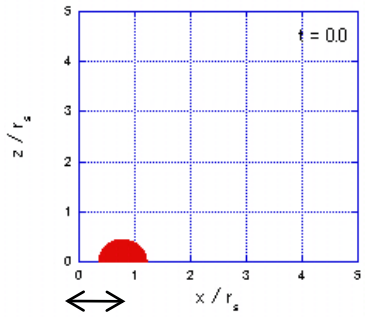
Spheroidal configuration

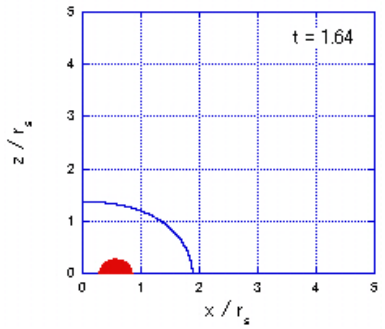


- Using the (4+1) ADM formalism.
- Express the matter with collisionless particle.
- No rotation.
- Maximal time slicing condition for lapse function.
  Minimal strain condition for shift vector.
- Search an apparent horizon.

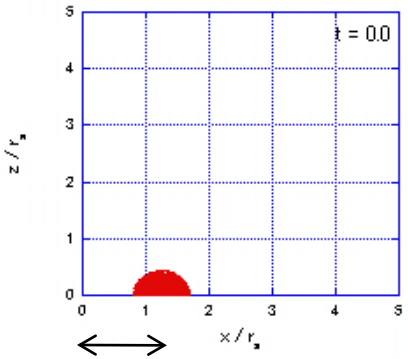
Results. 1　Evolution of ring configurations

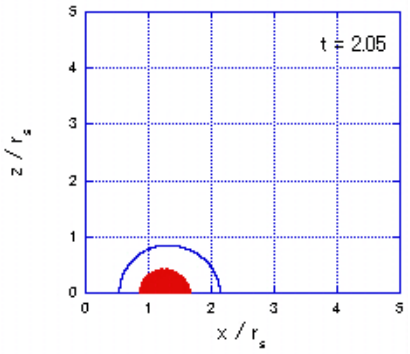
Case. 1　common horizon (small radius)

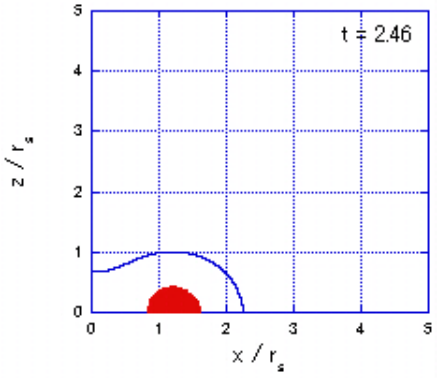




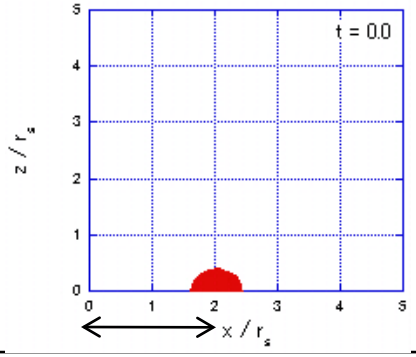
Case. 2　ring horizon → common horizon

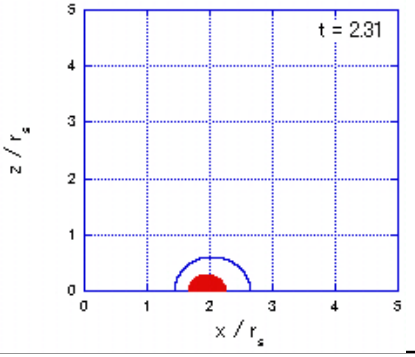






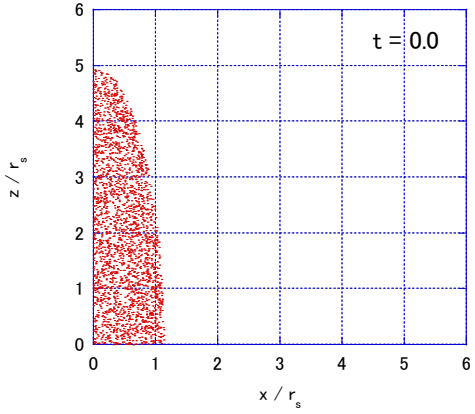
Case. 3　ring horizon (large radius)

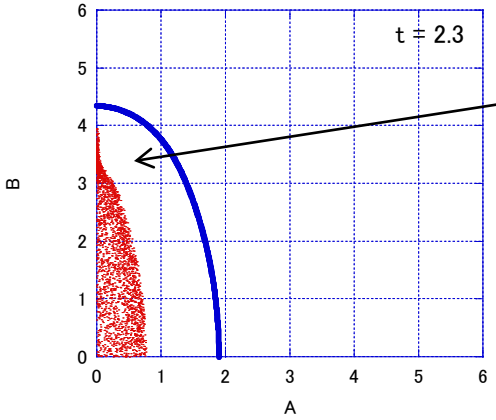


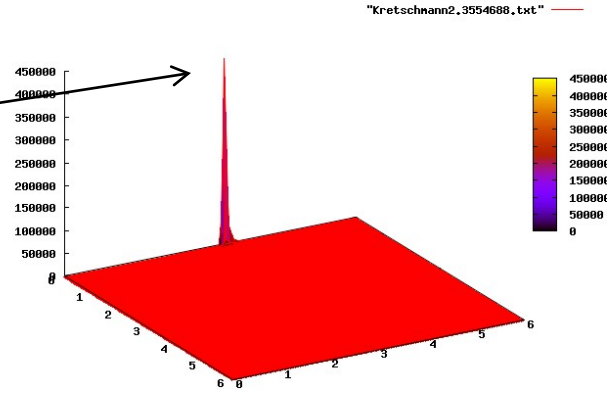


Results. 2　Evolution of spheroidal configurations

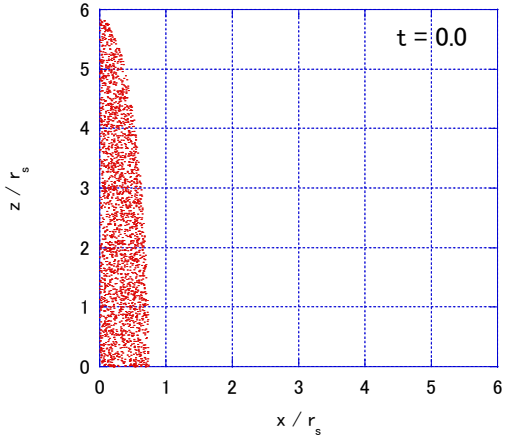
Case. 1　horizon forms.

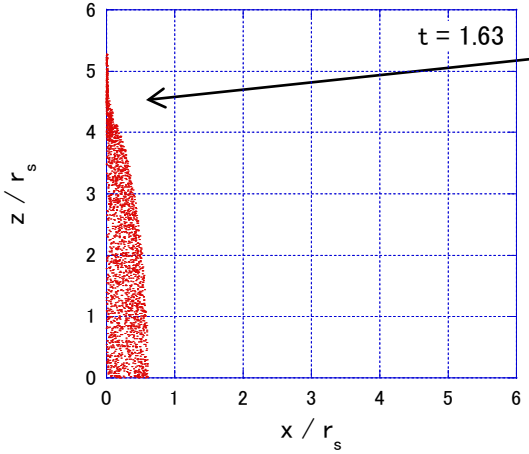


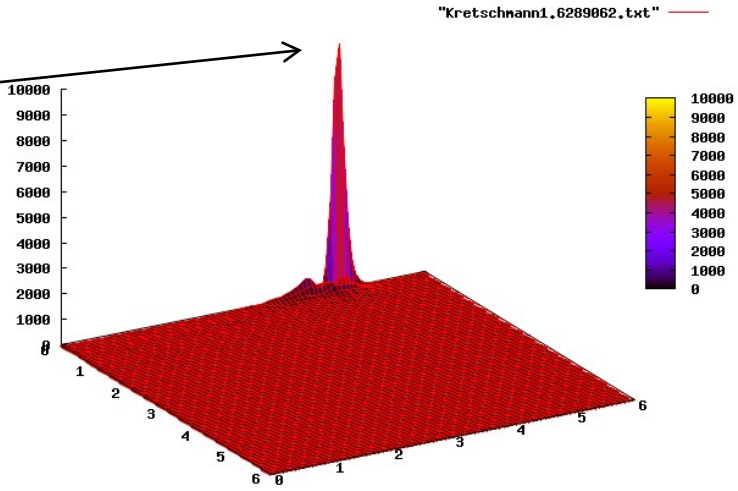




Case. 2　No horizon. (Naked singularity ?)







$R_{abcd}R^{abcd}$

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