

Incorporating Star Formation Feedback into The ATHENA (M)HD code

Group 3

2011-07-02

CAC Parallel Computing
Summer School

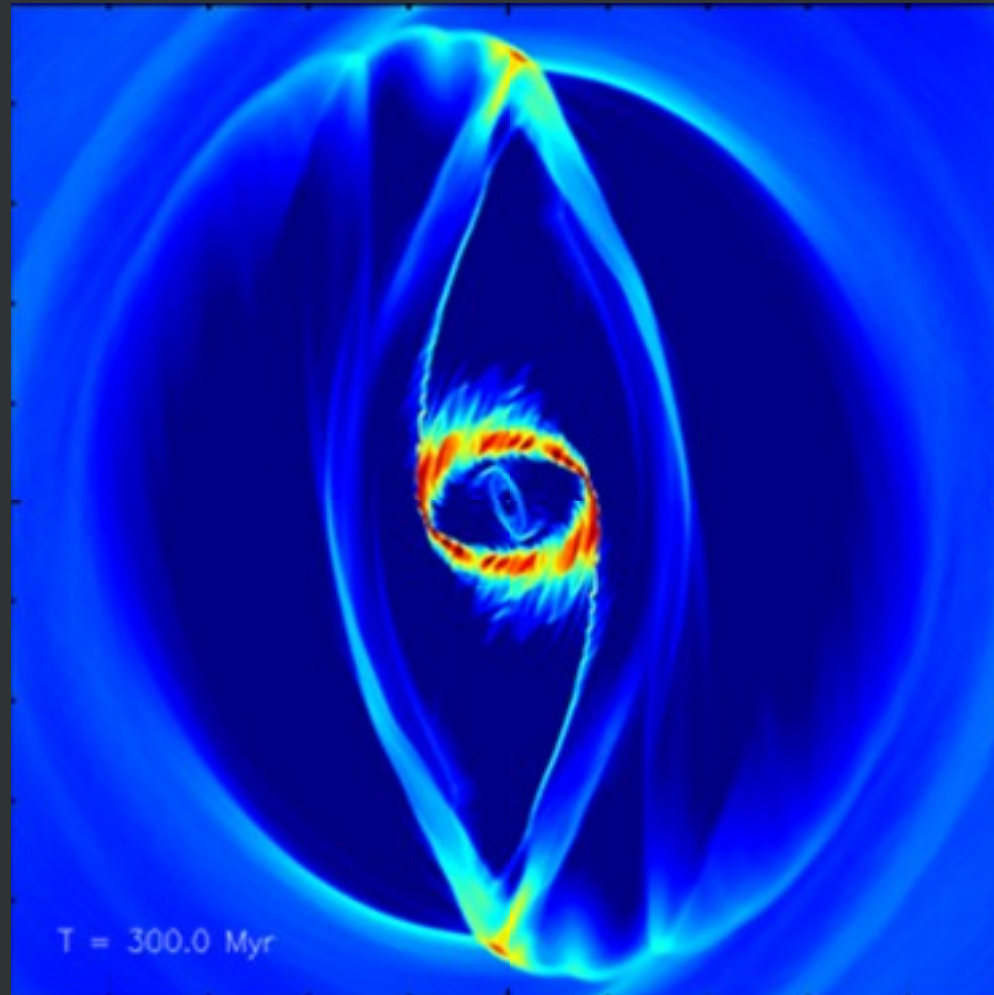
KIAS



Introduction

- Research Topic: Evolution of gaseous disks in barred galaxies
 - Mass transfer, Nuclear Star Formation / Star Cluster, galaxy-scale gas morphology
- 2D HD global simulations in XY plane
 - (Static) bar potential in a co-rotating frame
 - Include gas self-gravity
 - Star formation feedback
 - momentum feedback by Supernova explosion

Visuals



ATHENA (M)HD code

- Publicly available code being used for various astrophysical applications
- Static Mesh Refinement (Not AMR)
- Athena on parallel processors
 - Domain decomposition with ghost zones
 - Self-gravity solvers
(works only when periodic BC is adopted)
 - Parallelization for feedback prescriptions is required

Mechanical Feedback from SNe



- Star Formation can take place when local density reaches a certain threshold value
- Mechanical and Radiative feedbacks from star formation



Parallelization



```
MPI_Datatype Sntype;  
err = MPI_Type_contiguous(ninfo, MPI_INT, &Sntype);  
err = MPI_Type_commit( &Sntype);  
  
err = MPI_Allgather( &my_numSN, 1, MPI_INT,  
all_numSN, 1, MPI_INT, MPI_COMM_WORLD);  
disp[0]=0;  
for (i=1; i<Nproc; i++) disp[i]=all_numSN[i-1]+disp[i-1];  
  
err = MPI_Allgatherv( &(mySNinfo[0]), my_numSN,  
Sntype, pSNinfo, all_numSN, disp, Sntype,  
MPI_COMM_WORLD);  
  
err = MPI_Type_free( &Sntype);
```

MPI_Allgather(v)

MPI_Allgather

A			
B			
C			
D			

A	B	C	D

A	B	C	D
A	B	C	D
A	B	C	D
A	B	C	D

A,B,C,D = SN number in each sub domain (ex. A=1, B=3, C=0, D=2)
 Get displacement data : Disp = [0,1,4,4]

MPI_Allgatherv



a					
b	c	d			
e	f				

a	b	c	d	e	f

a	b	c	d	e	f
a	b	c	d	e	f
a	b	c	d	e	f
a	b	c	d	e	f



What will we do?

- 3D HD/MHD models w/o spiral arms
 - To do this, we need to improve our cooling solver
- 2D HD/MHD models in XY plane w/ spiral arms and SF
- More realistic SF prescription including hot gas

Thank you!

