Summary of
6th East-Asia Numerical Astrophysics Meeting

during September 15 to 19, 2014
In Kyung Hee University, Suwon, Korea

Dongsu Ryu
Ulsan National Institute of Science and Technology (UNIST)
Korea

EANAM (East-Asia Numerical Astrophysics Meeting)

- 0th Meeting - 2002 in ASIAA, Taipei, Taiwan
  (EANAM was suggested, Chi Yuan)
- 1st Meeting - 2004 in NAOJ, Mitaka, Japan
- 2nd Meeting - 2006 in KASI, Daejeon, Korea
- 3rd Meeting - 2008 in PMO, Nanjing, China
- 4th Meeting - 2010 in ASIAA, Taipei, Taiwan
- 5th Meeting - 2012 in YITP, Kyoto, Japan
- 6th Meeting - 2014 in Kyung Hee Univ., Suwon, Korea
- 7th Meeting – 2016 in China

List (partial) of topics covered in this EANAM, sorted by approach (instead of by objects)

- N-body/SPH simulations
  cosmological structure formation
  galaxy formation and evolution
  dynamics and evolution of stellar systems
  formation and dynamics of black hole
  formation and evolution of disk

- Hyrdodynamic and MHD simulations
  cosmological structure formation
  formation of black hole
  galaxy formation and evolution, spiral structure
  molecular cloud, star formation in the ISM
  supernova explosion, jet, accretion
  solar and space physics
  atmosphere of planets
  turbulence and dynamo
  reconnection
  cosmic ray acceleration

- Radiation hydrodynamic and MHD simulations
  radiative transfer
  radiation feedback

- Relativistic hydrodynamic and MHD simulations
  resistive (G)RMHD
  two fluid RMHD
  jet and accretion disk around black holes
  reconnection

- Numerical relativity
  dynamics and merger of black holes
  gravitational wave

- PIC simulations
  reconnection

- Solving QM equation
  cosmological structure formation

- Code

high-order, high-performance (R)HD/MHD code

code for two fluid plasma, code with specific S,

code for resisitive (G)RMHD, …

numerical relativity

stability of code (wiggle instability)

improvement of SPH

Focker-Plank equation

radiative transfer

i-ApMsFEM

image processing

Progresses in numerical astrophysics (partial list)

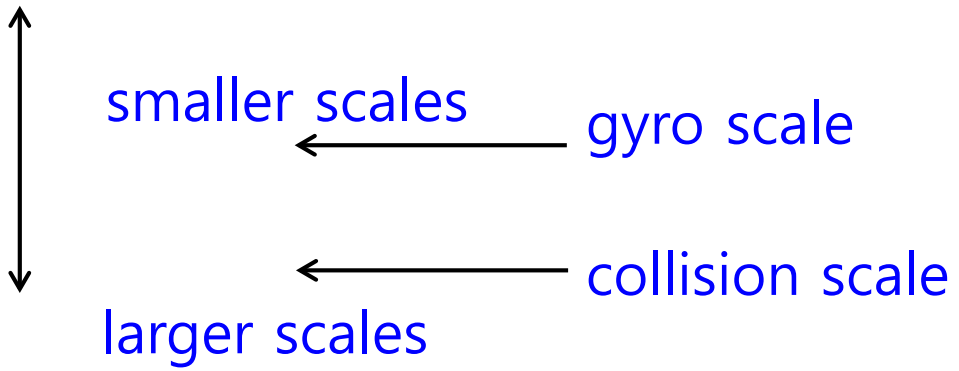
- 1d → 2d → 3d
- increasing number of zones and particles: ~ 1000^3 are common
- simulations with simple physics → simulations with multi-physics
- codes with 1^{st} or 2^{nd} order schemes → higher-order schemes
- single-level grid → AMR grid
- massive parallelization, GPU, etc → high performance

- line plots → images → movies

- and etc

My prediction (or wish list) of future direction

- Development of better codes
  ← higher-order, more accurate schemes,
  complying conservation laws or constraints, and etc
- Toward higher resolution and/or multi scale problems
  clusters with larger N_{cores} → need more efficient parallelization
  GPU → require modification of code
  AMR
  hybrid codes
- Introduction of new codes, for example
  for N-body, SPH, Vlasov-Poisson code, and etc
  for plasma
  PIC (particle-in-cell) code
  gyro-kinetic code
  gyro-fluid code
  fluid (hydro, MHD) code



- Radiation hydrodynamics and MHD, radiative transfer
- Inclusion of more realistic physics in simulations:
  some are incorporated as phenomenology models based on incomplete understanding of them
  needs more works to understand them from first principles
- Identification and exploration of more diverse issues of physics or even new physics
- More efforts to visualize the data

Numerical Astrophysics in East-Asia

- World leading computing facilities such as (June 2014)
  - Tianhe-2 in China (1st in Top 500 supercomputers)
  - K-computer in Japan (4th in Top 500 supercomputers)
  - TSUBAME 2.5 in Japan (13th in Top 500 supercomputers)
  - Tianhe-1A in China (14th in Top 500 supercomputers)
  - Tachyon II in Korea (167th in Top 500 supercomputers)
  - Alps in Taiwan (303th in Top 500 supercomputers)

  - how to utilize them for astrophysics?

- Numerical astrophysics
  - still minor among astronomy and astrophysics !

- After more than 10 years efforts through EANAN
  - the regional collaboration not much enhanced ?

Future Direction

- ???

Thanks to

Organization Committee Members

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