Curriculum Vitae

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PERSONAL DATA

Birth Date:	1964.5.1
Sex:	Male
Citizenship:	Republic of China

EDUCATION

Ph. D.	1994-2000, Institute of Physics and Astronomy, National Central University

EXPERIENCE

2012/3 – now	Associate Research Scientist, Institute of Astronomy & Astrophysics, Academia Sinica
2003/08 – 2012/2	Assistant Research Scientist, Institute of Astronomy & Astrophysics, Academia Sinica
2005/02 – 2009/6	Joint assistant professor, National Taiwan University of Art
2000/3 – 2003/7	Postdoctoral Fellow, Physics department, National Taiwan University
2001/2 – 2002/7	Joint assistant professor, National Chiao Tung University
2000/5 – 2000/8	Visiting Scientist, CITA
1994/8 – 1995/8	Research assistant, Institute of Space Science, National Central University

HONOUR AND AWARDS

2015	THE 2ND AWARD OF THE 2ND WORLD CHINESE POPULAR SCIENCE WRITING
2000	THE 3RD AWARD OF THE 8TH KWOH-TING LI POPULAR SCIENCE WRITING

PUBLICATIONS (from 2004-now)

Papers in refereed journal

1. Clusters in preheating simulation and its effect on CMB spectrum, Kai-Yang Lin, Tak-Pong Woo, **Yao-Haun Tseng**, Lihwai Lin, Tzihong Chiueh, Mod. Phys. Letts, A, Vol.19, Nos. 13-16, p1035, May 30, 2004
2. Simulation of a Combined SZE and Weak Lensing Cluster Survey for AMiBA Experiment, Keiichi Umetsu, Tzihong Chiueh, Kai-Yang Lin, Jun-Mein Wu,**Yao-Huan Tseng**, Mod. Phys. Letts, A, Vol.19, Nos. 13-16, p1027, May 30,2004
3. Effects of Preheated Clusters on the Cosmic Microwave Background Spectrum, Kai-Yang Lin; Tak-Pong Woo; **Yao-Huan Tseng**; Lihwai Lin; Tzihong Chiueh, ApJ, 2004, 608L, 1L
4. The effect of bars and transient spirals on the vertical heating in disk galaxies, Kanak Saha; **Yao-Huan Tseng**; Ronald Taam, ApJ, 2010, 721, 1878
5. 《具教育目的的小型電波望遠鏡動手作活動》,**曾耀寰**,物理教育學刊,2011 年秋季刊，第 12 卷第 1 期，p139
6. 《如何應用中學物理尋找系外行星》，**曾耀寰**，2011 年 11 月，兩岸四地首屆中學物理教學研討會論文集
7. 《非理工大學生之天文知識初探》,**曾耀寰**,海峽科學,2012 年 3 月第 3 期，p138
8. 《Raspberry Pi 在天文演示上的應用》，**曾耀寰**，2013 年 8 月，第十一屆物理演示實驗教學研討會論文集
9. 《科普傳播的另一條路》，**曾耀寰**，2015 年 4 月，2015 年科學傳播國際研討會論文集
10. 《透過智慧手機瞭解彈簧串聯和並聯現象》，邱家媛、**曾耀寰**，物理教育學刊，2016 年，第 17 卷第 2 期，p57-66
11. 《利用智慧手機測量單擺周期》，**曾耀寰**，物理教育學刊，2017 年，第 18 卷第 1 期，p65-76
12. 《智慧手機在比色法濃度檢驗的應用》，**曾耀寰**，物理教育學刊，2018 年，第 19 卷第 1 期，p59-72
13. Shang, H., Liu, C.-F., Wang, H.-H., Bu, D., Krasnopolsky, R., **Tseng, Y.-H**., and Gu, P.**,** “Formation of Isothermal Disks around Protoplanets. III. Three-Dimensional Locally Isothermal Simulations”, ApJ, in prep (2018)

14. Shang, H.**,** Wang, H.-H.**,** Liu, C.-F., Bu, D., Fung, J., Krasnopolsky, R., **Tseng, Y.-H**, and Gu, P.**,** “Formation of Isothermal Disks around Protoplanets. II. Three-Dimensional Global Simulations ”, ApJ, in prep (2018)
15. **Tseng, Y.-H**, Shang, H, Yen, C. –C, “Direct calculation of self-gravitational force for infinitesimally thin gaseous disks using adaptive mesh refinement”, ApJ Supplement submitted (2019)

THE MAJOR RESEARCH ACHIEVEMENTS

Before 2003 CFD-MHD group has only 4 single-processor and 2 dual-processor machines. These machines are not well-organized as a PC cluster for high performance computing. Right now (April 2009) I setup two pc cluster, 111-node cfd-mhd pc cluster with 13 single-processor(13x1), 33 dual-processor machines(33x2) and 4 dual Quardcore machines(4x8) and 98-node CP cluster with 8 single Quardcode machines(8x4) and 8 dual Quardcode machines(8x8). 8 of computation nodes are implemented with low-end GPU cards which form a testbed for GPU computation. For a simple direct nbody calculation, it can reach 88 times speedup with NVIDIA GeForce 8800GT.

Now CP cluster are all updated to a Mac-mini cluster with 16x4 nodes. The updated CP cluster is still served for all IAA users. These computation nodes are well connected with Gbps network switch and share with one common 24TB storage, which is suitable for parallel computing. For monitoring the cpu loading of each cp machine, I provide a script for user to show the real-time status (fig.1). Besides the cpu loading, the script can show who are using the machine for easy maintenance. The updated CFD-MHD cluster consists of 8 GPU computers. Each one is equipped with two GPU cards(GeForce GTX660Ti) and 8 GPU cards totally. I am working on a simple direct nbody parallel/GPU code which can run on a more than 10M particles case. I also work on optimization of different programs by parallel scheme.

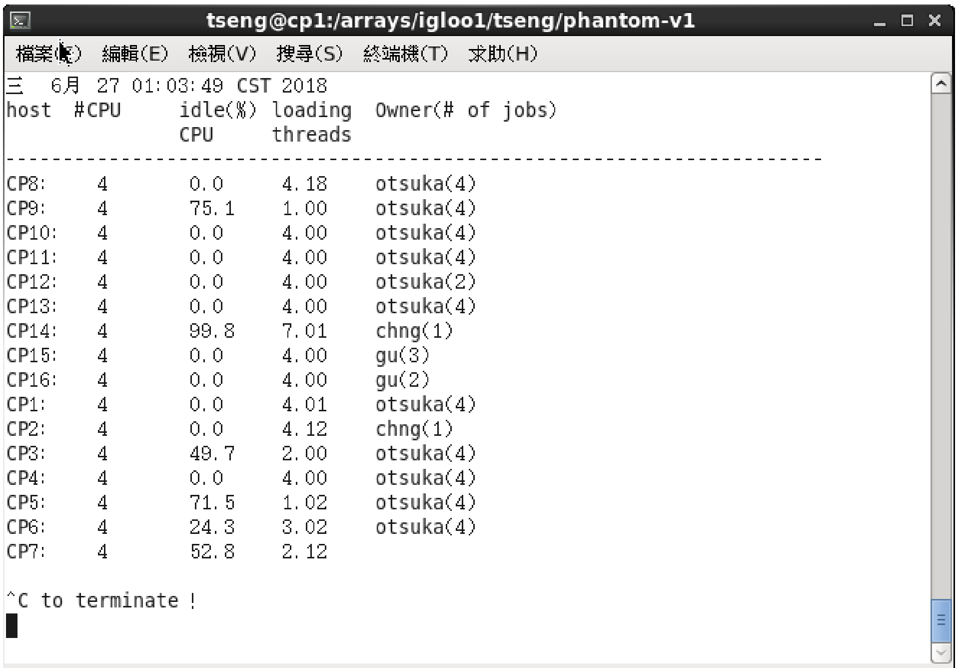

Fig.1

Working on galactic bending instability with Dr. Kanak. We started from a rigid halo that did not respond from the halo to the gravitational effect of the disk and found warp. The simulations will be done under the assumption of a live halo that include the backreaction from the halo to the embedded disk.

To benefit the computing power of the GPU cards, I write two versions of the direct nbody codes, the CUDA version and the OpenACC version. The CUDA version is faster than OpenACC version. CUDA is a parallel computing platform and API model created by Nvidia company and only works for Nvidia GPUs. OpenACC is a programming standard for parallel computing and designed to simplify parallel computing of CPU/GPU systems. So it is much easy to implement the code with OpenACC. I can rewrite the code with few OpenACC directive lines and run 50M particles to simulate the dynamics of a DM/bulge/disk galaxy on the TIARA GPU cluster (Fig.2).

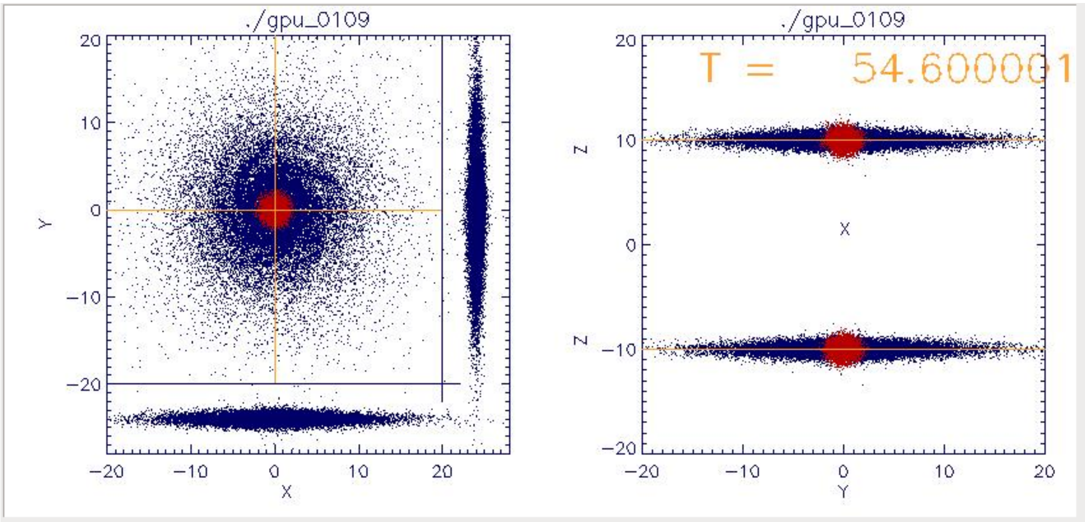

Fig. 2, A 50M collisionless particles simulation

Following the new method of solving self-gravity developed by Prof. Chien-Chang Yen, I write the Fortran code to reproduce his result and speed up with OpenACC. Instead of solving the complete potential function problem with standard FFT method, Prof. Yen calculate the force in infinite planes in Cartesian and polar coordinates by a reproducing kernel method. His proposed method is similar to a spectral method, but without the necessity of imposing a periodic boundary condition and can be implemented by direct nbody concept (Fig.3). The OpenACC version is about 48 times speedup. Then we port to a CUDA version in AMR case (Fig. 4) with multiple GPUs. Depending on the number of the active cells the performance can reach to ~ 500 times of the CPU(Table 1). The next step is to develop a library to solve the self-gravity of the AMR case which is very suitable for Antares code.

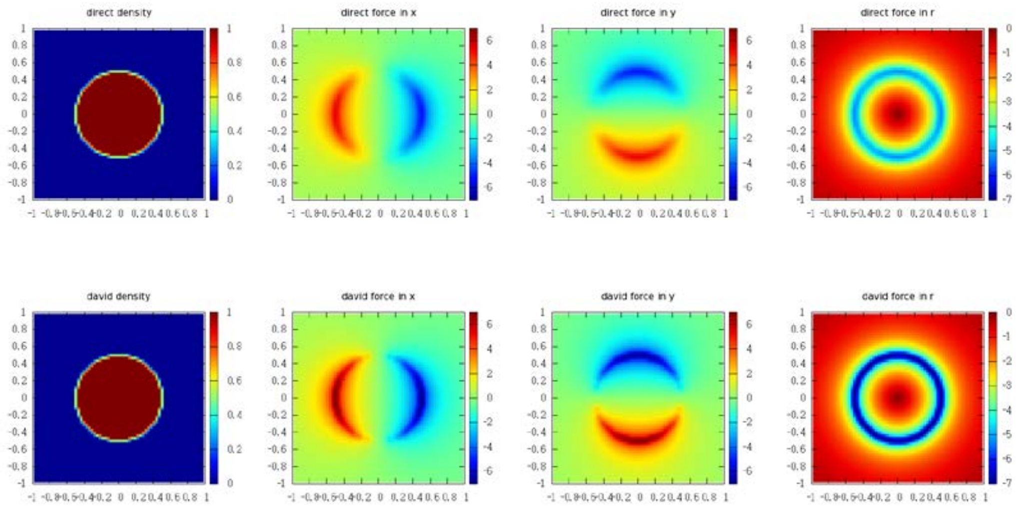

Fig.3, An uniform disc case. The upper one is the normal way, the lower one is Prof.Yen's method.

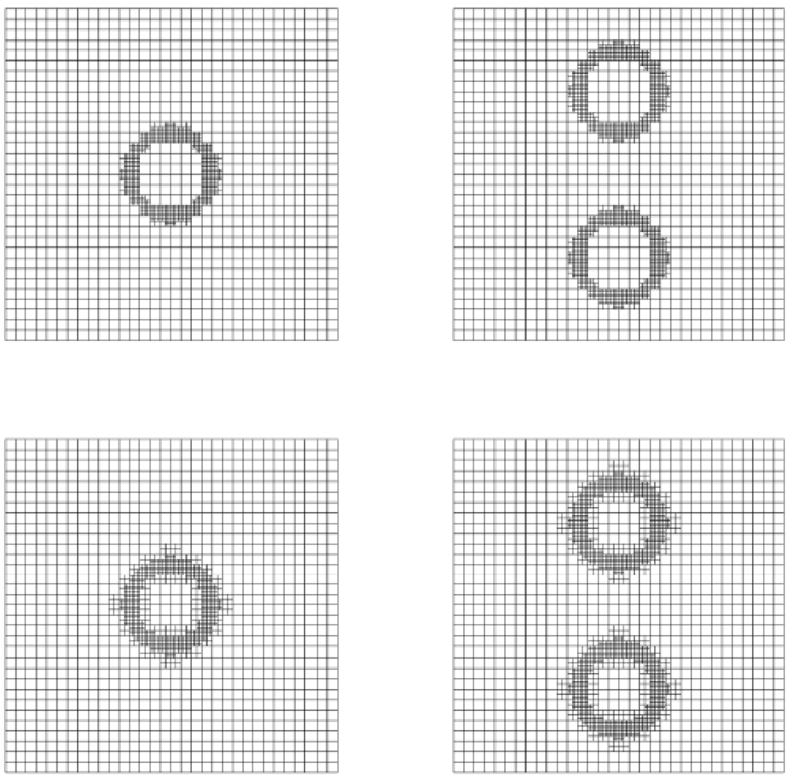

Fig. 4, Illustration of the grid structure for AMR with $N_k = 2^k$; k = 5 and L = 3 for the disks D_2 (left) and $D_{2;2}$ (right) under the ILR refinement (top) and the VLR refinement (bottom).

$AMR(1, D_2)$-N_k	Fortran (sec)	CUDA (sec)	Fortran/CUDA
128	1.58E+2	4.29E+0	3.68E+1
256	2.71E+3	7.28E+0	3.72E+2
512	4.11E+4	1.56E+1	2.63E+2
1024	–	1.71E+2	*
2048	–	2.63E+3	*
$AMR(1, D_{2,2})$-$N_k \times N_k$	Fortran (sec)	CUDA (sec)	Fortran/CUDA
128 × 128	1.62E+2	4.39E+0	3.69E+1
256 × 256	2.68E+3	5.29E+0	5.07E+2
512 × 512	–	1.57E+1	*
1024 × 1024	–	1.71E+2	*
2048 × 2048	–	2.62E+3	*

Table 1. The computational time for AMR(1,D_2) (top) and AMR(1,$D_{2;2}$) (bottom) simulation by Fortran and CUDA. The symbol “-" means that the computational time is more than one week and “*" means that no calculation. The result shows that CUDA is faster than Fortran about 263 times at N_k = 512.

CuPy is an open-source matrix library accelerated with NVIDIA CUDA. CuPy's interface is highly compatible with NumPy; in most cases it can be used as a drop-in replacement. All I need to do is just replace NUMPY with CuPy in my Python code. I wrote some simple python codes to benchmark the performance of CuPy on IAA’s P100 machine. The comparisons show that the benefit of GPU depends on the size of the problem in general. If the size of the matrix is larger than 100000, the CuPy is faster than Numpy (done by CPU) for three different cases(Fig. 5). It can be 100 times faster than Numpy when the size of the matrix is 10^7.

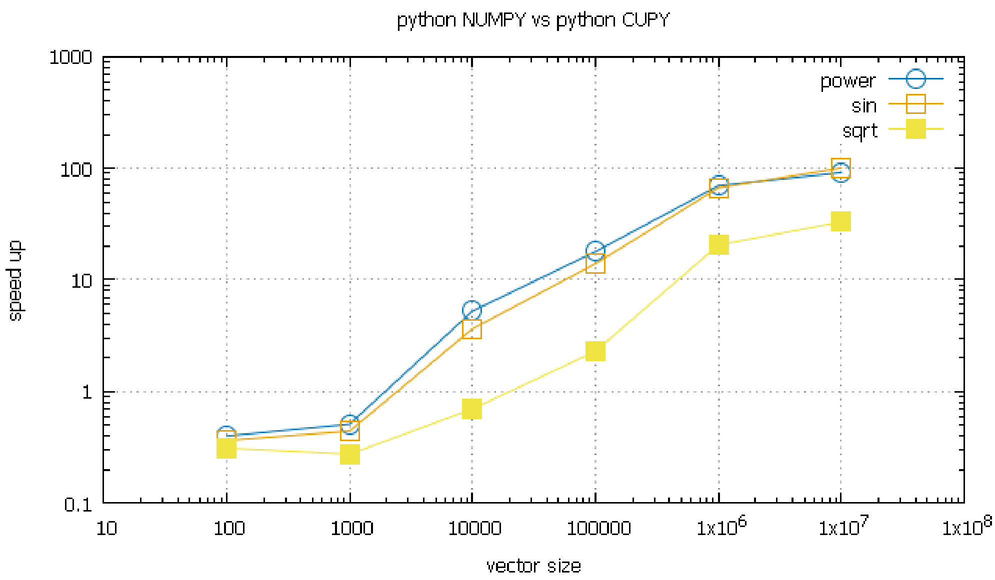

Fig. 5 The performance of the CuPy on one Nvidia P100 card

For better viewing of 3D simulation result, I use SPLASH visualization software to generate a 360 degree disk-planet movie (Fig.6). SPLASH is a free and open source visualization tool for Smoothed Particle Hydrodynamics (SPH) simulations in one, two and three dimensions, developed mainly for astrophysics. It provides the tool to generate 360 degree images after v2.8.0. The 360-degree photos let you look around in any direction from a single standing position. You can share 360-degree photos everywhere from Facebook and Youtube, even with a VR platforms like Google Cardboard.

Fig.6, A Jupiter-size planet is orbiting a solar-mass star. Two spiral arms generated around the planet.

OTHER SIGNIFICANT CONTRIBUTIONS

Invited Talks:

1. “PC cluster computation on astronomy” at *Construction and application of cluster computation workshop 2006*, Plasma and space science center, National Cheng Kung University, Taiwan (2006).
2. “雷達英雄後傳之電波天文學”，臺大科教中心科學史沙龍，台灣大學思亮館, 2018/4/30

Members of Editorial Board:

Member of Chinese Physics Education editorial board (2017/1 ~)

Editor-in-chief of **Physics Bimonthly magazine** (2014/1 ~ 2015/12)

Editor-in-chief of **Science Monthly magazine** (2013/7 ~ 2015/8)

Deputy chief editor of **Physics Bimonthly magazine** (2012/1 ~ 2013/12)

Deputy chief editor of **Science Monthly magazine** (2004/1 ~ 2013/6)

Member of **Physics Bimonthly magazine** editorial board (2004/1 ~ 2011/12)

Member of **Graphic Science magazine** editorial board (2007/10 ~)

Member of **Little Leonardo magazine** editorial board (2006/1 ~)

Member of **Science Monthly magazine** editorial board (1998 ~ 2003)

Member of **Earth Kids magazine** editorial board (2001 ~ 2004)