# 天文資訊與計算中心

## Center for Informatics and Computation in Astronomy (CICA)

**<u>*Shih-Ping Lai</u>[1,2], Huei-Ru Chen[1,2], Hsiang-Kuang Chang[1,2], Andrew Cooper[1,2], Tomotsugu Goto[1,2], Daniel Harsono[1,2], Ing-Guey Jiang[1,2], Albert Kong[1,2], Kuo-Chang Pan[1,2], and Hsiang-Yi Yang[1,2*] (14pt)**

*[1]Institute of Astronomy, National Tsing Hua University, Taiwan*
*[2]Department of Physics, National Tsing Hua University, Taiwan*
*E-mail: slai@phys.nthu.edu.tw*

The Center for Informatics and Computation in Astronomy (CICA) aims at exploring the Universe using the techniques in high-speed computing, big data analysis as well as building cutting-edge instruments to collect key astronomical data. Our achievements are highlighted as the following:

**1) Building a high-performance-computer cluster to simulate the Universe.**
CICA provides a highly efficient platform for the specialized analysis of large astronomical simulations and observational datasets; a rapid development and testing environment to prepare for production calculations on NCHC; and hands-on training for students in cutting-edge HPC methods used in research and industry. (Figure 1)

**2) Building Space telescopes**
Prof. Chang's Gamma-ray Transient Monitor has been selected to be a payload on FORMOSAT-8 (福衛八號) making it the first Space Telescope of Taiwan (Figure 2). Prof. Chang also collaborate with the Space Science Lab of UC Berkeley on making Compton Spectrometer and Imager (COSI), which is recently approved by NASA to be the next high-energy space telescope. In addition, Prof. Jiang collaborate with University college of London to search for the planets outside of solar systems with Twinkle Space Mission.

**3) Participating in the gravitational wave project**
Prof. Alber Kong's group and Prof. Pan's group have joined the Kamioka Gravitational Wave Detector (KAGRA) collaborations led by the Nobel Physics prize winner Kajita Takaaki. They contributed in searching for blackholes that generate the gravitational waves and simulated the expected gravitational wave signals.

**4) Dealing with 'Astronomically big' data**
To understanding our place in the universe, we participate in several international large survey to collect the key data as well as using the best telescopes in the world. The CICA cluster is critical for analysing the large dataset we obtained (Figure 4).

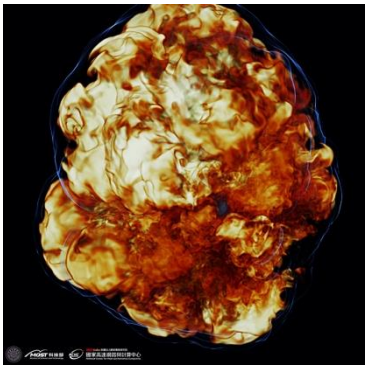
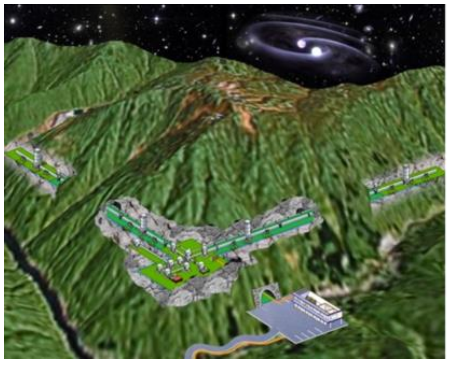


Figure 1. Computer simulation of Type Ia supernova by Prof. Pan. The yellow color represents the entropy, and the thin blue layer indicates the shock front. Full movie can be downloaded at https://reurl.cc/EZLoGa


Figure 2. The first space telescope of Taiwan highlighted by the Astronomical New Quarterly (天聞季報) of The Academic Sinica https://reurl.cc/73Lkk9



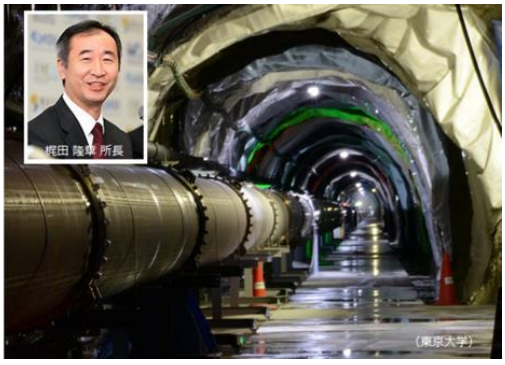



Figure 3. the Kamioka Gravitational Wave Detector (KAGRA) in Japan.

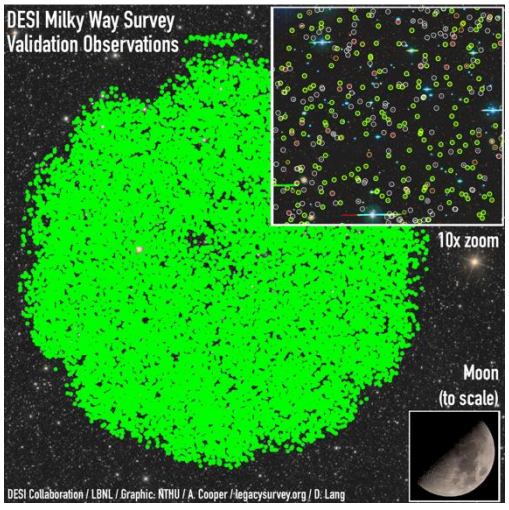



Figure 4. DESI project is the most densely sampled spectroscopic surveys of Milky Way stars ever carried out. Every green dot in this image is a star observed by DESI and only 1% of the total DESI survey is presented here. At NTHU, we are using the CICA cluster to analyze these observations and generate many different simulated realizations of the gigantic DESI dataset.