

# T2K Activity in U. Tsukuba

## Highly Productive Parallel Programming Language & Promotion of Interdisciplinary Computational Science

### Interdisciplinary Computational Science Promotion Program

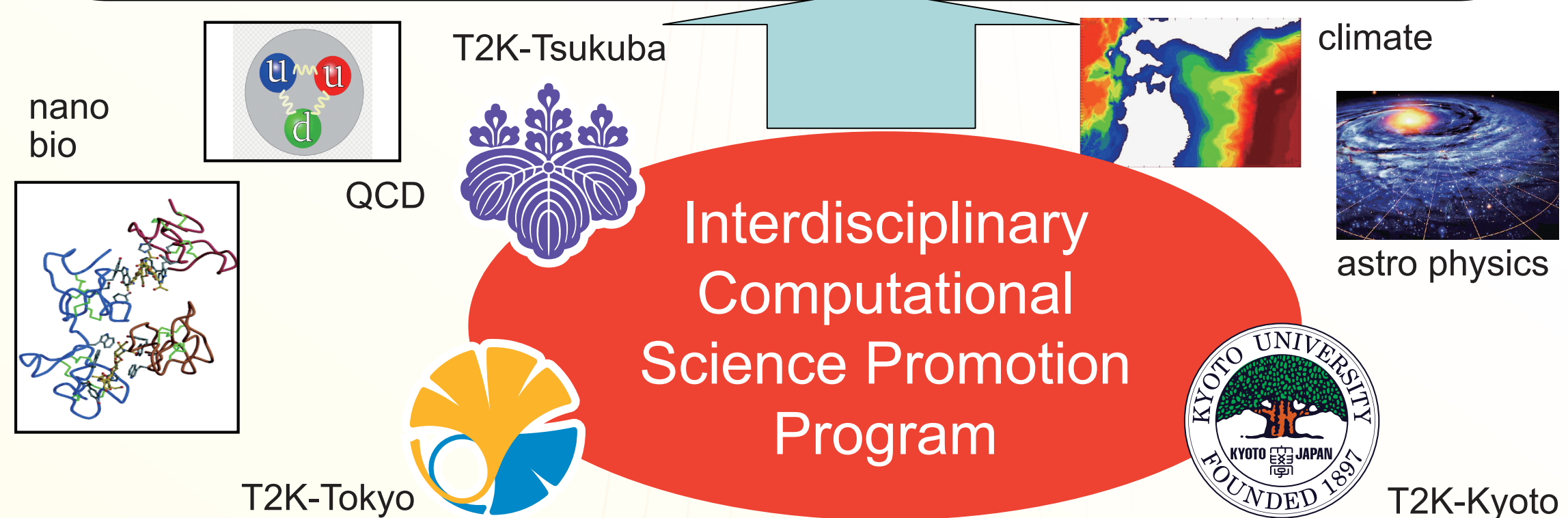
Computational science is a cutting-edge, indispensable multidisciplinary and interdisciplinary area for the development of science and technology in the 21st century. We, with Tokyo and Kyoto in T2K alliance, run “The Interdisciplinary Computational Science Promotion Program” to promote the interdisciplinary research activities of different disciplines and push forward the challenges of several fields in computational sciences by providing the computational power of T2K supercomputers.

Existing “computational science”

- Computational X as a part of X science
- Short-term individual projects
- Make use of “supercomputer” center

#### Interdisciplinary Computational Science

- Integration and collaboration of computational science and computer science: High-performance computing systems (HPC) will be increasing in size and become more complex in configuration. HPC technologies are indispensable for optimizing the possible benefits associated with these advances.
- The common base of computational science brings mutual intimate connections among various science disciplines and allows us to approach science as a whole from a global perspective.



### XcalableMP : Highly Productive Parallel Programming Language

Although MPI is the de facto standard for parallel programming on distributed memory systems, writing MPI programs is often a time-consuming and complicated process. XcalableMP is a directive-based language extension which allows users to develop parallel programs for distributed memory systems easily and to tune the performance by having minimal and simple notations.

- XcalableMP supports typical parallelization based on the data parallel paradigm and work sharing under “global view”, and enables parallelizing the original sequential code using minimal modification with simple directives, like OpenMP.
- XcalableMP also includes CAF-like PGAS (Partitioned Global Address Space) feature as “local view” programming.
- For flexibility and extensability, the execution model allows to combine with explicit MPI coding for more complicated and tuned parallel codes and libraries.
- For multi-core and SMP clusters, OpenMP directives can be combined into XcalableMP for thread programming inside each node as a hybrid programming model.

#### Code Example (NPB-CG)

```
!$XMP distribute (block) :: p, w
!$XMP shadow (*):: p
!$XMP reflect p
!$XMP loop affinity(w)
do j = 1, lastrow-firstrow+1
  sum = 0.d0
  do k = rowstr(j), rowstr(j+1)-1
    sum = sum + a(k) * p(colidx(k))
  enddo
  w(j) = sum
enddo
```