# SUNDIALS

**Suite of Nonlinear and Differential /Algebraic Equation Solvers**

> **Adaptive time integrators for ODEs and DAEs and efficient nonlinear solvers**
> Used in a variety of applications. Freely available. Encapsulated solvers & parallelism.

- **ODE and DAE time integrators:**
  - *CVODE:* adaptive order and step BDF (stiff) & Adams (non-stiff) methods for ODEs
  - *ARKODE:* adaptive step implicit, explicit, IMEX, and multirate Runge-Kutta methods for ODEs
  - *IDA*: adaptive order and step BDF methods for DAEs
  - *CVODES* and *IDAS:* provide forward and adjoint sensitivity analysis capabilities

- **Nonlinear Solvers:** *KINSOL* – Newton-Krylov; accelerated Picard and fixed point

- **Modular Design:** Easily incorporated into existing codes; Users can supply their own data structures and solvers or use SUNDIALS provided modules

- **Support on NVIDIA, AMD, and Intel GPUs:**
  - Vectors: CUDA, HIP, OpenMP Offload, RAJA, SYCL (DPC++)
  - Linear solvers: cuSOLVER, MAGMA, matrix-free Krylov methods

- **Open Source:** BSD License; Download from LLNL site, GitHub, or Spack
  - Supported by extensive documentation; user email list with an active community
  - Available through MFEM, deal.II, and PETSc

**SUNDIALS is used worldwide in applications throughout research and industry**
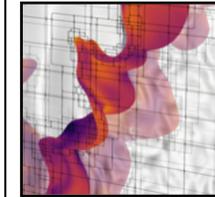

*Combustion (Pele)*
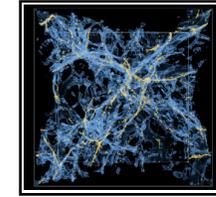

*Cosmology (Nyx)*
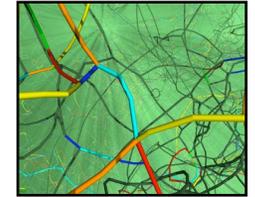

*Dislocation dynamics (ParaDiS)*
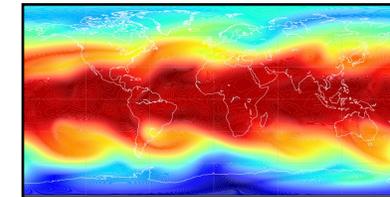

*Atmospheric Dynamics (Tempest)*
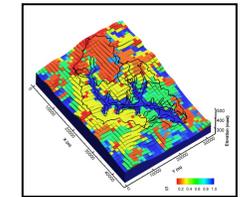

*Subsurface flow (ParFlow)*

Lawrence Livermore National Laboratory

ECP

FASTMATH

xSDK

**http://www.llnl.gov/casc/sundials**

ECP EXASCALE COMPUTING PROJECT