

Application to be ported to EGEE: Time evolution of spherically symmetric nonlinear fields

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- Time evolution of various nonlinear fields
(scalar, Higgs, electromagnetic, Yang-Mills)
- Aim: finding long living almost periodic configurations,
called *oscillons* (hep-th/0609023)
- Spherical symmetry: coordinates (t, r)
spatial compactification: $r \sim \frac{R}{1-R^2}$
 $0 < r < \infty \longrightarrow 0 < R < 1$
avoiding no incoming radiation condition at outer boundary
- ϕ^4 theory: $\phi_{,tt} + \Delta\phi = \frac{1}{2}\phi(\phi - 1)(\phi - 2)$

- uniform grid with step ΔR ($1 \leq R < 1$)
- time step $\Delta t \sim c\Delta R$ ($t > 0$)
- fourth order Runge-Kutta
- doubling the resolution makes four times longer computation time
- massive fields produce very high frequency oscillations in time and space
- reliable long time evolution also requires high resolution
- two executables: calculation + evaluation

- two C (C++) files: *ps1.cc*, *ps2.cc*, one binary: *ps*
- execution time: many hours
for testing: low resolution job takes few minutes
- **input:**
 - parameter file: *par.in*, one number
 - initial data file ($t = 0$): *indat.in*, 670KB
(kept fixed now)
- **output:**
 - lifetime file, *lifetime.out*, one number
 - upper and lower envelope curves of field at center:
max.out, *min.out*, 30KB
 - binary output file containing field as a function of time and space, *okg.out*, 40MB

- one C (C++) file: *oups.cc*
one command line parameter determining type of output
- fast job to process huge output files
may be necessary to run several times on same data file
- **input:** binary output file of first code
- **output:** data matrix in text form, *matrix.out*
(for gnuplot, OpenDX)
can be set to various quantities
(*field value, energy and current density, integrals, energy conservation, constraint, Fourier analysis*)
for testing today: field value at center

- 1 **Parameter study:** dependence of lifetime on parameter
one number in input parameter file
→ *one number in output lifetime file*
plan: automatic parameter generation of P-GRADE Portal
- 2 Storage of binary output file on storage element and run
second code to evaluate results
plan: **workflow** in P-GRADE Portal