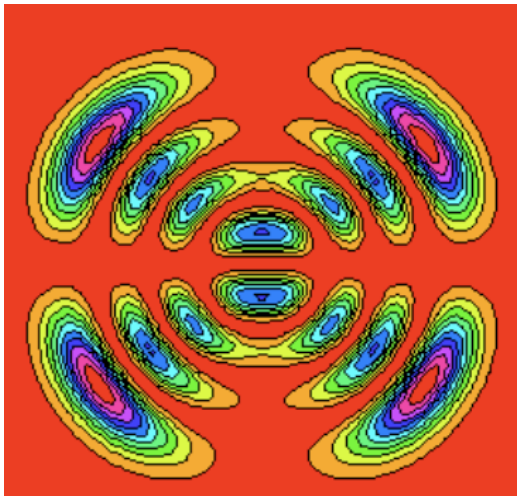
Frontier Nuclear Science Enabled By SciDAC Partnership

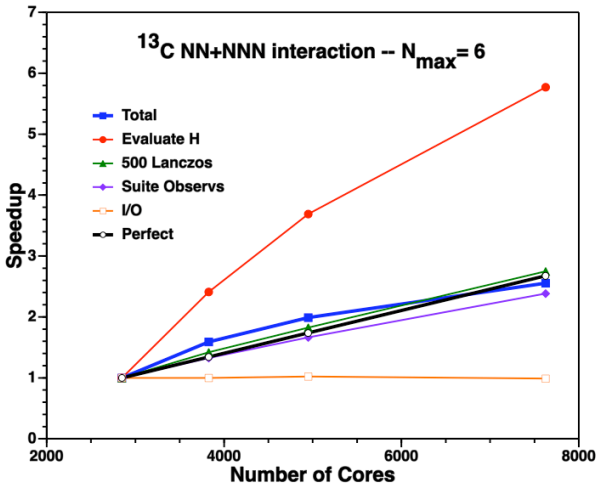


Exotic nuclei with atomic number 14, not previously discovered but important for stellar processes, are predicted to exist for short life-times through advanced simulations using MFDn, a parallel code for configuration interaction modeling in a harmonic oscillator basis (see fig. on left).

Collaboration among Physics, Applied Mathematics, and Computer Science enabled the simulations through critical improvements in MFDn by a factor of 4-6 on the Cray XT-4, equivalent of 3-5 years of progress in computing hardware.

Improvements in MFDn include new data structures, new parallel blocking and combinatorial algorithms, and enhanced inner loop and I/O performance.

Computing the 10 lowest eigenstates using the improved MFDn for ^{14}F requires 3 hours on 30,628 Cray XT-4 nodes at ORNL. This would have taken at least 18 hours using previous versions of MFDn.



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