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Do-it-yourself computational astronomy*

Hardwares, algorithms, softwares, and sciences

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Abstract. We overview our GRAPE (GRAvity PipE) and GRAPE-DR project to develop dedicated computers for astrophysical N-body simulations. The basic idea of GRAPE is to attach a custom-build computer dedicated to the calculation of gravitational interaction between particles to a general-purpose programmable computer. By this hybrid architecture, we can achieve both a wide range of applications and very high peak performance. GRAPE-6, completed in 2002, achieved the peak speed of 64 Tflops. The next machine, GRAPE-DR, will have the peak speed of 2 Pflops and will be completed in 2008.

We discuss the physics of stellar systems, evolution of general-purpose high-performance computers, our GRAPE and GRAPE-DR projects and issues of numerical algorithms.

Keywords and phrases: computational science, special-purpose computer, numerical algorithms

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