Simulating Galaxies

Galaxies can be more than 100,000 light years across, consisting of hundreds of billions of celestial bodies, and with a mass more than a trillion times that of our sun. Modeling such huge, complex systems, in which many of the stars have chaotic orbits, requires new computational techniques. Advances in the speed and memory of computers have improved models, as has parallel computing, but advances in algorithms—the way the mathematics of a problem is converted into steps a computer can perform—are indispensable in developing accurate galaxy models.

The complexity of simulating the behavior of a galaxy is not limited to the galaxy itself. Since a galaxy is usually part of a cluster or supercluster of galaxies, the external forces exerted by these larger agglomerations on the galaxy must also be accounted for. Thus, models must be accurate across many scales of distance. Instead of numerically solving the equations of the model uniformly across all sectors, researchers employ multi-scale algorithms that do more calculations in sectors determined to be more significant. This kind of technique uses computing power more efficiently, giving us a glimpse of the underlying structure of the universe.

For more information:
http://archive.ncsa.uiuc.edu/Cyberia/Cosmos/CosmosGoDigital.html

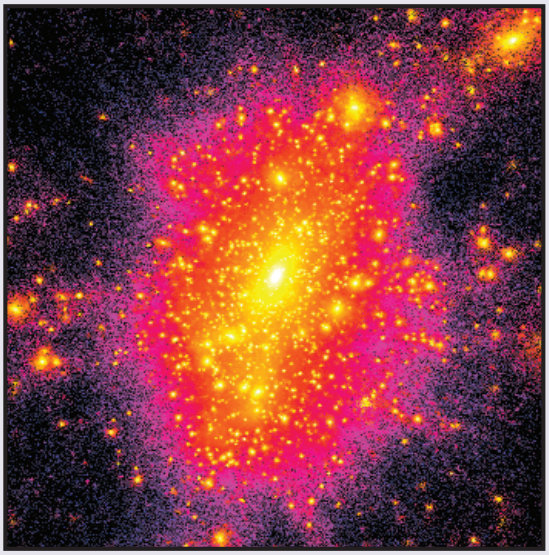

Image courtesy of Joachim Stadel and Thomas Quinn.

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