INSTITUT DU DÉVELOPPEMENT
ET DES RESSOURCES
EN INFORMATIQUE SCIENTIFIQUE

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Séminaires de l'IDRIS

The challenges of the massively parallel computations and the petaflops systems: the case of Supernova research in Astrophysics

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Andreas Marek

Max-Planck Society

The VERTEX code, a radiation-hydrodynamics code for simulating core collapse supernovae, has been used for more than 10 years now in supernova research and is one of the most advanced codes in this field of research. Over the years this code has developed from a serial, spherically-symmetric treatment of both the hydrodynamics and the radiation part to a highly parallel, three-dimensional treatment of the hydrodynamics and a five dimensional treatment of the seven dimensional radiation problem.

After shortly introducing the supernova problem and explaining the goals of the current simulations, the numerically challenges and our algorithmic approach will be described. In the course of the discussion, the parallelization method will be explained and some changes necessary for different computer architectures will be discussed. Specifically, it will be shown how we achieved to compute and scale on BlueGene systems until several 10.000 of cores. Strategies will be discussed in order to prepare the code for an optimal usage of the upcoming petaflops range on supercomputers.

After a PhD in theoretical astrophysics in 2007 and a post-doc at *Max-Planck Institute for Astrophysics*, where he calculated the by this time most detailed models of core-collapse supernovae, Dr. Andreas Marek joined the high performance application group of the Computer center of the *Max-Planck Society* in 2010. Since then he focuses on the development of highly scalable applications in Astrophysics and material sciences.

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