Abstract Submitted
for the DPP05 Meeting of
The American Physical Society

Prospects for the Meshless Adaptive Technique for Simulations in Plasma Physics SERGEI GALKIN, A.A. MARTYNOV, S.YU. MEDVEDEV, Keldysh Institute, Russian Academy of Sciences, Moscow, Russia — The meshless method is gaining popularity in recent days for numerical solution of partial differential equations in computational mechanics [1], fluid dynamics and astrophysics, but still being almost unused for plasma physics simulations. Finite element, finite volume, finite difference methods have been dominated in numerical simulations for a few decades. But for complex 3D boundaries, strong anisotropy of solution etc, the progress in their use has been slowed down by a slow progress in the development of 3D grid generators. For the meshless approach node locations are really needed but not a domain partitioning, that relieves pressure on the grid generator and simplifies adaptive node insertion/relocation. Applied to nonlinear problems such as plasma equilibria with negative central current, rotating star equilibria, convection-diffusion problem with high Reynolds numbers, the method had demonstrated high accuracy, robustness and performance. Difficulties, such as unknown boundaries, boundary layers and existence of multiple solutions, were clearly overcome and accurate numerical solutions were obtained with a relatively small total number of nodes. Due to its flexibility, the approach can bring essential benefits for the problems with various singularities. The method is straightforwardly extended to 3D and to time dependant problems. [1] S. Li and W.K. Liu, Meshfree Particle Methods, 2004, *Springer-Verlag.*

Sergei Galkin
General Atomics

Date submitted: 20 Jul 2005 Electronic form version 1.4