Elena V. Belova

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Research interests

Physics of plasmas. Interaction of energetic particles with MHD waves. Kinetic effects on MHD instabilities. Gyrokinetic equations using Hamiltonian methods. Fusion plasmas. Global stability of field-reversed configurations.

Numerical simulations: hybrid models, 3D MHD simulations, hybrid and gyrokinetic particle simulations.

Professional Experience

• Development of a 3D nonlinear code HYM in cylindrical geometry for studying the stability properties of field-reversed configurations (FRCs). MHD and hybrid (particle ions and fluid electrons) schemes have been implemented. HYM has been used to study the effect of sheared rotation, shaping, conducting shells (MHD) and kinetic effects on the tilting instability in field-reversed configurations (FRCs), as well as new methods of the FRC formation by the couter-helicity spheromak merging.

• Development of the parallel version of the HYM code using Message Passing Interface (MPI) for the distributed-memory parallel computers. Three-dimensional domain decomposition has been used to obtain optimal performance for typical production-size runs with good parallel scaling up to 256 proccessors.

• Modification of HYM code to study global stability in tokamaks and spherical torus configurations (NSTX). Nonlinear MHD simulation of sawtooth oscillations in NSTX. Calculation of kinetic equilibria for anisotropic fast ion distribution. Simulations of Global Alfven Eigenmode (GAE) and Compressional Alfven Eigenmode (CAE) instabilities driven by the energetic neutral beam ions in NSTX.

• Implementation of pressure coupling scheme with drift-kinetic ions and fluid electrons in the M3D code (PPPL). This version of the code has been used to study the thermal ions effects on the internal kink and fish-bone instabilities in tokamaks.

• Derivation of gyrokinetic equations using the action-variational Lie perturbation method. Calculation of nonlinear gyroviscous force in a collisionless plasma with nonuniform temperature using the gyrokinetic approach.

• Development of a 3D hybrid MHD-gyrokinetic $\delta f-$ particle code to self-consistently study the interaction of energetic ions with low-frequency MHD waves in the Earth's magnetosphere. The code employs fully electromagnetic gyrokinetic equations coupled to one-fluid MHD equations.

• Investigation of the effects of collisions and photoionization on velocity shear driven microinstabilities. Analytical study of excitation of ion cyclotron waves driven by density and velocity gradients in the Earth's magnetosphere.

Invited Papers:

1. Belova E. V., Numerical Modeling of NBI-driven sub-cyclotron frequency modes in NSTX. *Annual Conference of the Division of Plasma Physics, American Physical Society*, Chicago, IL, October 2010.

2. Belova E. V. Simulation Studies of Field-Reversed Configurations with Rotating Magnetic Field Current Drive. **Innovative Confinement Concepts Conference 2008**, Reno NV, June 2008.

3. Belova, E. V., Hybrid simulations of rotational instabilities in Field-Reversed Configurations. **Innovative Confinement Concepts Conference 2007**, College Park MD, February 2007.

4. Belova, E. V., Effects of Energetic Beam Ions on Stability Properties of Field-Reversed Configuration. **Innovative Confinement Concepts Conference 2006**, Austin TX, February 2006.

5. Belova, E. V., Advances in the Numerical Modeling of Field-Reversed Configurations. *Annual Conference of the Division of Plasma Physics, American Physical Society*, Denver, CO, October 2005.

6. Belova, E. V., Kinetic Effects on the Linear and Nonlinear Stability Properties of Field-Reversed Configurations. *Annual Conference of the Division of Plasma Physics, American Physical Society*, Albuquerque, NM, October 2003.

7. Belova, E. V., Stability Properties of Field-Reversed Configurations, International Sherwood Fusion Theory Conference, Corpus Christi TX, April 2003.

8. Belova, E. V., Stability of FRC Plasmas, *Varenna Conference on Innovative Confinement Concepts*, Italy, October 2000.

9. Belova, E. V., Numerical Study of Global Stability of Field-Reversed Configuration. *Innovative Confinement Concepts Conference 2000*, February 2000, LBNL, Berkeley CA.

10. Belova, E. V., Numerical Study of Global Stability of Field-Reversed Configuration. Annual Conference of the Division of Plasma Physics, APS (Seattle, WA, November 1999).

11. Belova, E. V. et al., Hybrid MHD-Gyrokinetic Simulations of Drift Alfven-Ballooning Modes, *IAGA Conference*, Upsala Sweden, August 1997.

Full-Time Employment

2008-present Principal Research Physicist, Plasma Physics Laboratory, Princeton University, Princeton NJ.

2004-2008 Research Physicist, Plasma Physics Laboratory, Princeton University, Princeton NJ.

1997-2004 Associate Research Physicist, Plasma Physics Laboratory, Princeton University, Princeton NJ.

1993-1997 Graduate Research Assistant, Physics and Astronomy Department, Dartmouth College, Hanover, NH.

1989-92 Junior Research Scientist, Space Research Institute, Moscow, Russia.

1987-89 Research Engineer, Space Research Institute, Moscow, Russia.

Education

1993-1997 **Ph.D.** (Plasma Physics).

Physics and Astronomy Department, Dartmouth College, Hanover, NH.

Thesis advisor: Professor M. K. Hudson.

1984-87 **Master of Science** (Plasma Physics).

Department of Physical Problems in Energetics, Moscow Institute of Physics and Technology, Moscow, Russia.

Thesis advisor: Professor L. M. Zelenyi.

1981-84 **B.S.** in Applied Mathematics.

Department of Applied Mathematics, Moscow Institute of Physics and Technology, Moscow, Russia.

Honors

2005: The Katherine E. Weimer Award for Women in Plasma Physics.

1996: A 1995 Dartmouth/NASA Space Grant Award.

1989: Award at the paper contest among young scientists of the Space Research Institute, Academy of Sciences, USSR.

1987: First-class (par excellence) diploma of a research engineer from the Moscow Institute of Physics and Technology.