

Bootstrap Current Simulation

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Numerical simulations of bootstrap current are carried out for tokamak configurations, for low and high energy particles. Bootstrap current is important because it is relied on to supply a large fraction of the total current in many projected tokamak ignition devices. Advances in computing capacity have made it possible to simulate the bootstrap current due to full Maxwellian distributions as well as to examine a larger range of collision frequencies than previously possible. Recently there have been a number of theoretical papers predicting anomalously large bootstrap current as a natural phenomenon occurring at the magnetic axis. We examine this prediction in detail, and the nature of the bootstrap contribution in the vicinity of the magnetic axis as a function of particle energy. Special burning plasma scenarios are also discussed.

References

- [1] A. A. Galeev and R. Z. Sagdeev, *Sov. Phys. JETP* **26**, 233 (1968)
- [2] B. B. Kadomtsev and V. D. Shafranov, *Plasma Phys. Controlled Nucl. Fusion Res.* **2**, 479 (1971)
- [3] R. J. Bickerton, J. W. Connor, and J. B. Taylor, *Nature Phys. Sci.* **229**, 110 (1971)
- [4] V. D. Pustovitov, *JETP Lett.* **54**, 313 (1991)
- [5] H. R. Wilson, *Nucl. Fusion* **32**, 257 (1992)
- [6] Y. Wu and R. B. White, *Phys Fluids* **5** 3291 (1993)
- [7] M. Sasinowski and A. Boozer, *Phys Plasmas* **2** 613 (1995)
- [8] Yang Chen and Roscoe White, *Phys Plasmas* **4** 3591 (1997)
- [9] V. Ya. Goloborod'ko, Ya. I. Kolesnichenko, and V. A. Yavorsky, *Nucl. Fusion* **23**, 399 (1983)
- [10] K. C. Shaing, R. D. Hazeltine, and M. C. Zarnstorff, *Phys. of Plasmas* **4**, 1375 (1997).
- [11] S. Wang, *Phys. of Plasmas* **5**, 3319 (1998).
- [12] K. C. Shaing, *Phys. of Plasmas* **7**, 5081 (2000).
- [13] Yu. V. Gott and E. I. Yurchenko, *Plasma Physics Reports* **28**, 382 (2002).
- [14] A. H. Boozer and G. Kuo-Petravic, *Phys Fluids* **24**, 851 (1981)