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# Interaction between Geodesic Acoustic Modes and Resonant Magnetic Perturbations in tokamak Plasmas

J. C. Li[1],*, Z. Lu[2], J. Q. Xu[3], Z. Lin[4], X. D. Lin1, J.T. Luo[1], Y. Liu[1], C. J. Xiao[5], J. Q. Dong[3], Z. B. Shi[3], W. L. Zhong[3], and the HL-2A team[3]

[1]Shenzhen Key Laboratory of Nuclear and Radiation Safety, Institute for Advanced Study in Nuclear Energy & Safety, College of Physics and Optoelectronic Engineering, Shenzhen University, Shenzhen 518060, China

[2]Department of Earth and Space Sciences, Southern University of Science and Technology, Shenzhen, China

[3]Southwestern Institute of Physics, PO Box 432, Chengdu 610041, China

[4]University of California, Irvine, CA 92697, United States of America

[5]Plasma Physics Laboratory, University of Saskatchewan, Saskatoon SK S7N 5E2, Canada

Email(J. C. Li): lijc@szu.edu.cn

An analysis of the statistical spectral characteristics of resonant magnetic perturbations (RMPs), geodesic acoustic modes (GAMs), and their nonlinear coupling with ambient turbulence in the edge region of the HL-2A tokamak has been performed. Experimental observations reveal that RMPs significantly affect low-frequency fluctuations and large-scale turbulence. We present the first direct evidence that increasing RMP current weakens the coupling between GAMs and other frequency modes. Specifically, the amplitude of GAMs decreases as the RMP current increases, with larger RMP currents leading to a more pronounced suppression of GAMs. Moreover, the radial correlation length of turbulence is found to strongly correlate with the increase in RMP current and the reduction of zonal flows. Advanced causal analysis further demonstrates that the radial magnetic field (Br) and poloidal flows ($\tilde{E}r$) exhibit a distinct modulation at a frequency consistent with GAMs, with a phase shift of $\pi$, which is modulated by RMP perturbations. These results provide new insights into the impact of RMPs on edge transport, highlighting the dominant role of the interaction between RMP-induced magnetic perturbations, GAMs, and ambient microturbulence in governing edge plasma behavior.

Reference

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