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Synchronization of GAMs and Magnetic Fluctuations on HL-2A tokamak

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The synchronization of geodesic acoustic modes (GAMs) and magnetic fluctuations is identified in the edge plasmas of the HL-2A tokamak for the first time. The frequency entrainment and phase lock are elucidated. Meso-scale electrostatic fluctuations (MSEFs) with components of the dominant GAMs and the $m/n = 6/2$ potential fluctuations are found to have the same frequency as magnetic fluctuations of $m/n = 6/2$. The temporal evolutions of the MSEFs and magnetic fluctuations clearly show the frequency entrainment between the GAMs and the $m/n = 6/2$ magnetic fluctuations. The phase lock between GAMs and magnetic fluctuations is also demonstrated. The results suggest that the GAMs and magnetic fluctuations can transfer energy between each other through nonlinear synchronization. The nonlinear synchronization may contribute to the LFZF (low frequency zonal flow) formation, reduction of turbulent level, and thus confinement regime transitions.

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