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Coherent drift wave modes and turbulent structures in a high density helicon plasma OLAF GRULKE, CHRISTIANE SCHROEDER, THOMAS WINDISCH, THOMAS KLINGER, MPI for Plasma Physics, Euratom Association, Greifswald, Germany — Helicon plasma sources are characterized by high plasma densities at low electron temperature. This results in a highly collisional plasma with collision frequencies orders of magnitude higher than characteristic plasma drift frequencies such as E×B and diamagnetic frequencies. In the helicon plasma of the cylindrical linear device, low-frequency coherent fluctuations with mode numbers ranging from $m = 2 \ldots 8$ are excited using the ambient magnetic field as a control parameter. Based on detailed investigation of fluctuation degrees and phase shifts between plasma density and plasma potential fluctuations, these modes are identified as coherent drift modes. Most striking is the measured finite wavelength of fluctuations parallel to the magnetic field, which unambiguously distinguishes them from flute modes. In contrast to low collisional plasmas the spatial azimuthal mode structure is of spiral-like shape. Numerical solution of the linear drift mode eigenvalue equation reveals that the spiral structure is a result of radial gradients in the collision frequencies. At high magnetic field the drift wave develops to a weakly developed turbulent state. Here, no coherent modes are found but fluctuations develop coherent turbulent structures. The propagation properties of these structures are investigated in detail with special attention to deviations from pure azimuthal propagation and the associated radial transport.

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