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Kinetic Equations for the Plasma Edge IAN ABEL, Princeton Center for Theoretical Science, Princeton University, GREG HAMMETT, Princeton Plasma Physics Laboratory — A hybrid fluid-kinetic framework for studying large-amplitude fluctuations in the edge of tokamak plasmas is presented. We derive equations for the behavior of an anisotropic plasma in the presence of both large fluctuations and steep gradients. The system consists of kinetic equations for electrons and ions, supplemented with fluid equations for the electromagnetic fields. In this way it builds upon both kinetic MHD and from the use of vorticity equations in gyrokinetics. This framework, by including both Alfvénic (including current-driven modes) and drift wave dynamics, can handle fully nonlinear perturbations such as erupting ELM filaments and blob-based turbulence. We not only present equations for such fast behavior, but also develop higher order equations that describe pedestal equilibria and slow scrape-off-layer dynamics. The relationship between this framework and existing collisional edge models is made clear.

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