Pressure Balance in the Presence of Zonal Flows\textsuperscript{1} W.W. LEE, Princeton Plasma Physics Laboratory, Princeton University — The presence of equilibrium zonal flows in the gyrokinetic particle simulation of the gradient-driven microinstabilities was first observed in 1983 \cite{Lee1983}. It was caused by the difference of the second-order finite Larmor radius effects between the electrons and the ions, which, in the presence of background spatial inhomogeneity, gave rise to a zeroth-order radial mode, $\phi_{00}(x)$. Recently, a more complete formulation taking into account both the density and temperature gradients has been derived \cite{Lee2009}. The question concerning its relationship with the usual diamagnetic current was raised by Bolton \cite{Bolton2009}. For this presentation, we will explore the pressure balance,

$$\sum_{a} n_{a} q_{a} E + \frac{1}{c} \sum_{a} q_{a} n_{a} V_{a} \times B = \nabla \sum_{a} p_{a},$$

in the presence of the equilibrium zonal flows as well as the global zonal flows, $\phi_{00}(x)$, generated nonlinearly due to the ITG turbulence \cite{Lee2008}.

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\cite{Bolton2009} C. Bolton, private communication.