Gyrokinetic equation for tokamak plasmas with sonic level equilibrium toroidal flow YANG CHEN, HAOTIAN CHEN, JUNYI CHENG, University of Colorado, Boulder, YOUJUN HU, LEI YE, Institute of Plasma Physics, Chinese Academy of Sciences, SCOTT PARKER, University of Colorado, Boulder — We present the electromagnetic gyrokinetic equations in the presence of a sonic level equilibrium toroidal flow, suitable for implementation in the delta-f Particle-in-Cell code GEM. A unique feature of the GEM algorithm is the appearance of the vorticity equation, which is the time derivative of the quasi-neutrality condition. Without the large toroidal flow, all terms in the vorticity equation are of the second order in the gyrokinetic ordering parameter. When the sonic level flow is present, terms proportional to the flow appear, and such terms are first order. These first order terms must cancel physically, but might not be properly cancelled numerically. We derive a form of the vorticity equation that makes the cancellation of the first order terms explicit. The derivation of the gyrokinetic equation follows the procedure of Artun et. al. [M. Artun and W. M. Tang, Physics of Plasmas 1, 2682 (1994)]. The gyrokinetic equation appears to contain additional terms that are not contained in the equation of Sugama and Hortan [Physics of Plasmas 5, 2560 (19980)]. Implementation details will be discussed.

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