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The effect of strong radial variation of the diamagnetic frequency on two-fluid stabilization of edge localized MHD instabilities[1] TYLER COTE, CHRIS HEGNA, University of Wisconsin-Madison, PING ZHU, University of Science and Technology of China and University of Wisconsin-Madison — The conventional theory for two-fluid stabilization of ballooning instabilities in tokamaks assumes a constant diamagnetic frequency throughout the radial structure of the ballooning mode. However, this approximation is not valid in the pedestal region, due to large density and temperature gradients being present. In this work, we apply WKB theory to solve for the radial structure of the ballooning eigenmode[2] in the presence of a radially varying diamagnetic frequency[3] for MHD equilibria with edge pedestal regions. A semi-classical ray tracing code is used to quantify the stabilizing influence of two-fluid physics, with and without variation in the diamagnetic frequency. Linear ideal NIMROD simulations are utilized to provide a benchmark for the ray tracing code, as well as aide studies into the validity of the WKB theory for intermediate toroidal mode number. Preliminary results for the varied diamagnetic frequency model indicate the variation in the diamagnetic frequency significantly decreases the stabilizing effect of the two-fluid physics in comparison to that of the constant diamagnetic frequency model.

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[2]R. L. Dewar et al, Nucl. Fusion, 493 (1981)
[3]R. J. Hastie et al, Phys. Plasmas, 4561 (2000)

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