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Diagnosing Energy and Angular Momentum Deposition Using Diocotron Mode Frequency Shifts[1] A.A. KABANTSEV, C.F. DRISCOLL, UCSD — Monitoring frequency variations$f_1(t)$ of a small amplitude $m_\theta = 1$ diocotron mode in pure electron plasmas determines the energy and angular momentum deposited by a variety of damped plasma waves. The finite length and temperature model[2] of f_1 determines the frequency variations due to plasma radius R and temperature T, arising from thermal pressure on the ends. For energy ΔT and angular momentum input resulting in ΔR, the model gives $\Delta f_1/f_1 \approx 1.2(R_w/L)[\Delta T/e^2N - \Delta R/R]$. Typical plasma and wall sizes give $R/R_w \sim 0.3$, $L/R \sim 30$, so $R_w/L \sim 0.1$. With accuracy $\Delta f_1/f_1 \leq 10^{-4}$, we have confidently measured the energy deposits (ΔT) from Landau damped $m_\theta = 0$ plasma waves with $\Delta n/n \leq 10^{-2}$; as well as both the energy deposits (ΔT) and angular momentum (ΔR) deposits from collisionally damped $m_\theta = 1$ trapped-particle diocotron modes with $D/R_W \leq 10^{-2}$. In prior work, the $m = 2$ frequency has been used to diagnose the plasma expansion, as $2\dot{R}/R = -\dot{f}_2/f_2$. Together, these two modes give a rather complete non-destructive diagnostic.

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[2]Fine, Driscoll, Phy. Plas **5** 601 (1997)

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