1035-37-614 **Sara Reynolds***, Department of Mathematics, Nazareth College, 4245 East Avenue, Rochester, NY 14618, **Stanley Snelson** (ses2140@columbia.edu), Department of Mathematics, Room 509, MC 4406 - 2990 Broadway, Columbia University, New York, NY , and **Tamas Wiandt** (tiwsma@rit.edu), School of Mathematical Sciences, 85 Lomb Memorial Drive, Rochester Institute of Technology, Rochester, NY 14623. *External Cavity Mode Solutions to the Lang-Kobayashi Equations.*

We investigate the Lang-Kobayashi equations, a nonlinear delay differential equation system in three variables that describes the behavior of semiconductor lasers. Delay differential equations (DDE's) are similar to ordinary differential equations, except that the rates of change of the state variables depend on both the state at the present time, $\vec{x}(t)$, and at some time in the past, $\vec{x}(t-\tau)$. This time delay introduces an infinite dimensionality to the system. Our talk will focus on a family of periodic solutions of this system known as External Cavity Modes (ECM's). Varying the system's parameters, we determine when ECM's appear, when they are stable, when they lose stability through a Hopf bifurcation, and when they become arbitrarily large (i.e. the physical model breaks down) and cease to exist. Finally, we turn to the related six-dimensional system that models two delay-coupled lasers and examine the analogous solutions of that system. Our analytic investigation is supplemented throughout by an in-depth numerical study using the cutting-edge MATLAB package DDE-BIFTOOL. (Received September 12, 2007)