1163-35-89 **Xinyue Evelyn Zhao*** (xzhao6@nd.edu) and **Bei Hu**. *A free boundary tumor growth model with a time delay in cell proliferation.*

We propose a new PDE model to study non-radially symmetric tumor growth with a time delay in cell proliferation. The time delay represents the time taken for cells to undergo replication (approximately 24 hours). The model is a coupled system of an elliptic equation, a parabolic equation, and a backward ordinary differential equation. It incorporates the cell location under the presence of time delay, with the tumor boundary as a free boundary. The inclusion of a small time delay makes the system non-local, which produces technical difficulties for the PDE estimates. For this new model, we carry out the stability and bifurcation analysis around the radially symmetric stationary solution, and establish the following results: 1) tumor with large aggressiveness parameter would trigger instability; 2) adding the time delay would result in a larger tumor; and 3) for each even $n \geq 2$, there exists a unique bifurcation point, at which a symmetry-breaking stationary solution bifurcates from the radially symmetric solution. (Received August 12, 2020)