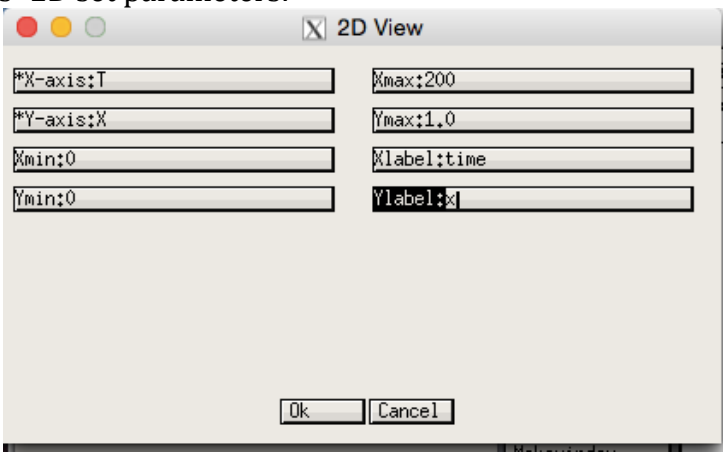
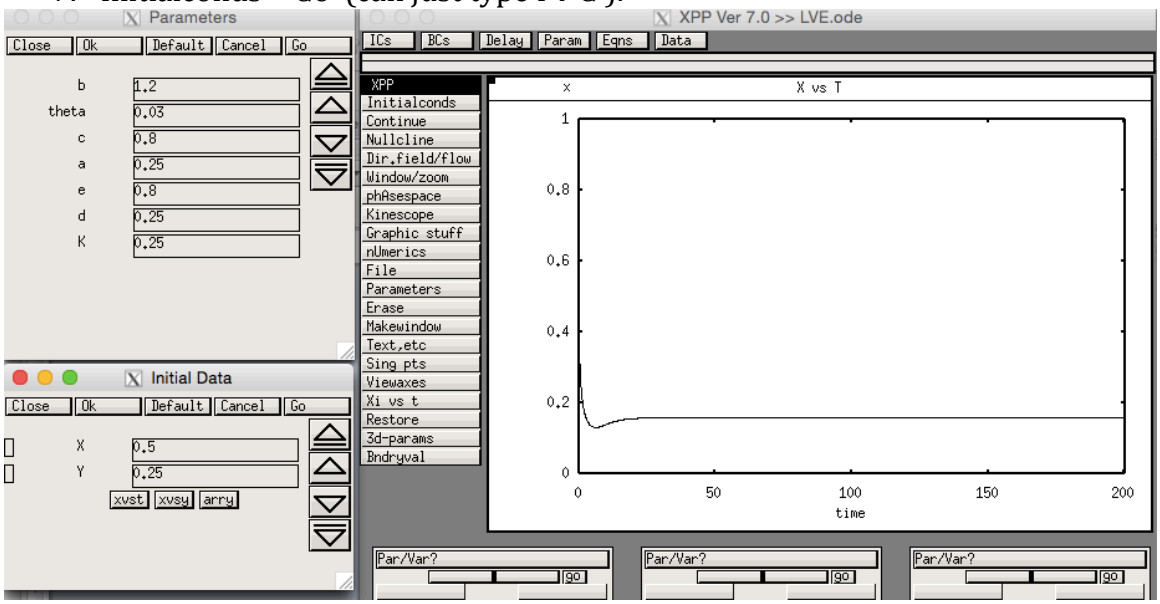
LVE.ode Example

Plotting Solutions

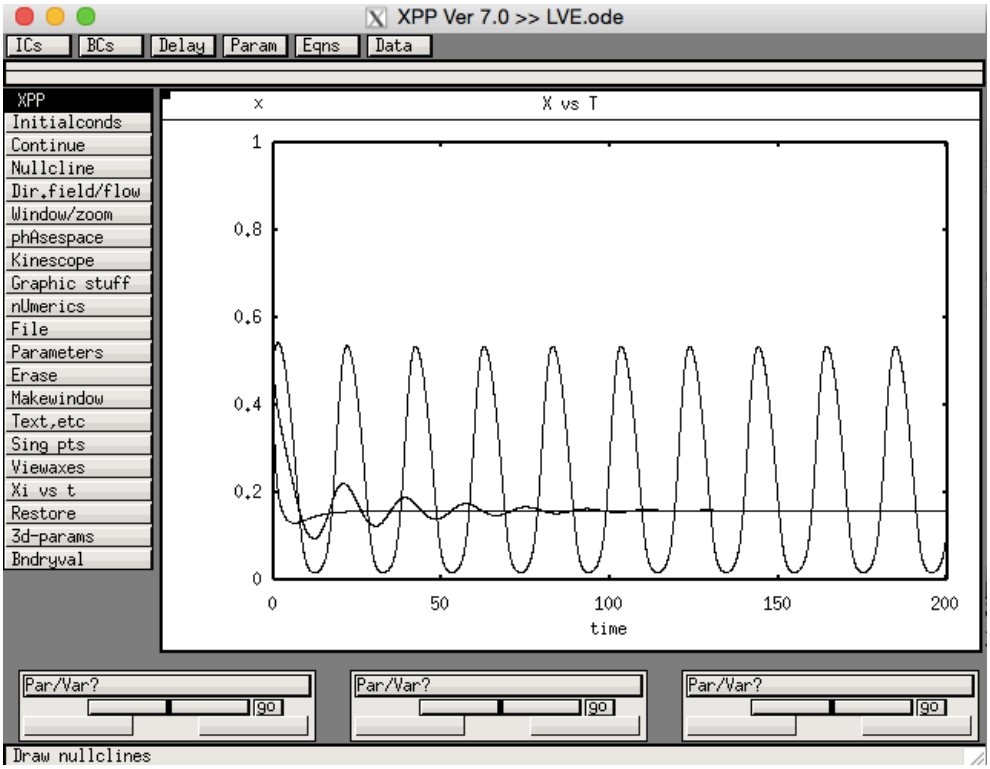
1. Start Xming
2. drag and drop LVE.ode onto XPP-shortcut on desktop
3. Open Params and ICs
4. Initialconds > Go
5. Viewaxes>2D set parameters:



6. nUmerics >Total > change from 20 to 200> enter >esc
7. Initialconds > Go (can just type I→G).

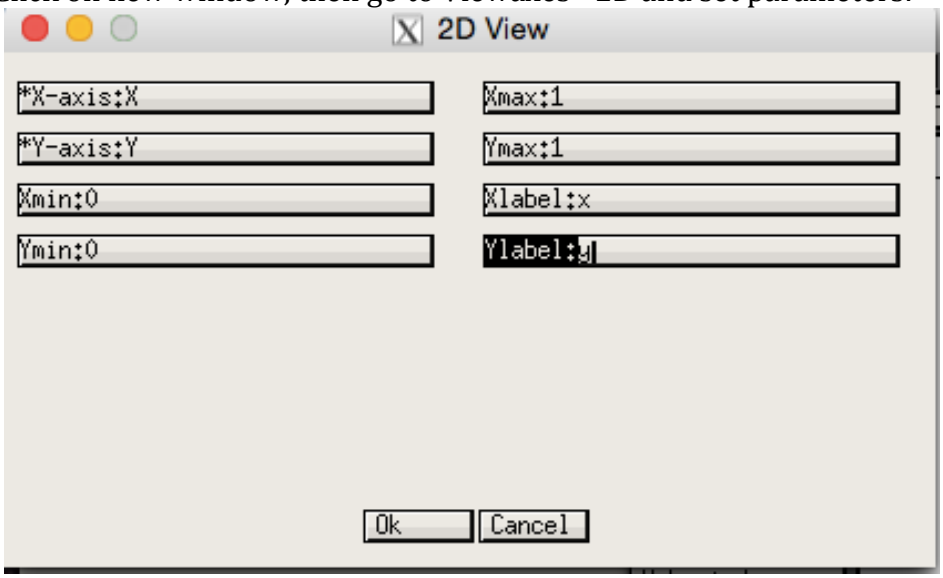


8. In Parameters window change K to 0.5 and hit Go button, change K to 0.75 and hit Go button.

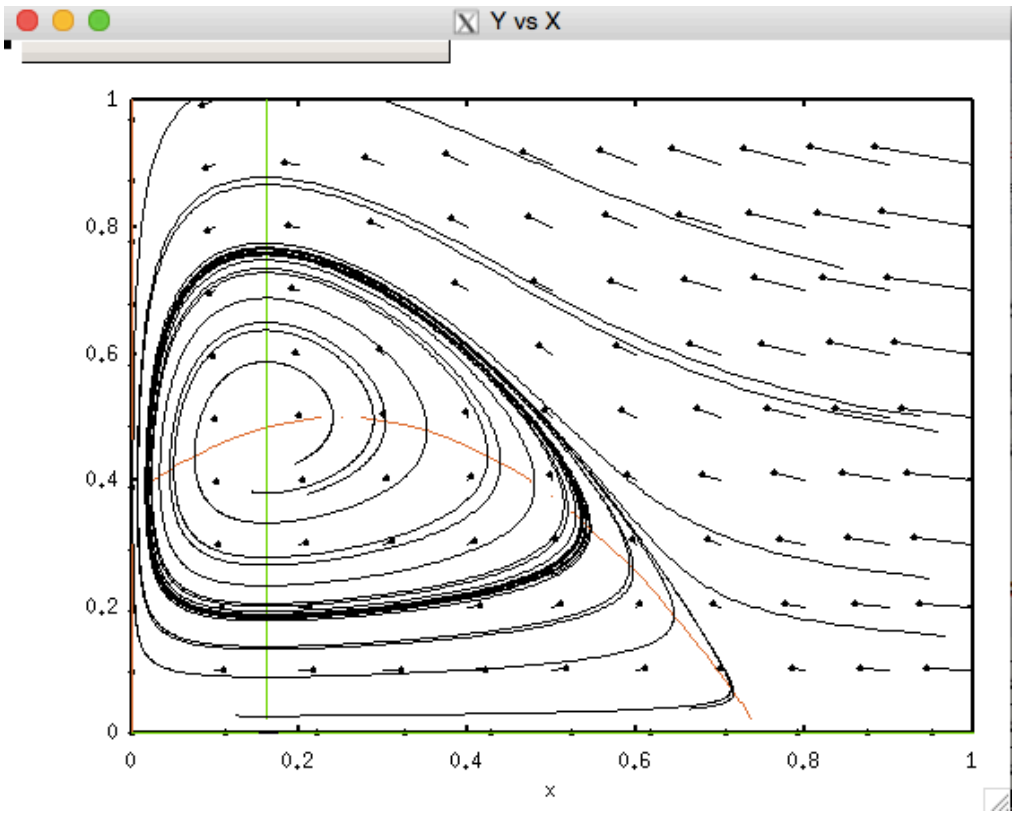


Phase Plane

9. Makewindow
10. Click on new window, then go to Viewaxes >2D and set parameters:

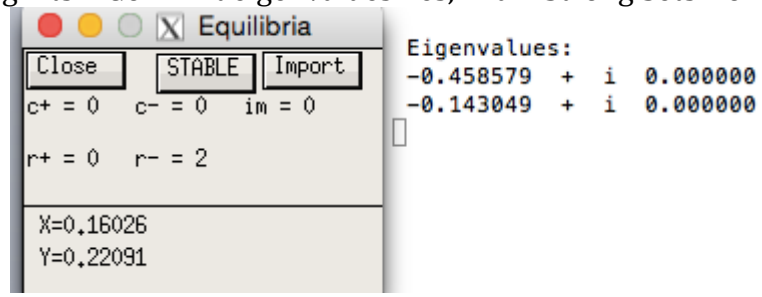


11. Dir.field/flow> Direction field> grid set to 10 > enter.
12. Nullcline > New
13. Intialconds > mIce, click on points to see trajectories

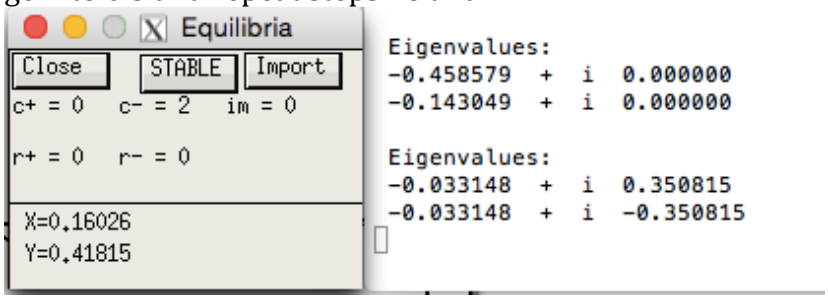


Stability

14. Back to main window time plot, Erase
15. Set K back to 0.25, I→ G.
16. Get Initial Data to the equilibrium point: I→L, I→L
17. Sing. Pts > Go. Print eigenvalues Yes, Draw Strong Sets No.

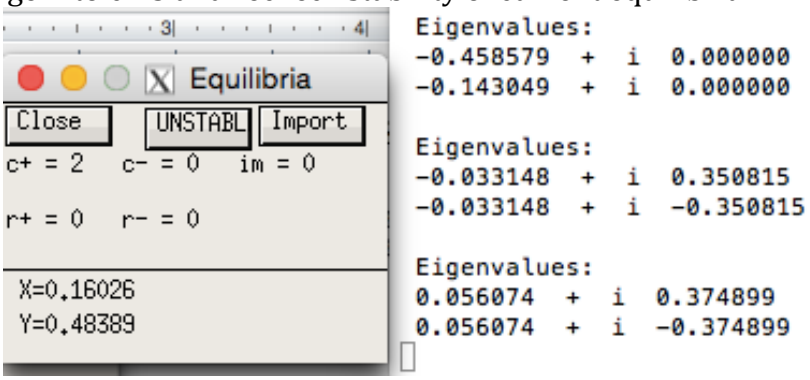


18. See this is stable and eigenvalues have negative real parts, zero im parts.
19. Change K to 0.5 and repeat steps 16 and 17.



20. See this is stable and eigenvalues have negative real parts, nonzero im parts

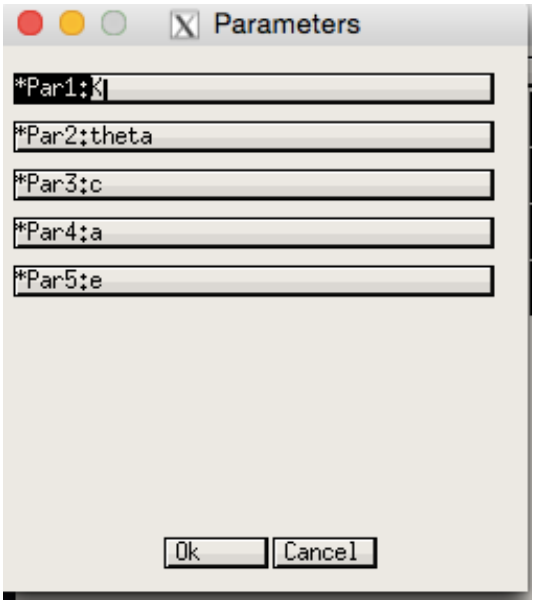
21. Change K to 0.75 and recheck stability of current equilibrium.

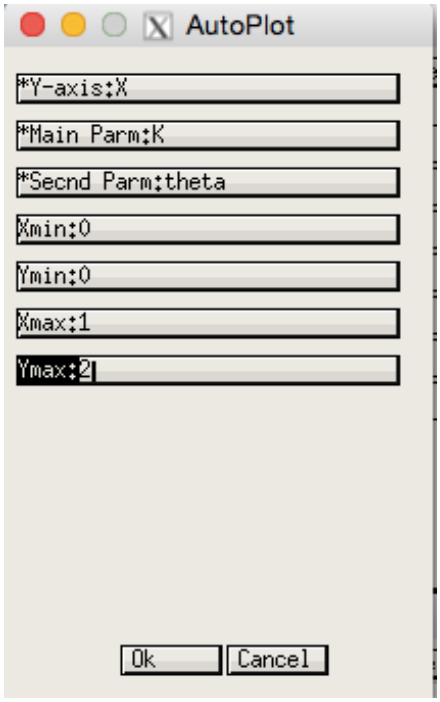


22. See this is now unstable.

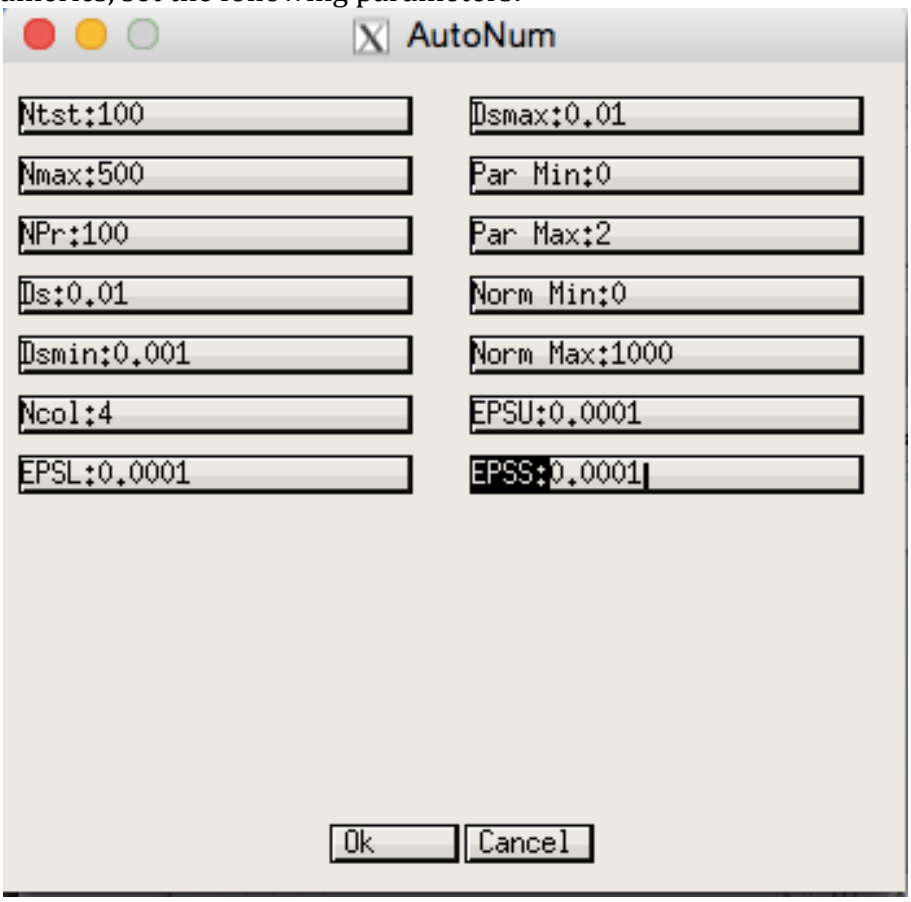
Bifurcation dynamics with AUTO

23. Before we go to AUTO to create a bifurcation diagram we have to be on a stable equilibrium value. Set K = 0.25, I→L, I→L.
24. File>Auto.
25. Parameter. Set K as Par1.
26. Axes> hI-lo (good for limit cycles), and set parameters up:

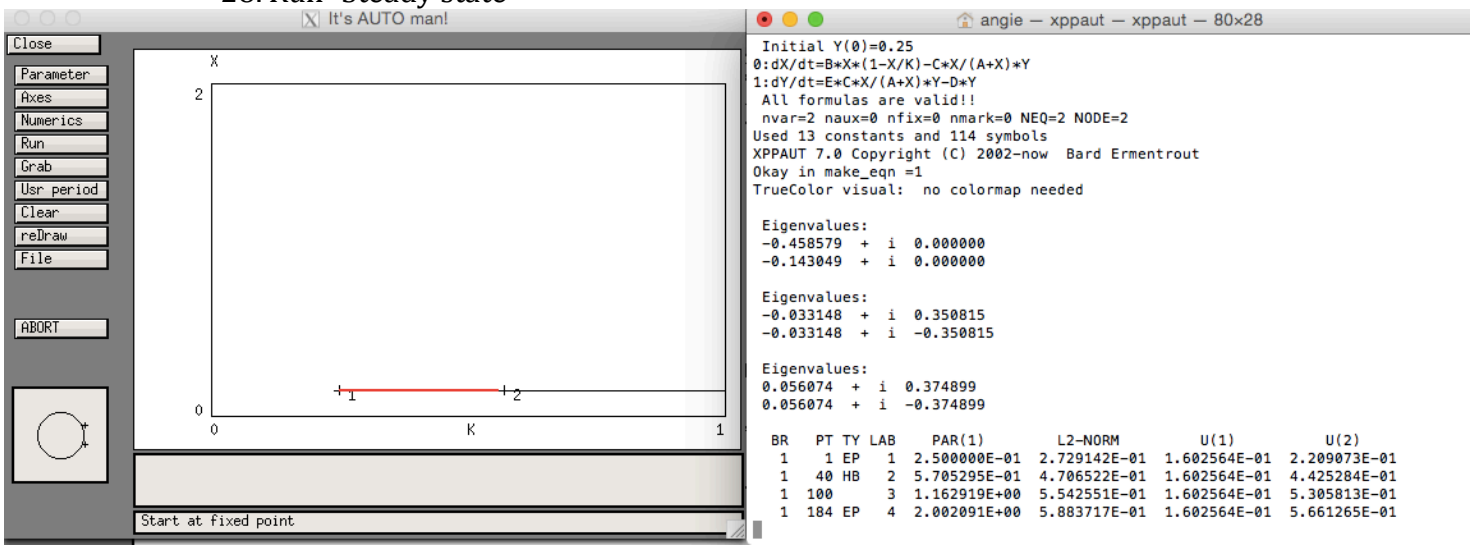




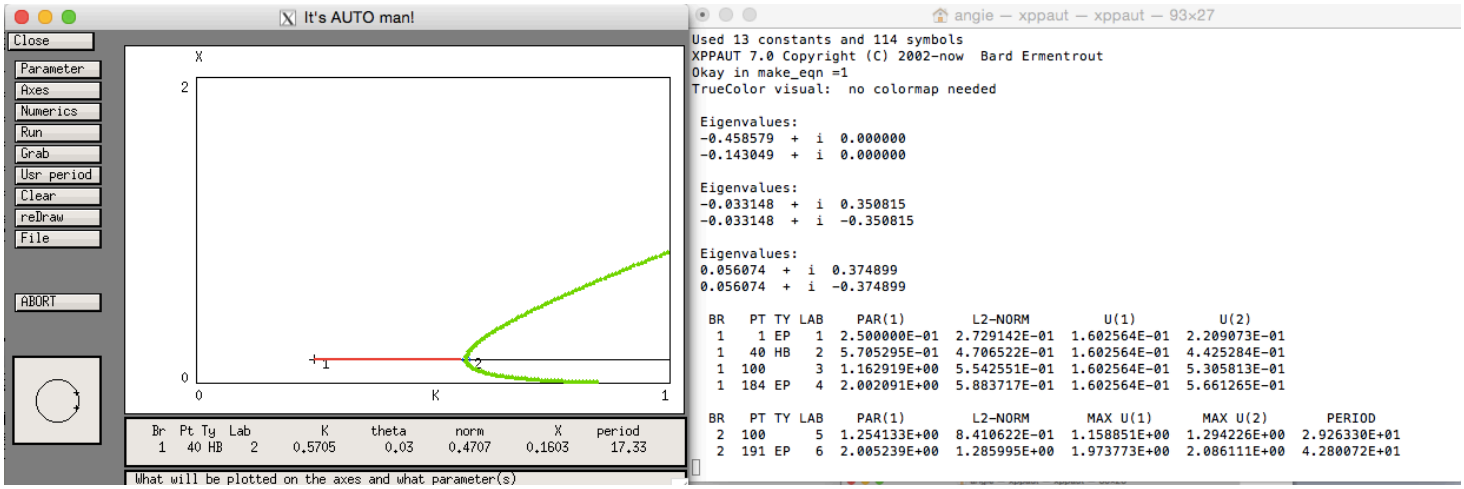
27. Numerics, set the following parameters:



28. Run>Steady state



29. Grab the HB: Grab (click up arrow on keyboard and choose HB, enter)
30. Run>Periodic



31. Save data: File>Write points.
32. To close: File>Quit>Yes.

MorrisLecar.ode example

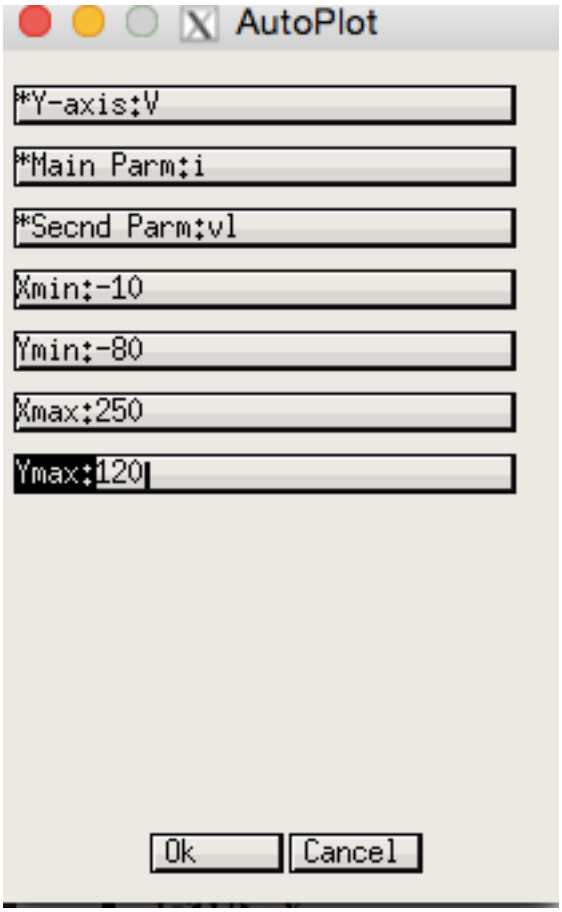
Plotting solutions

1. 1. drag and drop LVE.ode onto XPP-shortcut on desktop
2. Open Params and ICs
3. Viewaxes>2D set parameters so ymin= -80.
4. I→G. Should already be at equilibrium.

Bifurcation dynamics with AUTO

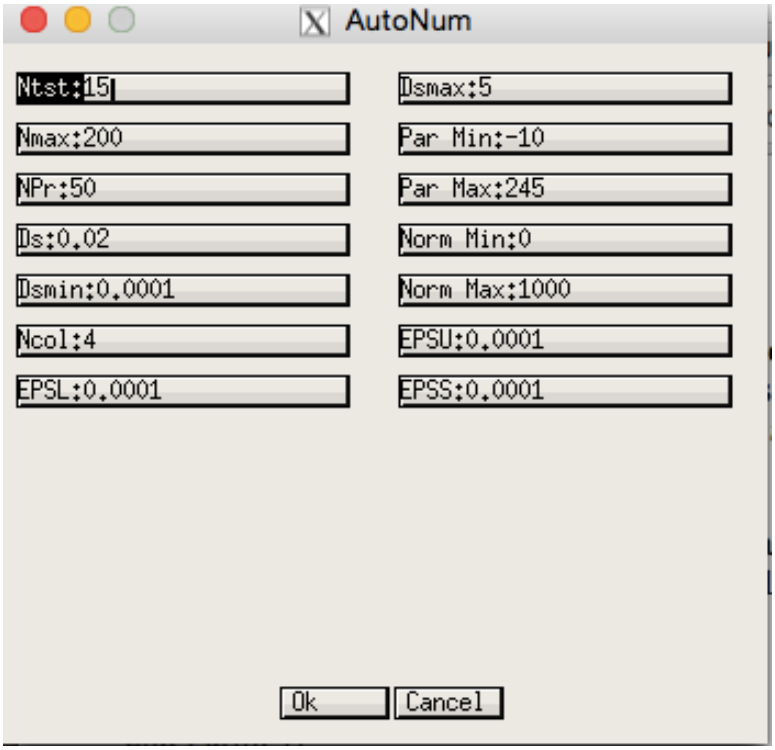
5. File>Auto
6. Axes> hI-lo (good for limit cycles), and set parameters up

- Y-axis: V
- Main Parm: i
- 2nd Parm: vl
- Xmin: -10
- Ymin: -80
- Xmax: 250
- Ymax: 120

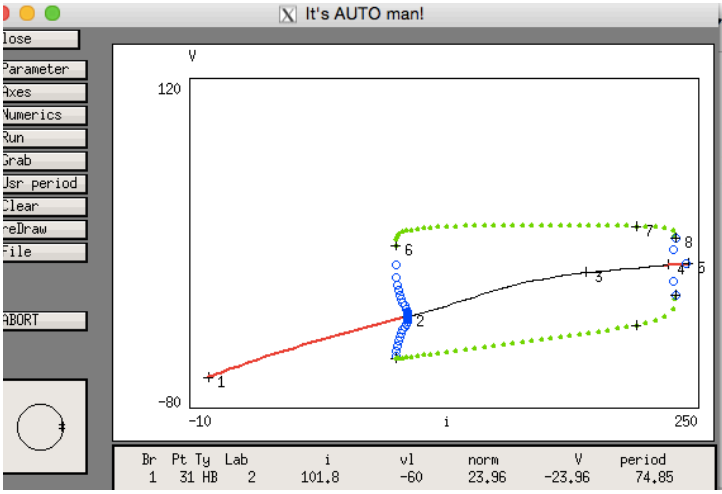


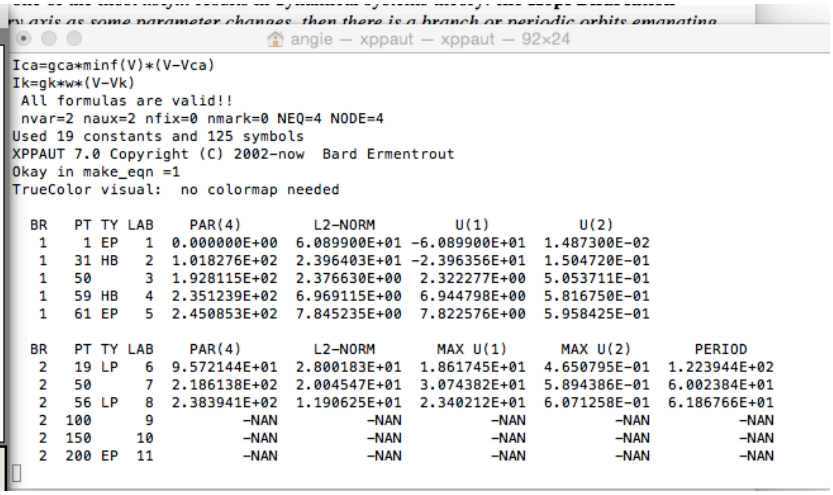
7. Numerics, set the following parameters:

   - Ds: 0.02
   - Dsmin: 0.0001
   - Dsmax: 5
   - Par Min: -10
   - Par Max: 245
   - Norm Max: 1000



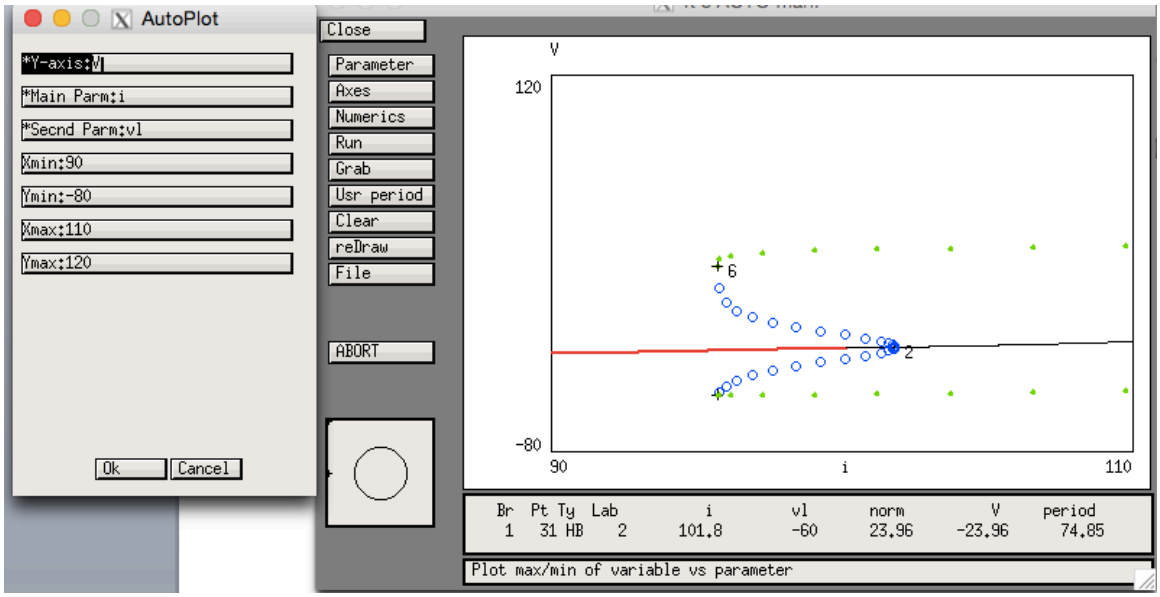
8. Run>Steady state.
9. Grab the HB: Grab (click up arrow on keyboard and choose HB, enter)
10. Run>Periodic





Notice how the unstable branch that emanates from the Hopf bifurcation bends to the left and thet the steady state solution loses stability to the right. If the direction of the bifurcating branch is opposite the direction at which stability of the main branch is lost, the branch is called **subcritical** and it is generally **unstable.** Note that there are two subcritical Hopf bifurcations; the second one is for a high current of about 220. (It is subcritical because the steady state branch loses the stability going *left* and the periodic branch goes *right*

11. See region of bistability: axes change y region to be (90, 110). Redraw.



viralBlips.ode