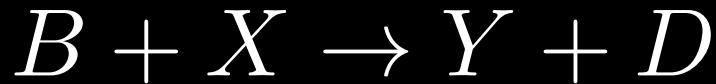


Chemical Cycles and Chaos

Chris Kempes



Brusselator



Brusselator



$$\frac{dX}{dT} = k_1 A - k_2 BX + k_3 X^2 Y - k_4 X$$

$$\frac{dY}{dT} = k_2 BX - k_3 X^2 Y$$

Brusselator

$$\frac{dX}{dT} = k_1 A - k_2 BX + k_3 X^2 Y - k_4 X$$

$$\frac{dY}{dT} = k_2 BX - k_3 X^2 Y$$

$$\frac{dx}{dt} = a - bx + x^2y - x$$

$$\frac{dy}{dt} = bx - x^2y$$

Brusselator

$$\frac{dx}{dt} = a - bx + x^2y - x$$

$$\frac{dy}{dt} = bx - x^2y$$

Steady State:

$$x^* = a$$

$$y^* = b/a$$

Brusselator

$$\frac{dx}{dt} = a - bx + x^2y - x$$

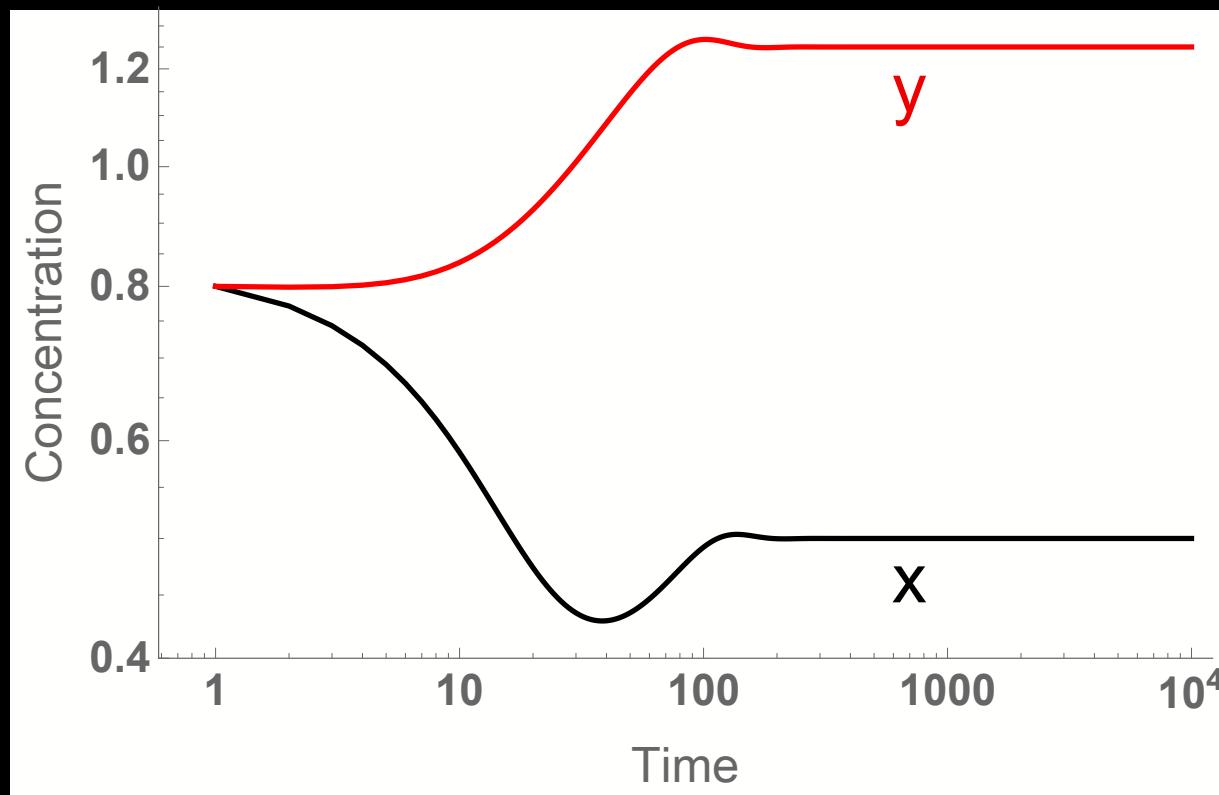
$$\frac{dy}{dt} = bx - x^2y$$

Stability Analysis:

$$b > a^2 + 1$$

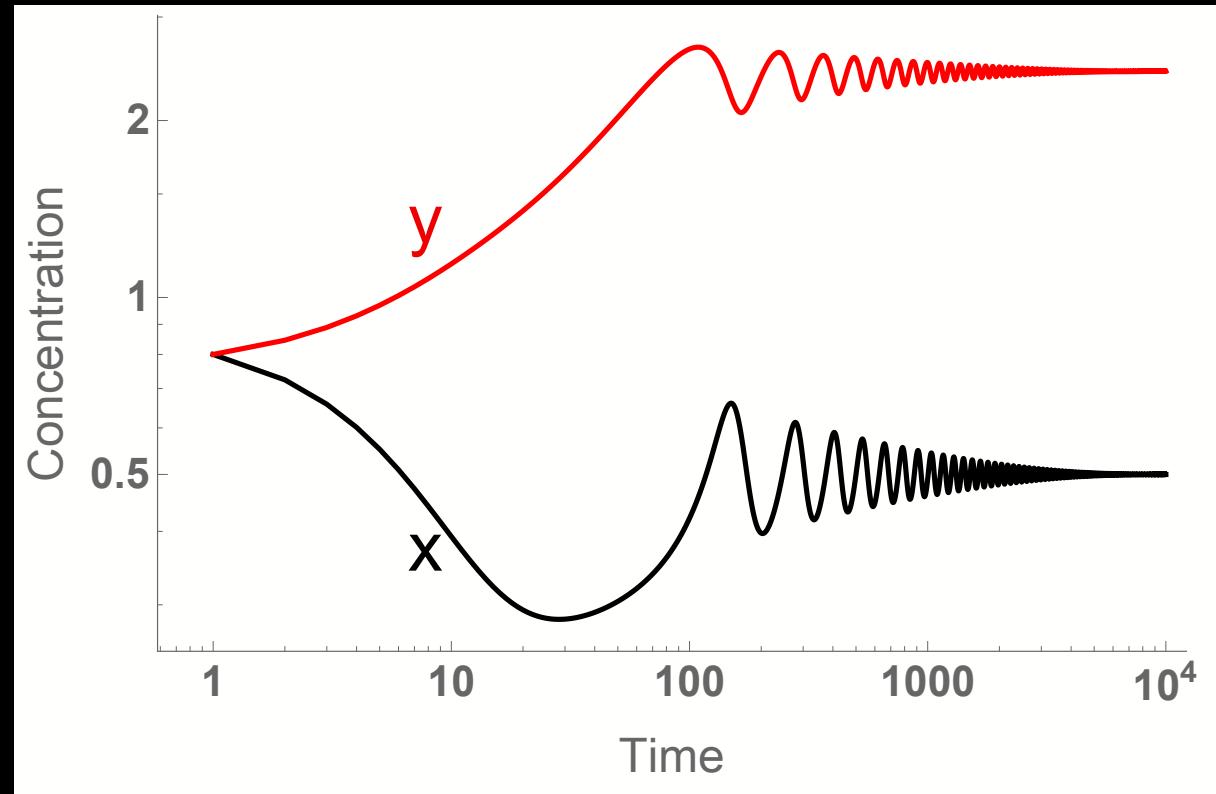
Brusselator

$$b > a^2 + 1$$



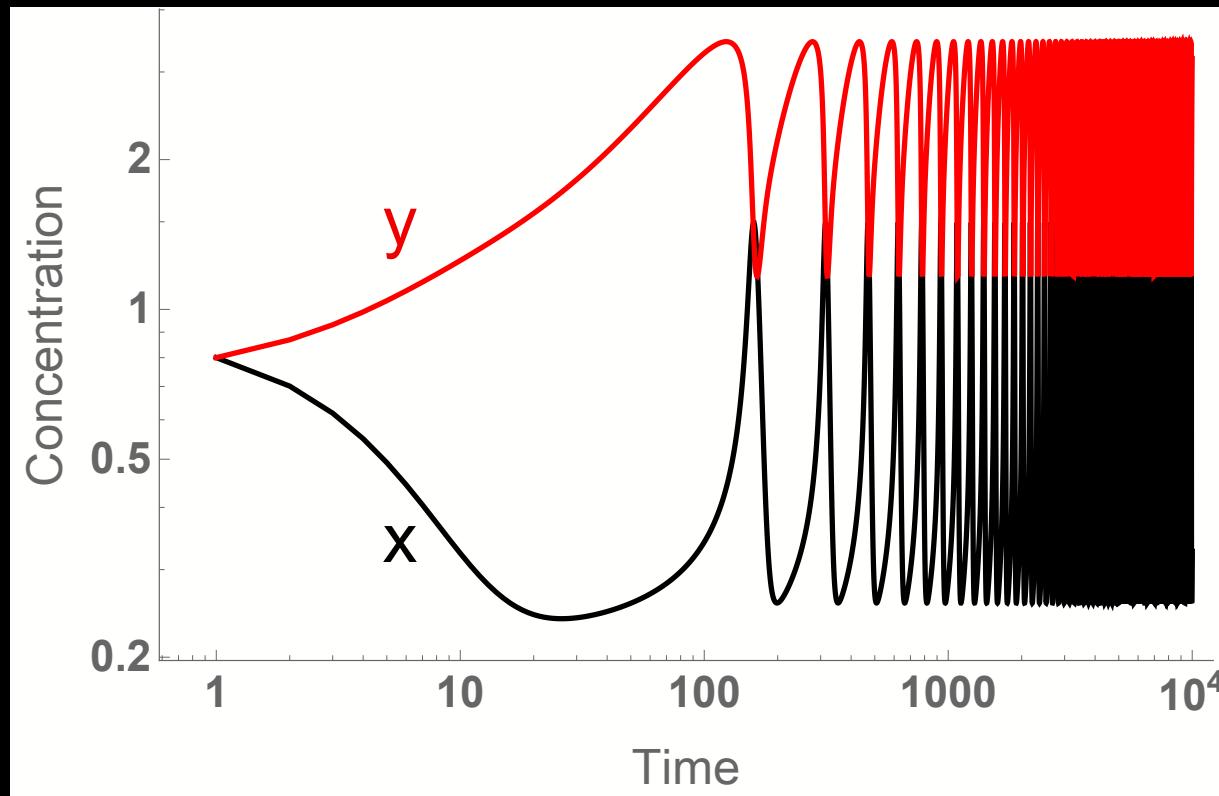
Brusselator

$$b > a^2 + 1$$



Brusselator

$$b > a^2 + 1$$



Lorenz System

$$\frac{dx}{dt} = \sigma(y - x)$$

$$\frac{dy}{dt} = x(\rho - z) - y$$

$$\frac{dz}{dt} = xy - \beta z$$

Lorenz System

