Traffic flow analysis / modeling Microscopic Scale -> each vehicle is an individual entity can be written for each a) an ODE tracking change in position & velocity b) cellular automation model Nagel-Schreckenberg model Macroscopic scale Use systems of PDEs to track the density of vehicles or mean track quantities like mean velocity Think of our discussion on diffusion. Terms Density -> number of vehicles per unit length of roadway  $Flow \rightarrow number of vehicles passing a reference point per unit of time.$ Inverse of flow is headway  $\rightarrow$  that elapses between it vehicle passing a reference point in space and the (i+1)th vehicle In congestion -> h is constant as traffic jam forms h -> thfmity  $q = k \vee q = \frac{1}{h}$ 

$\ddot{x}_{j} = F(s_{j}, \dot{x}_{j}, \dot{x}_{j+1})$ $x_{j}  position \qquad s_{j} = x_{j+1} - x_{j} - 1$ $\dot{x}_{j}  speed \qquad gap to leader$ $\ddot{x}_{j}  acceleration$ $\dot{x}_{j+1}  lead  vehicle  speed$ $\overbrace{X_{j-1}}^{V}  X_{j}  X_{j+1-1}  X_{j+1}$ $Two  models$ $A)  follow the leader model \qquad \dot{x}_{j} = \beta  \frac{\dot{x}_{j+1} - \dot{x}_{j}}{(s_{j})^{2}}$ $acceleration  proportional to  difference in speed and inversely  proportional to the square of the difference in position  if \dot{x}_{j+1} > \dot{x}_{j}  lead  vehicle  faster \dot{x}_{j+1} < \dot{x}_{j}  lead  vehicle  slower \rightarrow slow  dawn  acceleration  negative  decceleration  m^{2}/s$	Car	following Models Agent based implementation	•
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1 and half to 2 minutes -> See in stabilities	٠	•	•	٠	•	•
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6) What does unstable mean?	٠	•	•	•	•	•
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7) When vehicles aim at a pairticular optimed speed, the vehicles granitule to wards equispaced orientation?	٠	•	٠	•	•	•
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¥ 8) What happens if instead of starting relocities at 5 + 10 ≠ rand(size(q))	•	•	•	•	•	•
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* 9) Plot V function from 0 to 20 V	•	•	•	•	•	
$\star$ 10) Try Euler step with $dt = 0.5$ What happens & why?	٠	٠	•	٠		
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