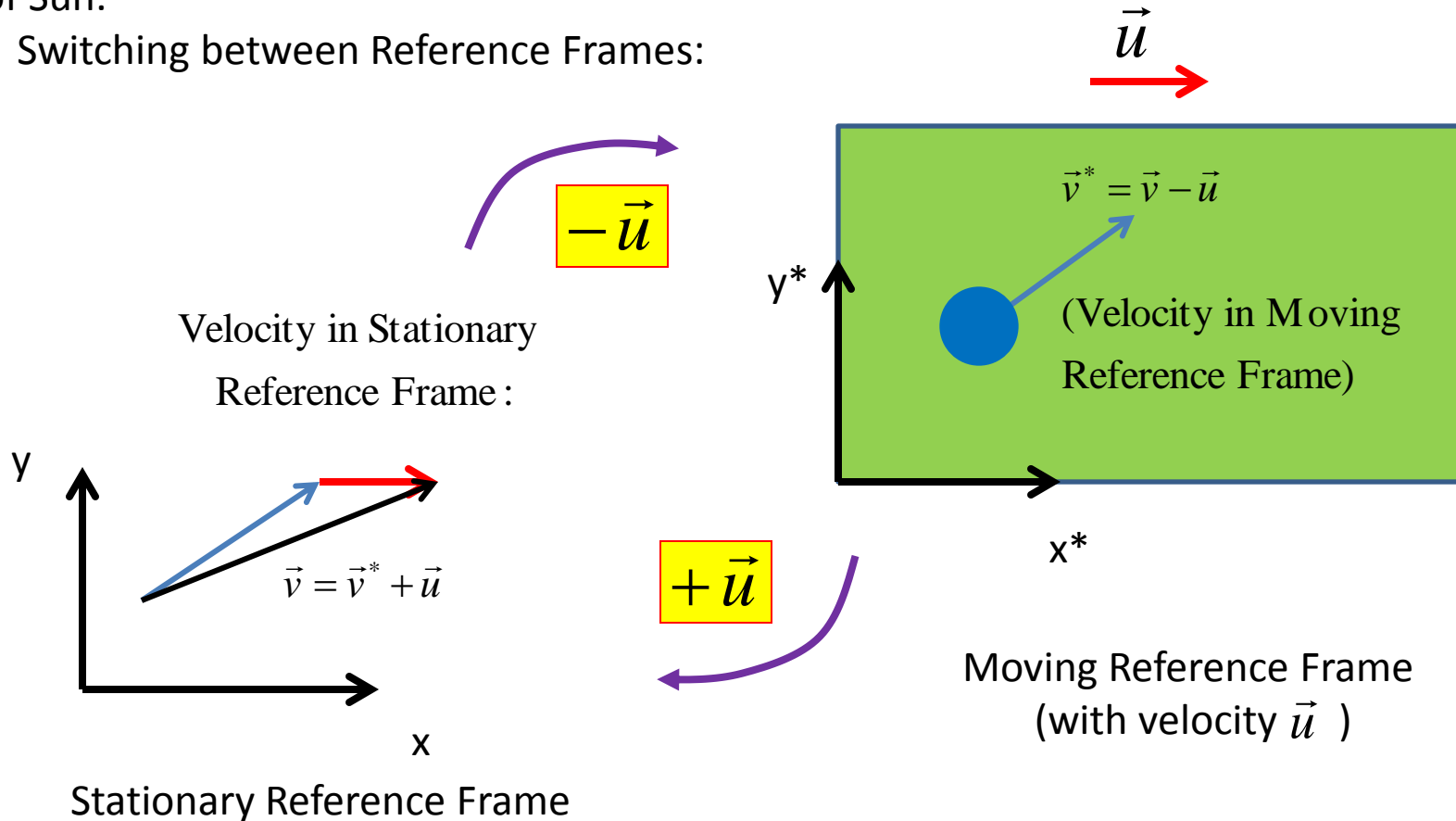# Reference Frame

- In order to describe a motion , we need to specify the **Reference Frame**, i.e. Coordinate System at each moment of time.
- **Examples:** Reference Frame of a moving train, of water in river, of a person on a bench, of Sun.
- Switching between Reference Frames:

$\vec{u}$

$$-\vec{u}$$

Velocity in Stationary
Reference Frame :

$\vec{v}^{\,*} = \vec{v} - \vec{u}$

(Velocity in Moving
Reference Frame)

y*

x*

y

$\vec{v} = \vec{v}^{\,*} + \vec{u}$

$$+\vec{u}$$

x

Stationary Reference Frame

Moving Reference Frame
(with velocity $\vec{u}$)

Homework 5

A car of length L=4.0m is moving on a road. Its position is determined by three photogates (like we did in class): Gate 1. Gate 2 and Gate 3. The table below shows the time moments at which each of gates gets blocked and unblocked (t_1 and t_2), in seconds:

GATE #	t_1 ,s (gate blocked)	t_2 ,s (gate unblocked)	v, m/s
Gate 1	0.000	0.120	
Gate 2	5.210	5.300	
Gate 3	7.070	7.140	

a) Find the speed of the car at the moments when it passed each gate, and fill the blanks in the table.

b) Find accelerations of the car when it travels between Gates 1 and 2, and Gates 2 and 3

c) Estimate the distances between Gates 1,2 and 3.

Problem 2

River flows with speed $v_r=2m/s$. A fisherman uses his boat to get to a village situated at distance $d=2\ km$ down the river, and returns back to his home. During the whole trip, the speed of the boat is **V=3m/s** *with respect to the water*. Find the total time of the two-way trip. Does river flow make it longer or shorter?

$v_r=2m/s$

$d=2\ km$