

September 26, Week 6

Physics 151

Today: Chapter 4: Newton's Third Law

Homework Assignment #5 - Due September 28.

Mastering Physics: 11 problems from chapters 4 and 5.

Written Questions: 4.50, 5.58

On problem 4.36, assume the weightlifter and barbell are not accelerating.

Problem 5.6, ignore the weight of the patella.

Homework Assignment #6 - Due October 5.

Mastering Physics: 6 problems from chapter 5.

Written Questions: 5.54

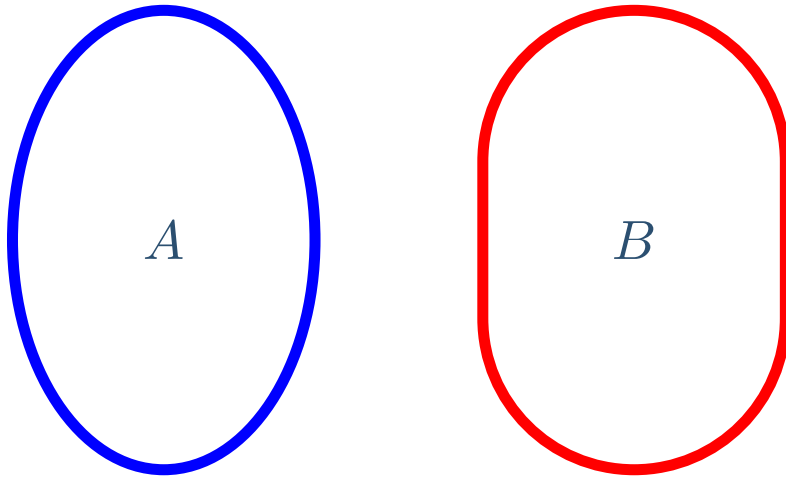
Office hours today, 3:00-5:00, room 11 of Physics and Astronomy building.

Newton's Third Law

For every action, there is an equal but opposite reaction.

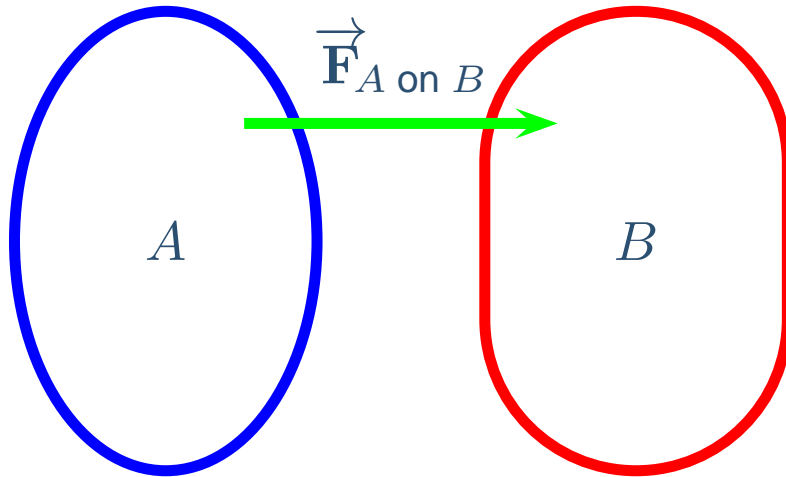
Newton's Third Law

For every action, there is an equal but opposite reaction.



Newton's Third Law

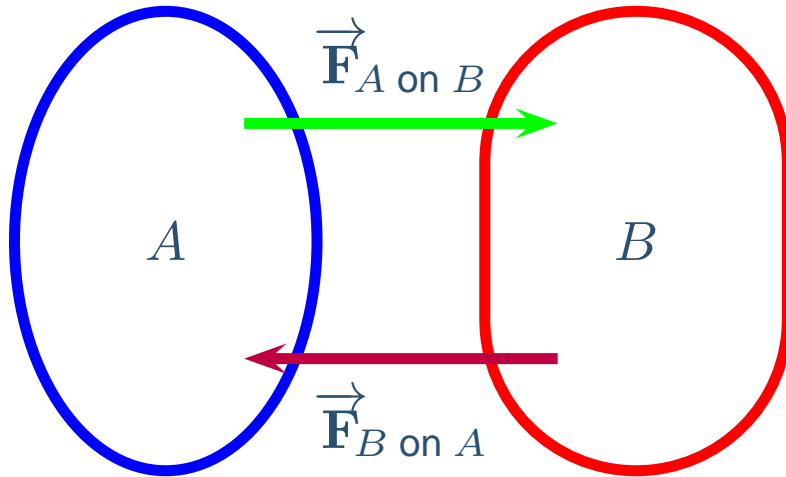
For every action, there is an equal but opposite reaction.



$\vec{F}_{A \text{ on } B}$ = Force that A exerts on B

Newton's Third Law

For every action, there is an equal but opposite reaction.

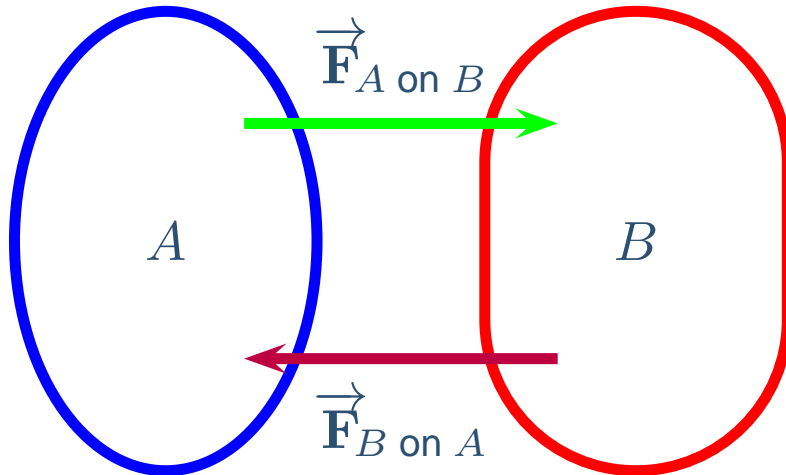


$\vec{F}_{A \text{ on } B}$ = Force that A exerts on B

$\vec{F}_{B \text{ on } A}$ = Force that B exerts on A

Newton's Third Law

For every action, there is an equal but opposite reaction.



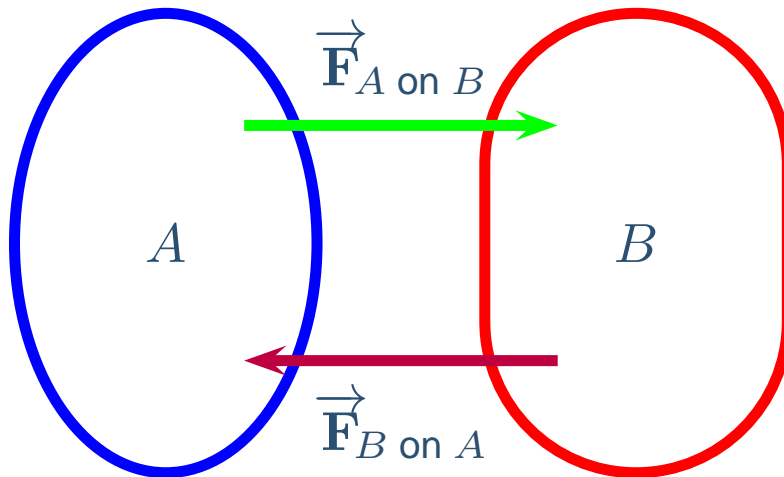
$\vec{F}_{A \text{ on } B}$ = Force that A exerts on B

$\vec{F}_{B \text{ on } A}$ = Force that B exerts on A

Third Law : $\vec{F}_{B \text{ on } A} = -\vec{F}_{A \text{ on } B}$

Newton's Third Law

For every action, there is an equal but opposite reaction.



$\vec{F}_{A \text{ on } B}$ = Force that A exerts on B

$\vec{F}_{B \text{ on } A}$ = Force that B exerts on A

Third Law : $\vec{F}_{B \text{ on } A} = -\vec{F}_{A \text{ on } B}$

Action and Reaction are applied to different objects!

Third Law Followup



Third Law Followup



Third Law Followup

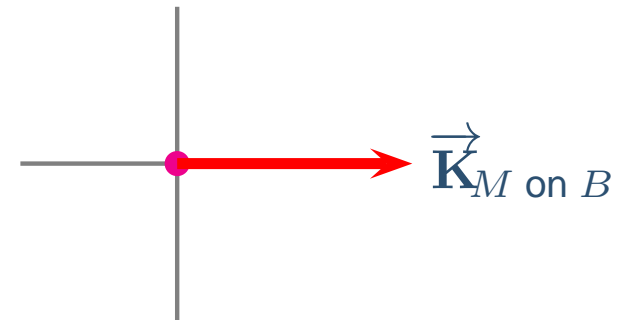
Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$



Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

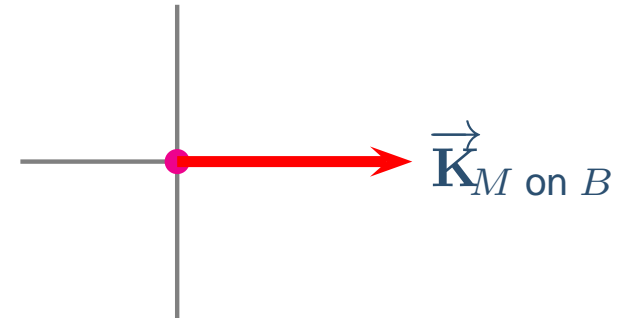


Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B

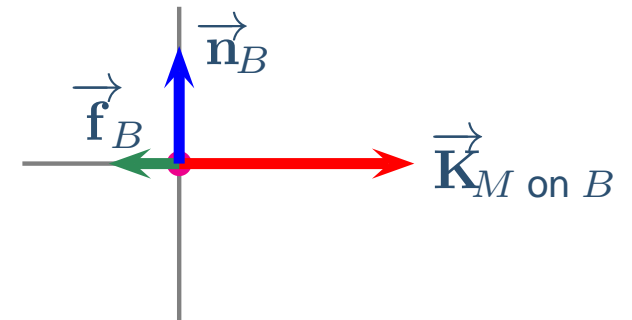


Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B



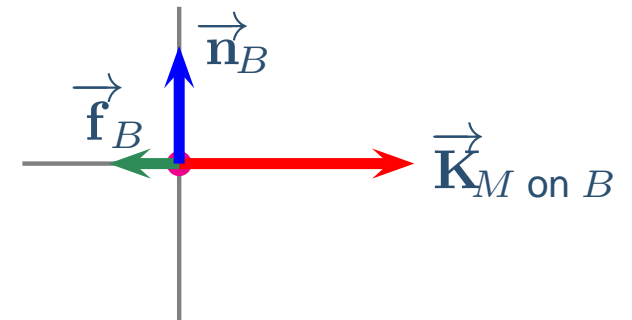
Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B

Long-Range Force on Ball: Weight \vec{w}_B



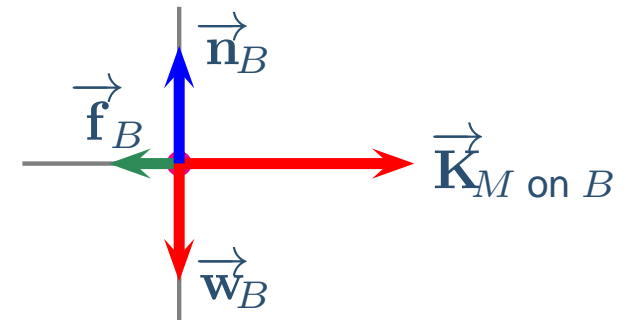
Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B

Long-Range Force on Ball: Weight \vec{w}_B



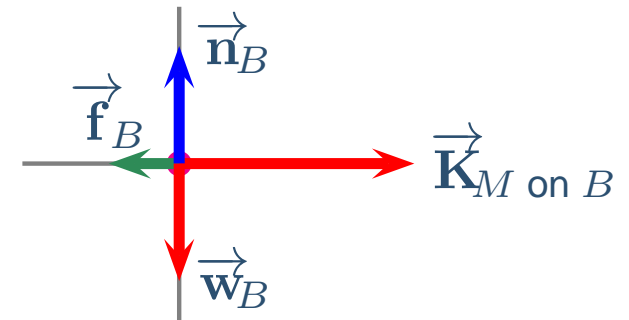
Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B

Long-Range Force on Ball: Weight \vec{w}_B



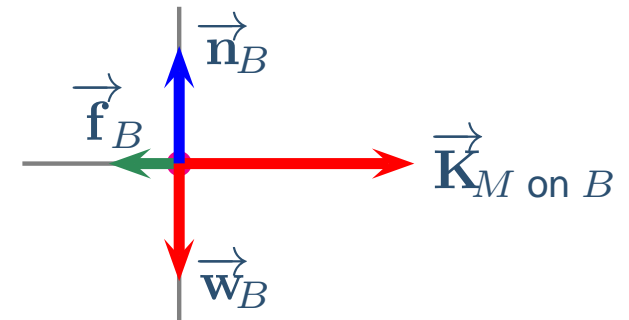
Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B

Long-Range Force on Ball: Weight \vec{w}_B



Forces on Messi from Ball: Kick $\vec{K}_{B \text{ on } M}$

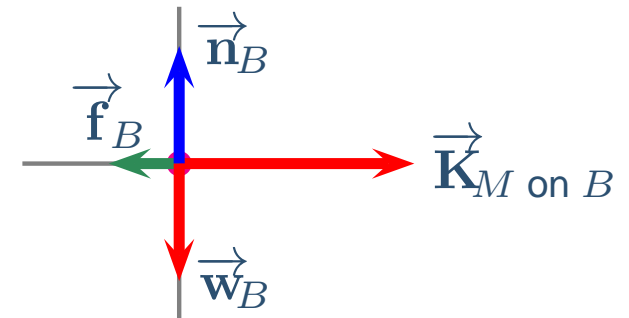
Third Law Followup



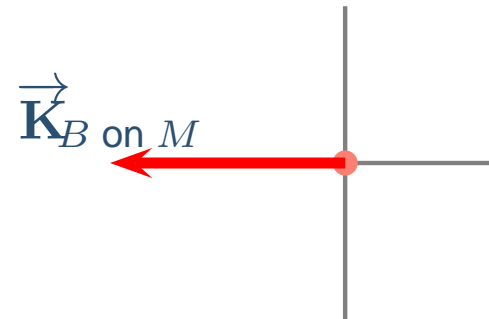
Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B

Long-Range Force on Ball: Weight \vec{w}_B



Forces on Messi from Ball: Kick $\vec{K}_{B \text{ on } M}$



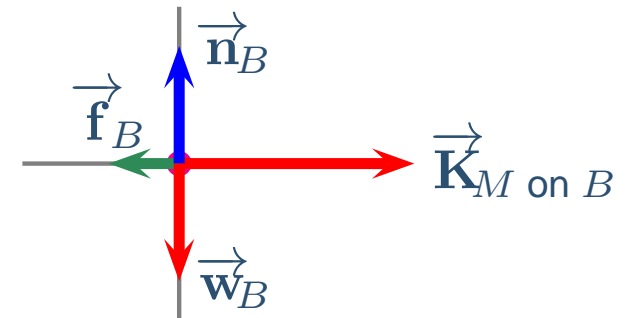
Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

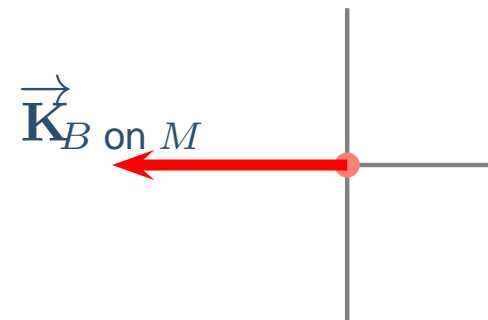
Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B

Long-Range Force on Ball: Weight \vec{w}_B



Forces on Messi from Ball: Kick $\vec{K}_{B \text{ on } M}$

Forces on Messi from ground: Normal \vec{n}_M , static friction \vec{f}_M



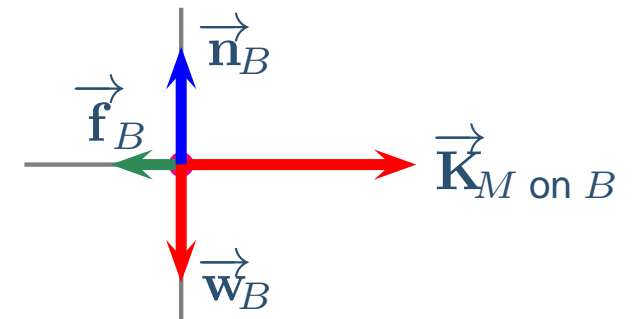
Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

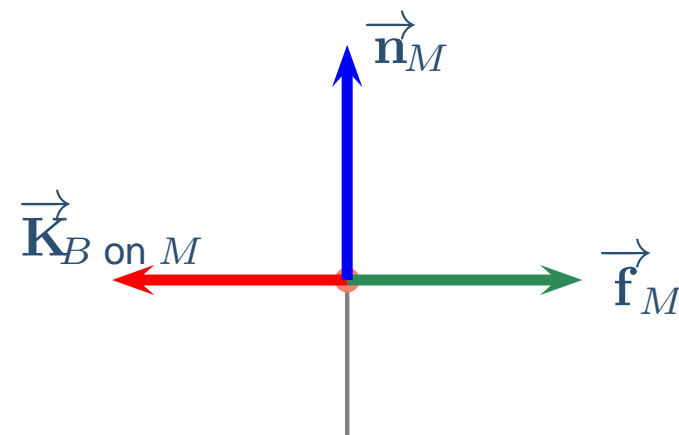
Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B

Long-Range Force on Ball: Weight \vec{w}_B



Forces on Messi from Ball: Kick $\vec{K}_{B \text{ on } M}$

Forces on Messi from ground: Normal \vec{n}_M , static friction \vec{f}_M



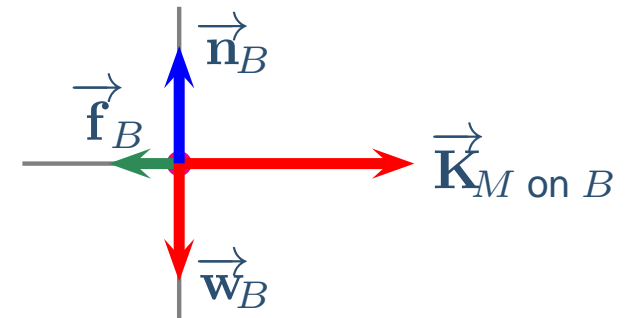
Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B

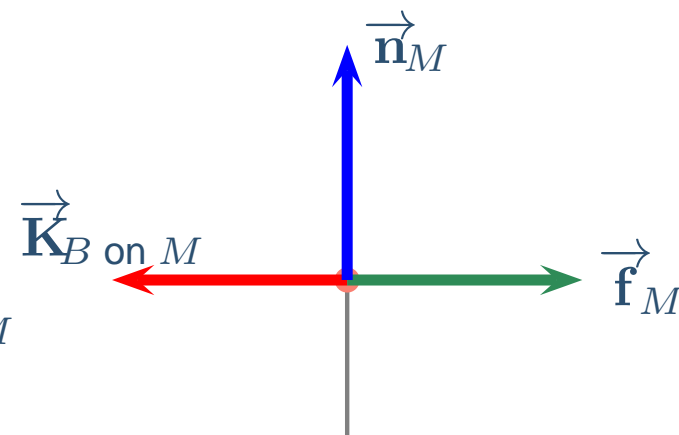
Long-Range Force on Ball: Weight \vec{w}_B



Forces on Messi from Ball: Kick $\vec{K}_{B \text{ on } M}$

Forces on Messi from ground: Normal \vec{n}_M , static friction \vec{f}_M

Long-Range Force on Messi: Weight \vec{w}_M



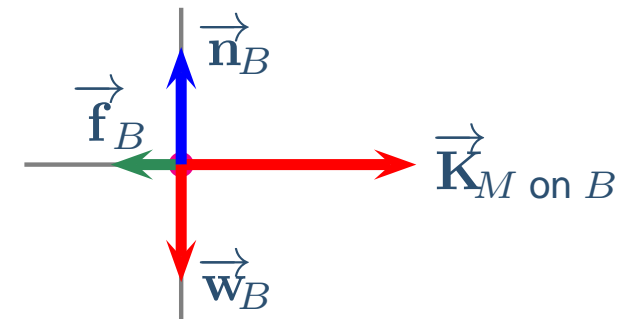
Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B

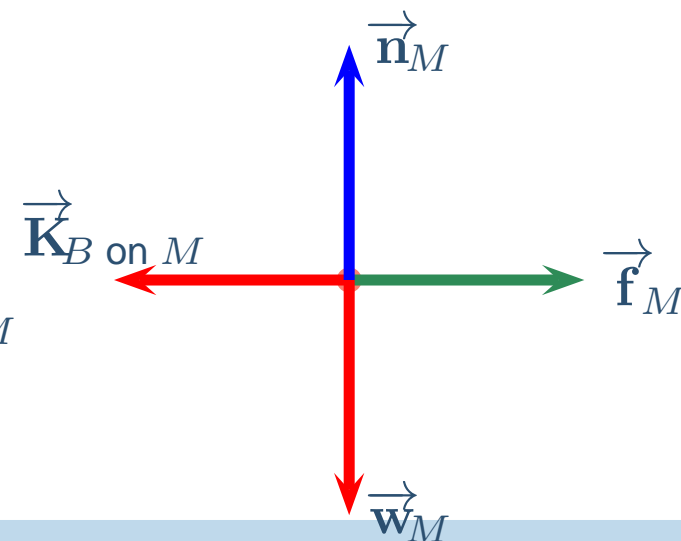
Long-Range Force on Ball: Weight \vec{w}_B



Forces on Messi from Ball: Kick $\vec{K}_{B \text{ on } M}$

Forces on Messi from ground: Normal \vec{n}_M , static friction \vec{f}_M

Long-Range Force on Messi: Weight \vec{w}_M



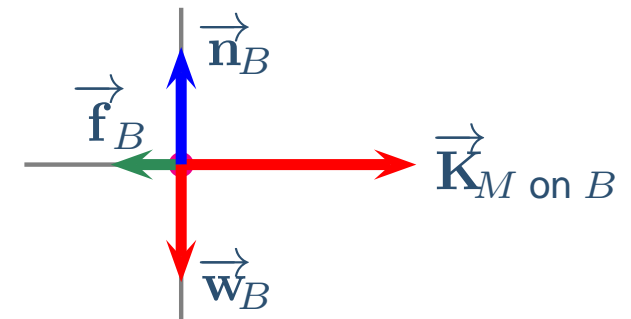
Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B

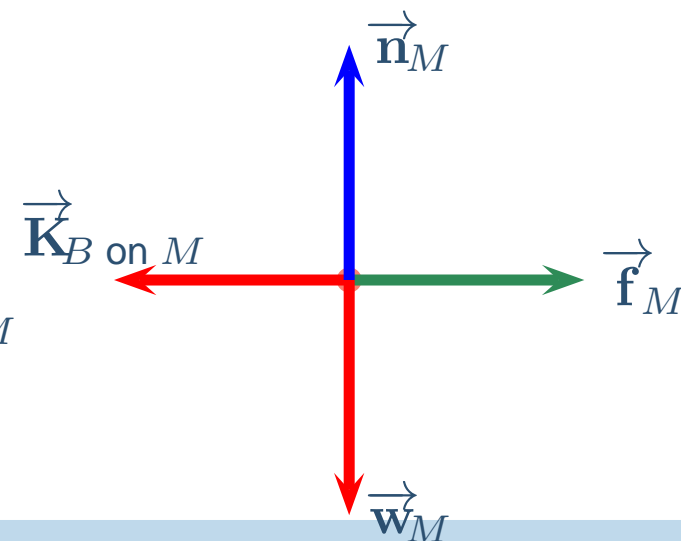
Long-Range Force on Ball: Weight \vec{w}_B



Forces on Messi from Ball: Kick $\vec{K}_{B \text{ on } M}$

Forces on Messi from ground: Normal \vec{n}_M , static friction \vec{f}_M

Long-Range Force on Messi: Weight \vec{w}_M



End Result: Ball moves, Messi does not