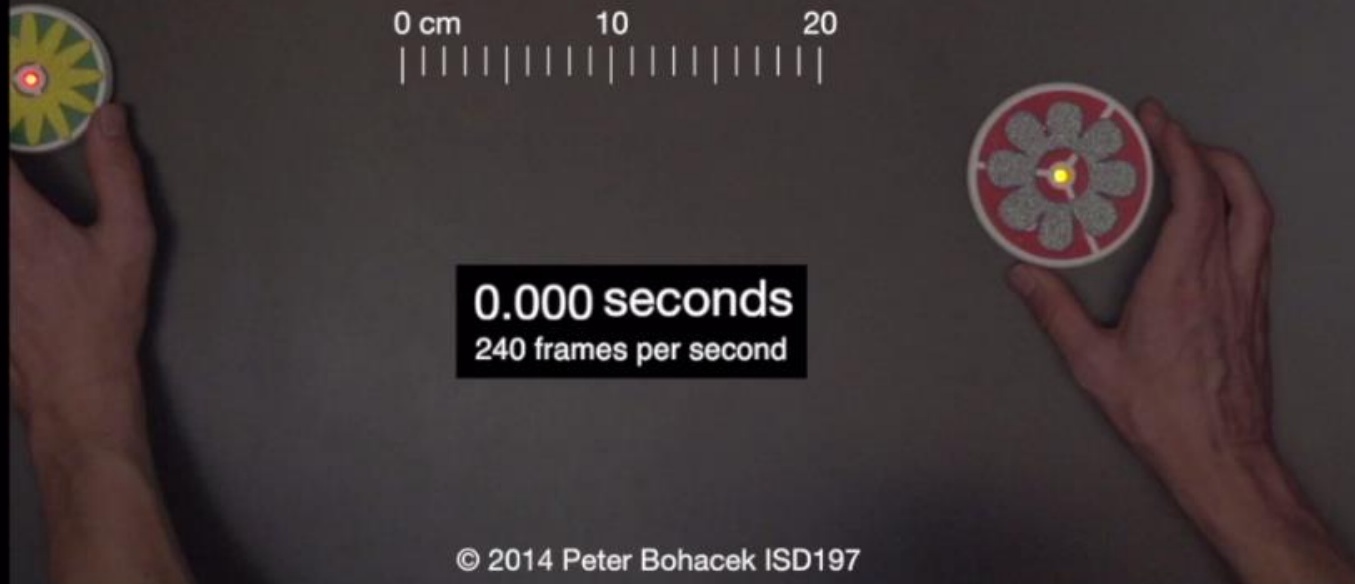


Two-dimensional collision on a horizontal surface

Small disk mass: 38.1 ± 0.1 g
Big disk mass: 55.7 ± 0.1 g



This video is ten seconds long.

It would take much longer to set up in lab, and it would be difficult to make accurate measurements

Mars Science Laboratory Launch ATLAS V rocket

November 26, 2011

VIDEO CREDIT: NASA

Note that this video
has been modified
from its original form.
Text, scaling, and
timing information
have been added.



frames+433

60 frames per second



This video could simply not be done in lab

Cart Push-off 2

© 2014 Peter Bohacek ISD 197
Direct Measurement Video

Christine's mass = 57.8 ± 0.2 kg (back of left cart)
Hailey's mass = 68.6 ± 0.2 kg (front of left cart)
Connor's mass = 69.4 ± 0.2 kg
Cart mass = 22 ± 0.2 kg

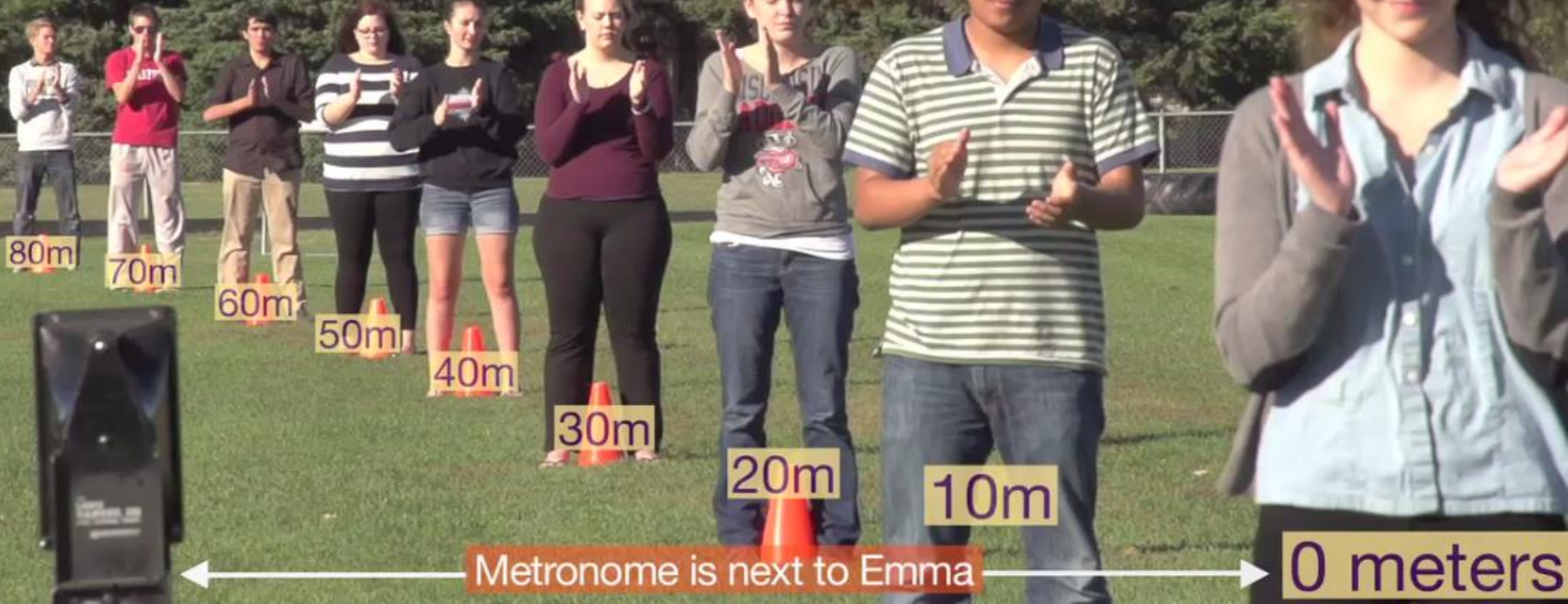


frames-188
240 frames per second

This looks like something that could be done in lab, but most students end up leaning in such a way that it doesn't show momentum conservation.

Keep in time!

frame:+0
480 frames per second



This 19 second video allows students to accurately and intuitively measure the speed of sound in air.

Trampoline Jumper



Frames: +74
240 frames per second

© 2012 Peter Bohacek ISD197

This is soooo much cooler than the typical mass on a spring problem.

How Fast is That?

Number 2: Skaters racing



© 2014 Peter Bohacek ISD 197

Direct Measurement Video

DMV's even work for really simple concepts

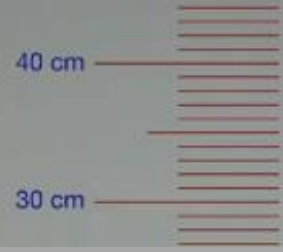


frames+264
240 frames per second

The Wave

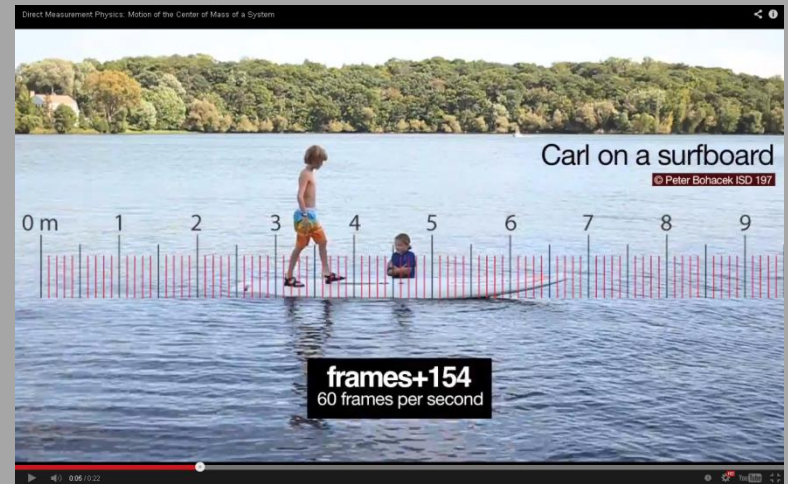
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Imagine this as a word problem.



Using Direct Measurement Videos to Teach Introductory Mechanics

AAPT Summer Meeting
July 29, 2014
Minneapolis!



Matthew Vonk University of Wisconsin River Falls
Peter Bohacek Henry Sibley High School

Hockey Slap Shot

frame:+61

240 frames per second
puck mass = 169.7 ± 0.01 g



© Peter Bohacek ISD 197

DMV's are short videos of real events that are shot in such a way that students can directly measure important quantities.



Why Use DMV's?

They're fun

They're real

They're free

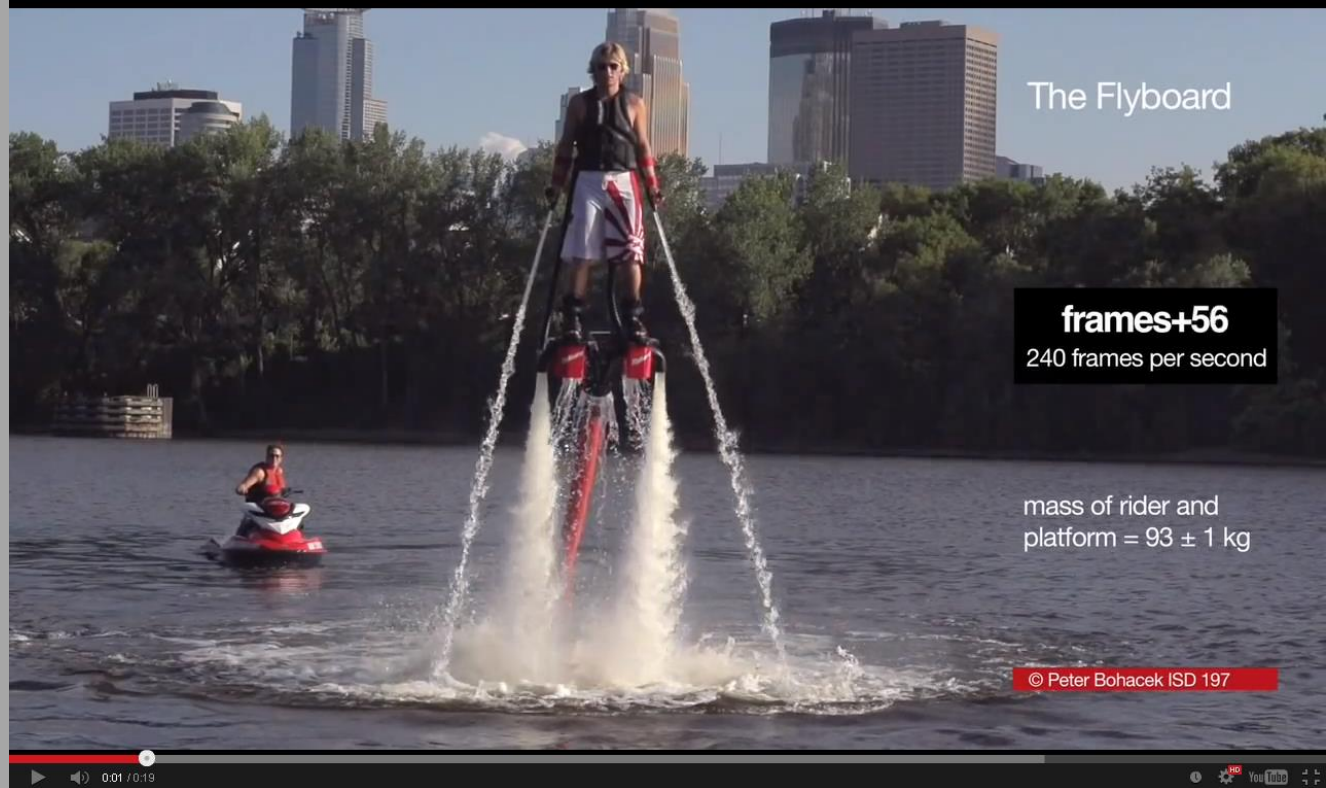
They are easy to use

They come in a variety of levels

More than just mechanics

Students start to notice other things

Students ask about uncertainty



We there are lot options. ...



Quality explanations & entertaining



Infinitely changeable parameters.



A uniform ladder 5 m long weighing 200 N is leaning against a smooth vertical wall with its base 3 m from the wall. The coefficient of static friction between the bottom of the ladder and the ground is 0.4. How far along the ladder can a 600 N man climb before the ladder starts to slip?

Easy to customize
Highly portable



Students take ownership

Coming Soon: New Tools that encourage science practices

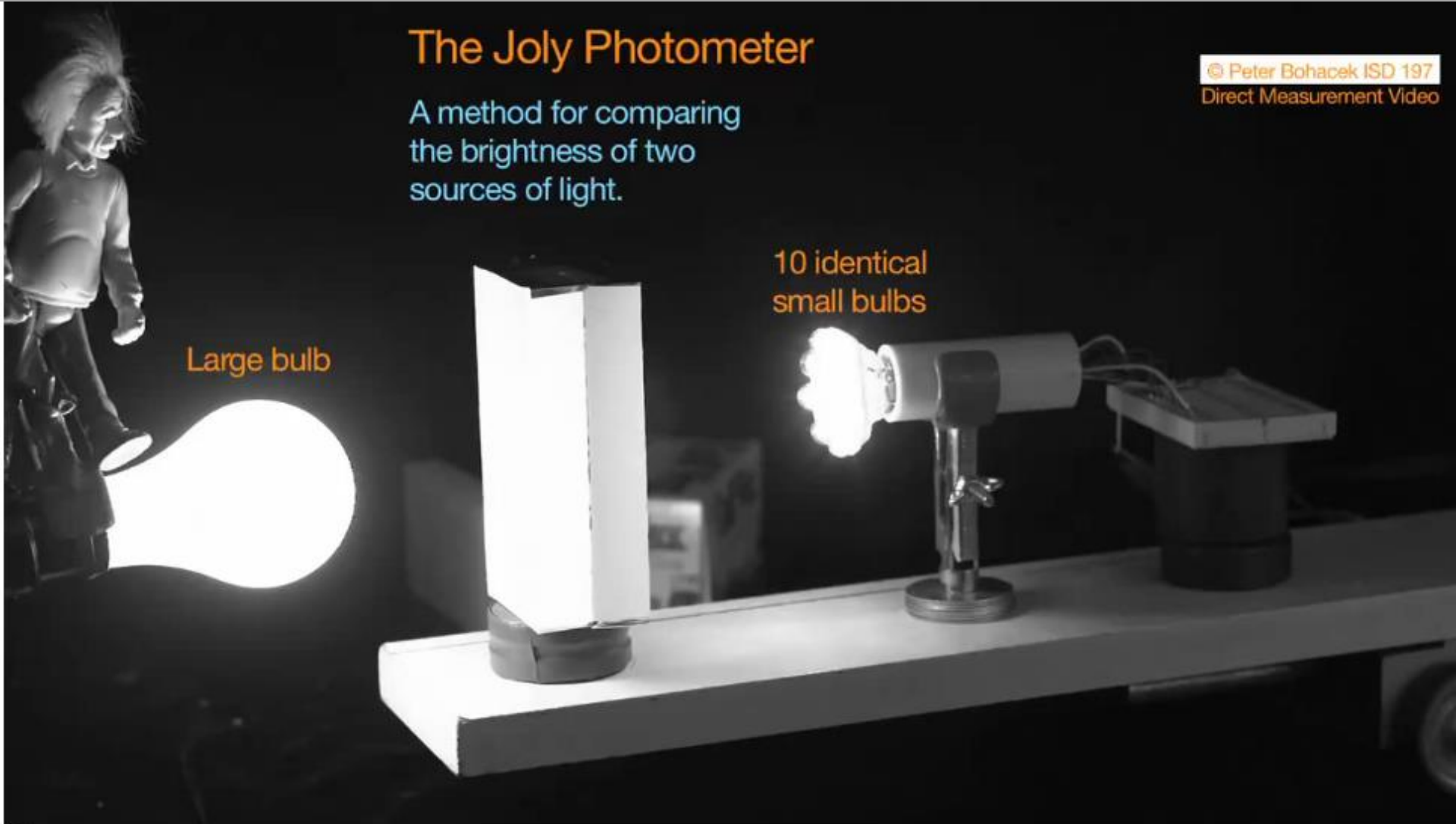
The Joly Photometer

A method for comparing the brightness of two sources of light.

© Peter Bohacek ISD 197
Direct Measurement Video

Large bulb

10 identical small bulbs



Go!

Pick a Video: Introduction ▾

The Joly Photometer

A method for comparing the brightness of two sources of light.

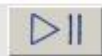
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Direct Measurement Video

Large bulb

10 identical small bulbs



- Introduction
- 1 Bulb
- 2 Bulbs
- 3 Bulbs
- 4 Bulbs
- 5 Bulbs
- 6 Bulbs
- 7 Bulbs
- 8 Bulbs
- 9 Bulbs



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Pick a Video:

Introduction ▾

Marble Collides with Pendulum

80 cm

70 cm

Pneumatic (compressed air) cannon

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Go!

Tools:

Horizontal Ruler

Vertical Ruler

Protractor

Reset Tools

Marble Collides with Pendulum



Pneumatic (compressed air) cannon



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Go!

Tools:

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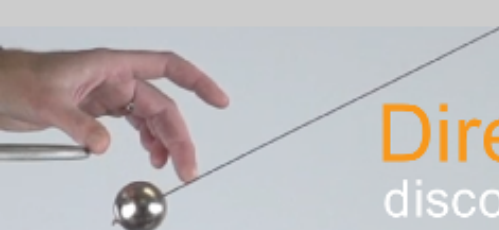
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Direct Measurement Videos

discovering physics ...one frame at a time

40 cm

30 cm

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Video Library

Each video below links to a page with several file format options and some suggestions for teaching [library](#).

Jump down to:

[One Dimensional Motion](#) | [Two Dimensional Motion](#) | [Forces and Motion](#) | [Rotation](#) | [Impulse and Momentum](#) | [Sound](#) | [Light](#)

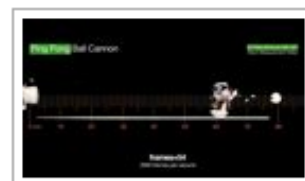
One-Dimensional Motion



[How fast is that? Ice skaters 1](#)



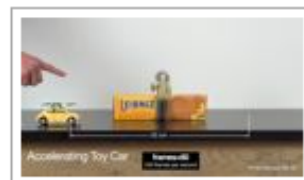
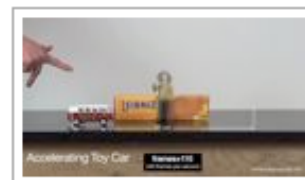
[How fast is that? July 4th cannon](#)



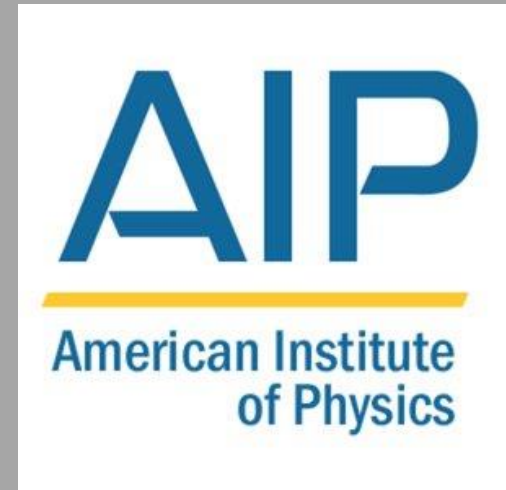
[How fast is that? Ping pong ball cannon](#)



[How fast is that? Roller coaster 1](#)



Acknowledgements



Award #1245268

SERC the Science Education
Resource Center
at Carleton College



Direct Measurement Videos

discovering physics ...one frame at a time

40 cm

30 cm

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Peter Bohacek Henry Sibley High School

- <http://www.hispanicphysicists.org/study/world.html>

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