PHYS*1A03
Introductory Physics

Fall 2015

http://avenue.mcmaster.ca/

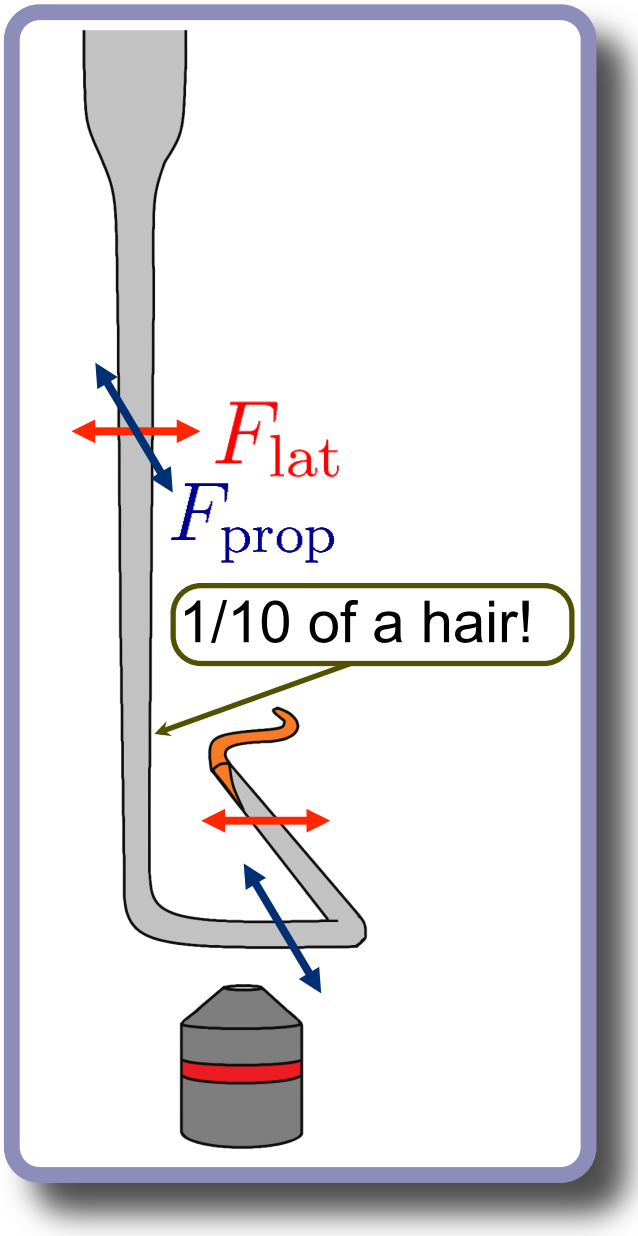
PHYS 1A03

Section C01:

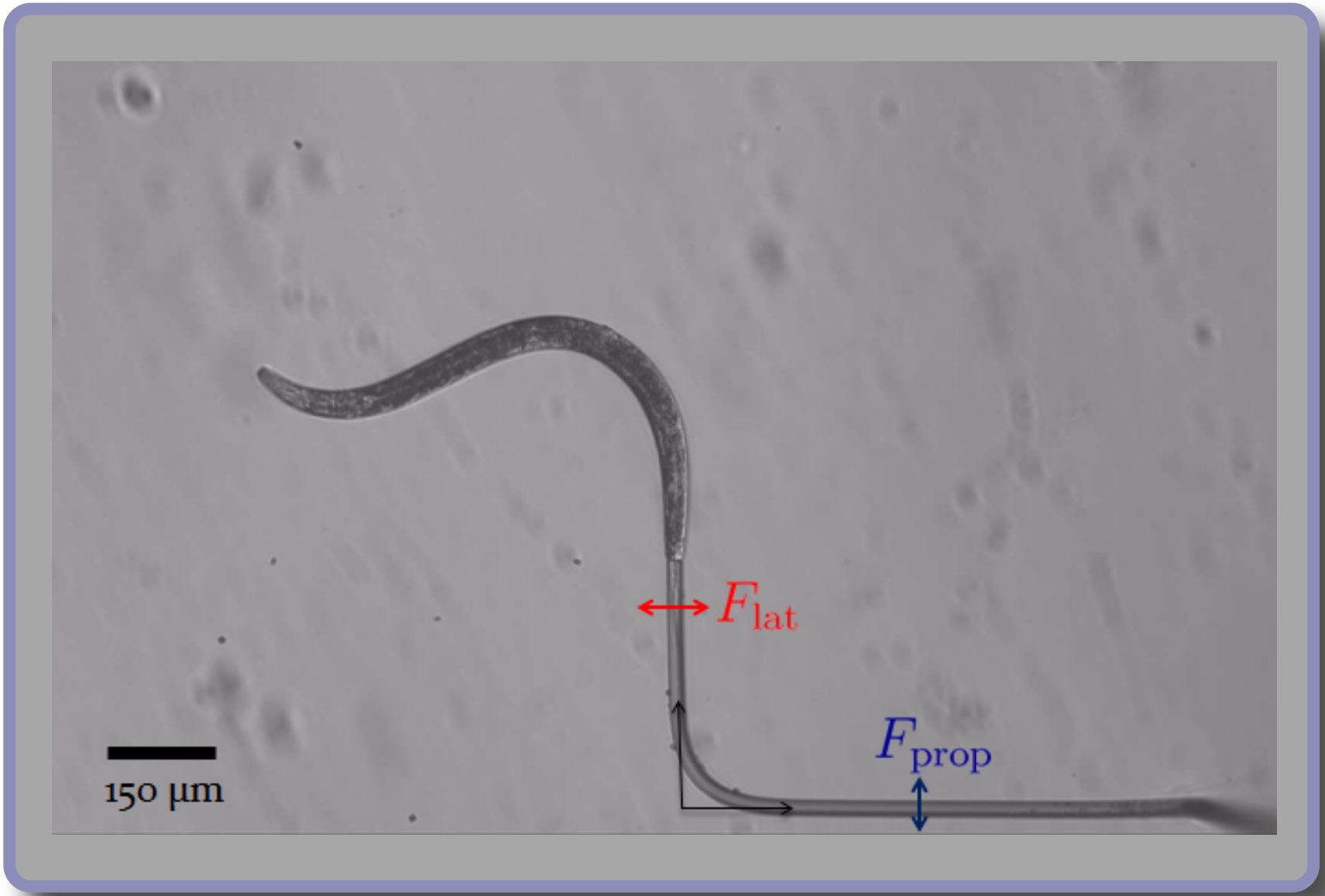
Monday & Thursday, 9:30-10:20, JHE 376

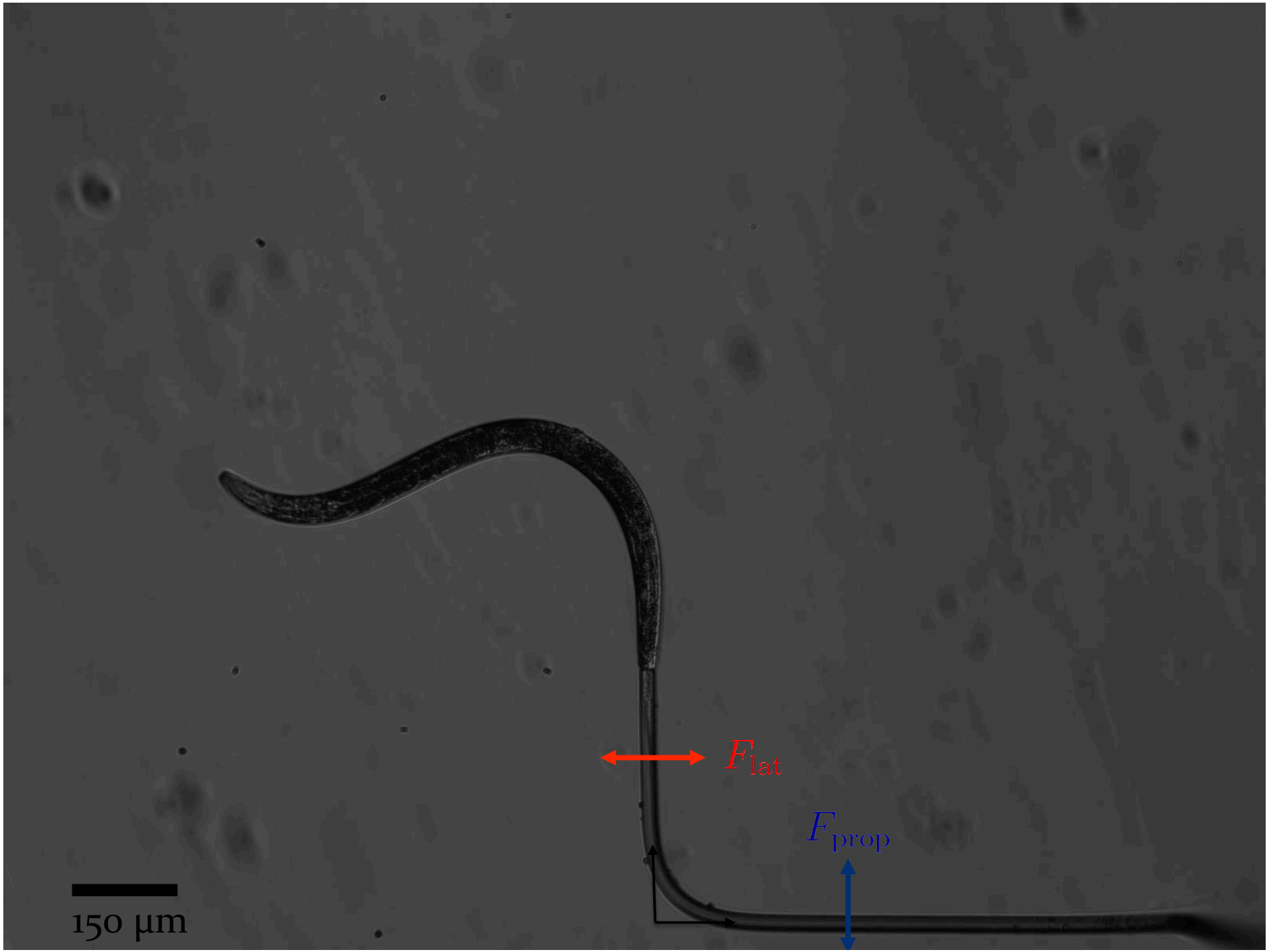
- Lecturer: Kari Dalnoki-Veress
  dalnoki@mcmaster.ca
  Office: ABB 432

Propulsive and lateral motion



Swimming forces




F_{lat}
F_{prop}
150 µm

Physics 1A03

- Introductory course in physics
  - This is a brand new course, redesigned from the ground up with a different focus:
    - **This course is not:**
      - a weeder course
      - a gate keeper to other programs
    - **This course is:**
      - designed to give you an appreciation for physics
      - designed to teach you how to *model* the real world
      - designed with faculty input from other programs
      - designed keeping in mind different backgrounds
      - blended format……

Course Materials

Textbook (Recommended): ***Physics for the Life Sciences, 2nd edition*** by Zinke-Allmang and co-authors is an ideal companion to the material presented.

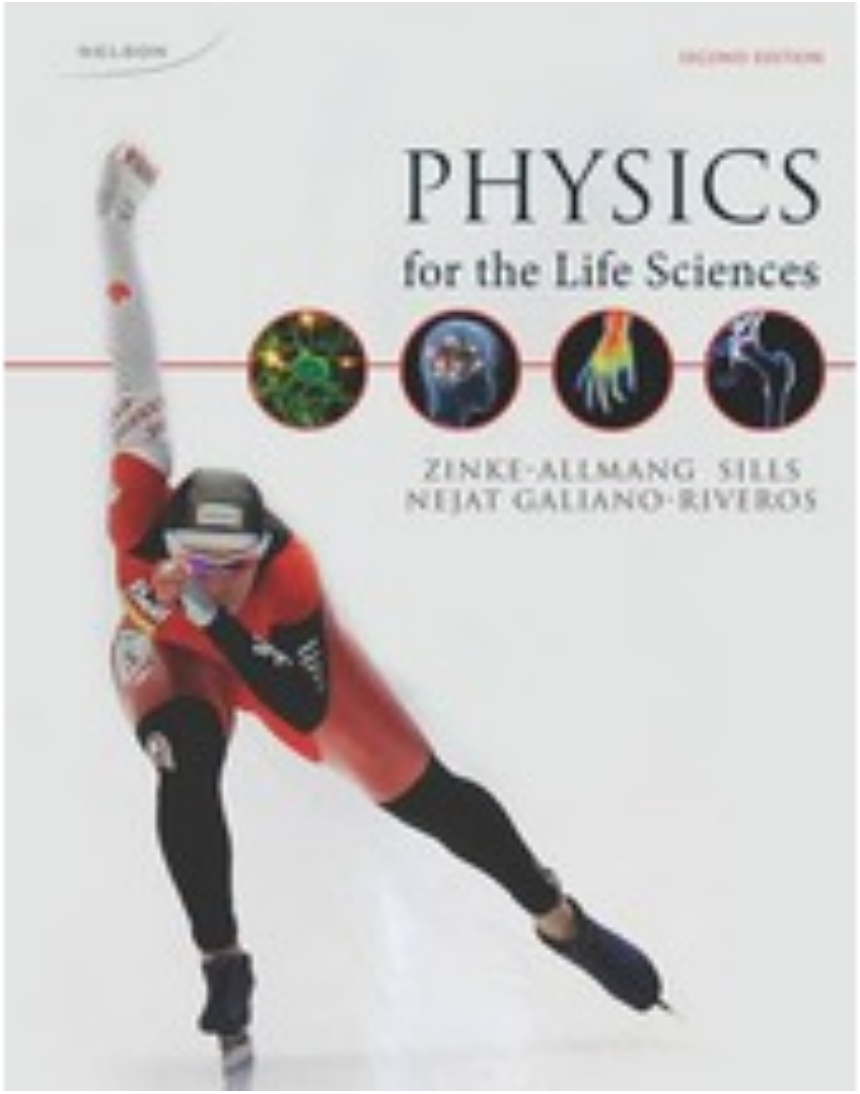
i>clickers (Required): i>clickers will be used in every class and are an integral part of the course.

Lab manual (Required): PHYS 1A03 Laboratory course manual available from the bookstore.

Lab notebook (Required): Black hard cover bound Physics Laboratory Notebooks available from the bookstore.

Calculator (Required): Only the McMaster Standard Calculator will be permitted during tests and examinations

Course Textbook



"Physics for the Life Sciences, 2nd Edition" by Zinke-Allmang

Available in the bookstore

Course Format

- **On-line modules** (11 in total) will provide an introduction to the course material
- **Lectures** (2 hrs per week) will serve to reinforce your understanding of the material
- **Labs** (5 in total: 4 typical labs + 1 home experiment)
- **Homework** will be assigned throughout the term – this may include on-line assignments & quizzes
- **Midterm tests**
  - Friday, October 9, 2015, 7-9 pm
  - Tuesday, November 10, 2015, 7-9 pm
- **Final Exam**
  - see McMaster Examination Timetable

Assessment in the Course

	Option 1	Option 2	Option 3
Class activities (i-clicker questions)	5%	5%	5%
Homework	5%	5%	5%
Labs	20%	20%	20%
Midterm 1	20%	15%	20%
Midterm 2	15%	20%	20%
Final Exam	35%	35%	30%

Avenue to Learn

- Avenue is your main portal into the course material
  - Calendar of events
  - News items
  - Course outline – you must read this in carefully, the outline represents the contract between you and me
  - Online modules
  - Extra resources

- <u>It is your responsibility to check Avenue regularly</u>

LON-CAPA

- "Learning Online Network with Computer Assisted Personalized Approach"
- You log in and receive personalized questions (numbers are different)

https://loncapa.physics.mcmaster.ca

- On a nearly weekly basis questions will be assigned for practice **[these are NOT for marks]**
- **HOWEVER!** In class, we will have you solve one of your homework problems
  - Don't forget to bring yourself some paper!!

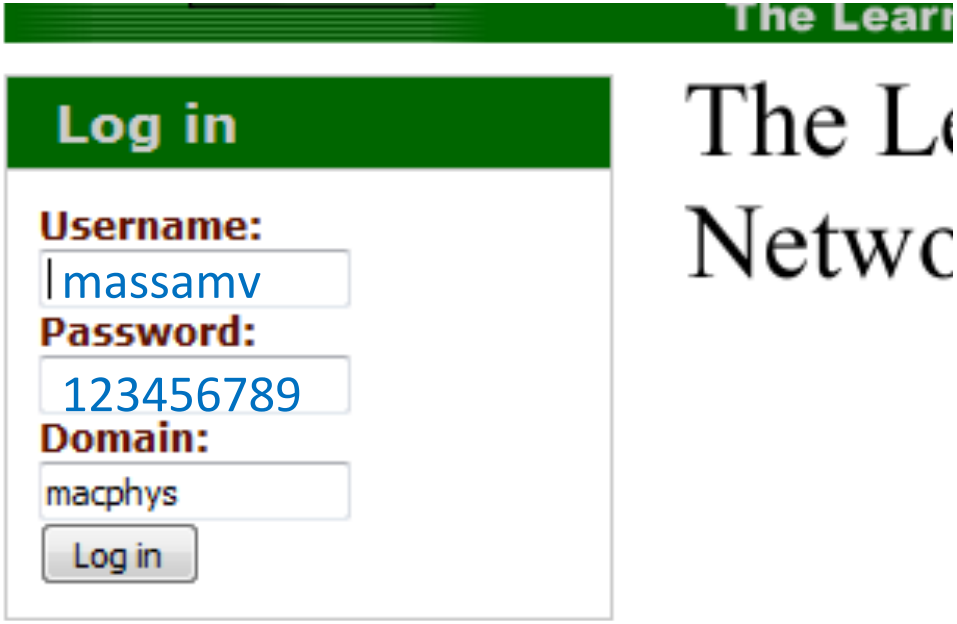
LON-CAPA

https://loncapa.physics.mcmaster.ca

Login:

Username is MacID

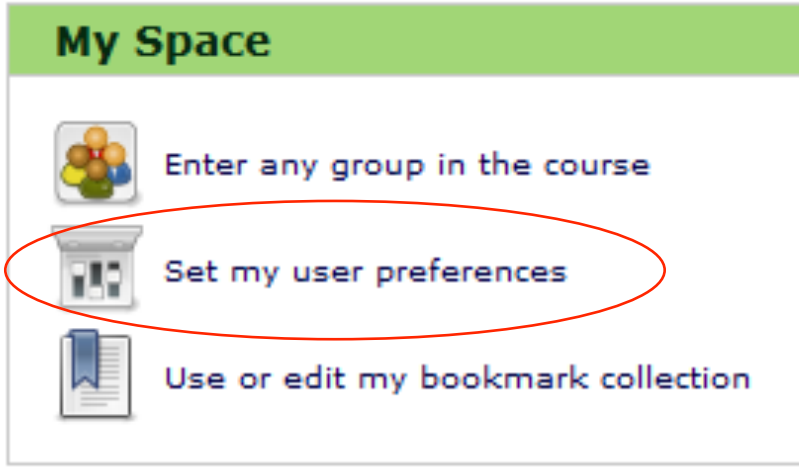
Password is Student #



Change your password!!

Click on “Main Menu”

then find this:



i-Clicker

- We will pose questions in class on a regular basis
  - Multiple choice
  - You click, we get instant feedback!
  - Participation is a crucial part of this course

General in-class questions

strictly participation

In-class Quizzes (based on modules)

additional marks for correct answers

- All questions count towards your total grade for class activities (5%)
- **Must have your iClicker by next class!!**

i-Clicker Registration

- i>clicker Web Registration
- Have questions about clicker registration?
  Contact us at support@iclicker.com or 866-209-5698.
- Thank you for using i>clicker! Please complete the form below. Your professor will then be able to give you credit for using your i>clicker in class.

First Name
Mike

Last Name
Massa

Student ID
massamv

Clicker ID
NOYB123

Labs

- 5 labs during the semester
  - 4 in the lab room
    - Kinematics in 1D
    - Forces
    - Conservation of energy
    - Waves, superposition and reflections
  - 1 home experiment on fluids
- Lab room is BSB B115, there are 18 sections, check your section carefully

Labs

- Labs start Monday September 28 (see AtL for schedule)
- Lab sections alternate week by week:
  - For lab sections L01 to L09:
    - Lab#1 week of 05.10.2015
    - Lab#2 week of 19.10.2015
    - Lab#3 week of 02.11.2015
    - Lab#4 week of 16.11.2015
  - For lab sections L10 to L18:
    - Lab#1 week of 28.09.2015
    - Lab#2 week of 26.10.2015
    - Lab#3 week of 09.11.2015
    - Lab#4 week of 23.11.2015
- Lab#5 will be assigned when we start topic on Fluids

Topics

- Broken up into 4 Themes, with sub-modules (see AtL)
  - Introduction and core concepts
    - Units, conversion, precision, estimation
  - Mechanics
    - Kinematics, forces, energy and momentum
  - Waves
    - Wave motion, superposition, sound, light
  - Fluids
    - Fluids, pressure, surface tension, flow, turbulence

Academic Integrity

- ***If it feels like cheating, it probably is!***

- It is your responsibility to understand what constitutes academic dishonesty.

- For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at

  http://www.mcmaster.ca/academicintegrity/

C01: In-class Quizzes & Homeworks

September

M	T	W	Th	F
	8	9	10	11
14	15	16	17 Q	18
21	22	23	24 Q	25
28	29	30		

October

M	T	W	Th	F
			1 Qh	2
5	6	7	8 Qh	9 MT1
12	13	14	15	16
19	20	21	22 Qh	23
26	27	28	29 Qh	30

November

M	T	W	Th	F
2	3	4	5 Qh	6
9	10 MT2	11	12 Qh	13
16	17	18	19 Qh	20
23	24	25	26 Qh	27
30				

December

M	T	W	Th	F
	1	2	3 Qh	4
7 h	8			

What is Physics?

- The goal of physics is to understand the way the world works
  - It's the study of the fundamental laws of nature

- Why study physics?
  - Physics is at the intersection of many disciplines (biophysics, medical physics, geophysics, etc.), ties these disciplines together, and bridges them to mathematics.

Physics and other areas of Science

- Chemistry – deals with interactions between atoms and molecules
- Medicine – diagnostic equipment and practices
  - Ultrasound & CT scans image using sound/ electromagnetic waves
  - MRI & PET imaging use magnetic properties of atoms and exotic particles (positrons)
- Cell biology
  - Membrane structure and function
- Architecture
  - Structural stability, acoustics, heating, lighting…

The Chain in a cup

The Chain in a cup

Image taken from: http://phys.org/news/2014-01-chain-fountain-problem-solving-partnership-video.html

Can you beat a phone book in a tug-of-war?

Can you beat a phone book in a tug-of-war?

Images taken from:
http://sciphile.org/lessons/phone-book-friction

http://www.france5.fr/emissions/on-n-est-pas-que-des-cobayes/experiences/experience-1-defi-suspendre-une-voiture-avec-deux-annuair-0

How does Physics work?

- Our understanding of the way the world works comes through observation, measurement and modeling
- **Observation** is essential for understanding a phenomenon
  - In physics, observations should be quantitative
- **Measurements** are observations with a numerical value (i.e. a "quantity", rather than a "quality")
  - Quantitative observations can tell us about the consistency and the extent of a phenomenon, how factors affect its behaviour
- **Models** are created to capture the essential features of a phenomenon
  - they offer a concise, often approximate, representation (analogy) for something that is difficult to describe directly

Models in physics

PANIC!!

- What can we say about how people panic in, say, a crowded classroom that's on fire?
- What kind of observations might we make of people leaving a room?

Simulating dynamical features of escape panic

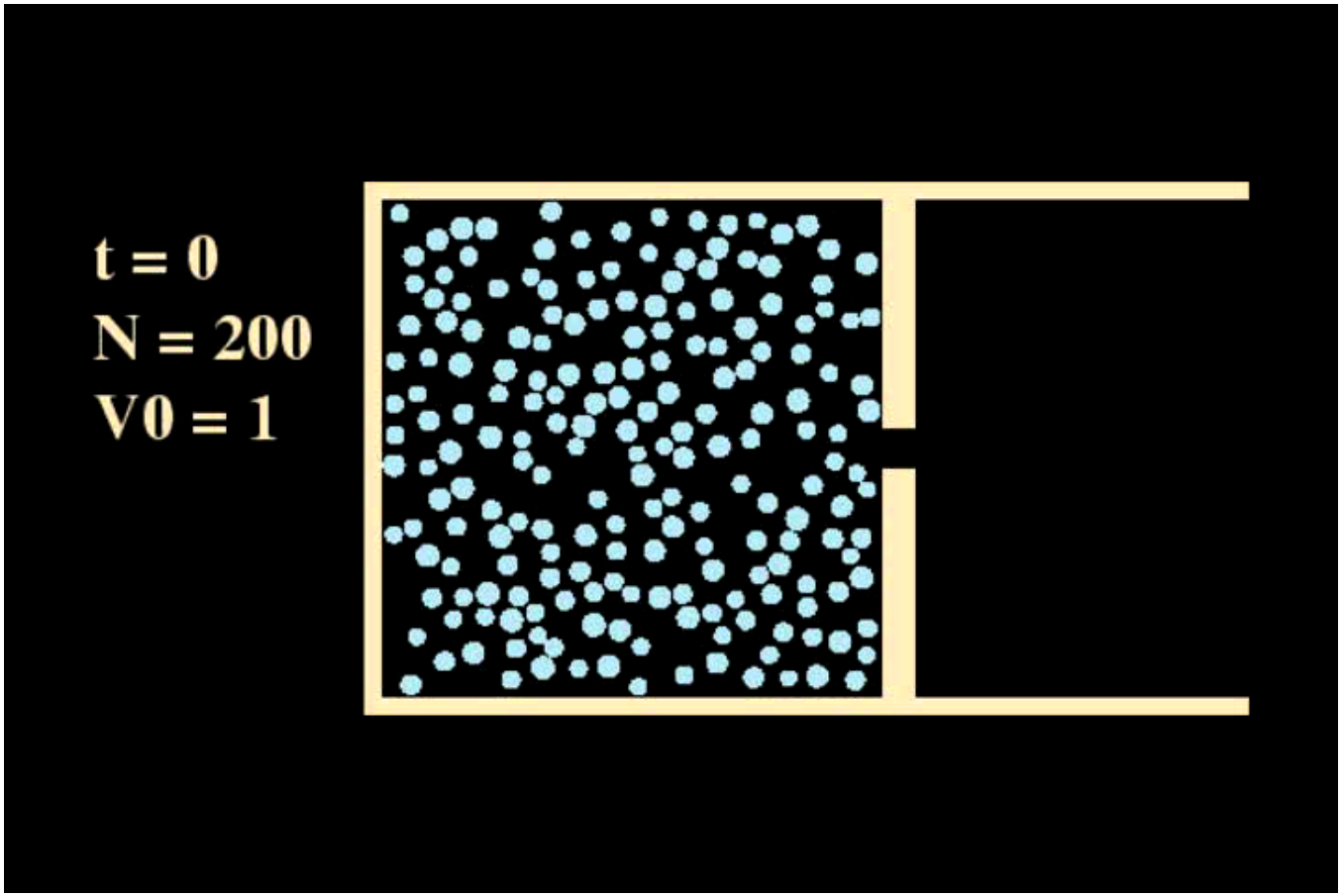
Dirk Helbing*†, Illés Farkas‡ & Tamás Vicsek*‡

* *Collegium Bu*
H-1014 Budape
† *Institute for E*
D-01062 Dresd
‡ *Department o*
H-1117 Budapest, Hungary

$$m_i \frac{\mathrm{d}\mathbf{v}_i}{\mathrm{d}t} = m_i \frac{v_i^0(t)\mathbf{e}_i^0(t) - \mathbf{v}_i(t)}{\tau_i} + \sum_{j(\neq i)} \mathbf{f}_{ij} + \sum_W \mathbf{f}_{iW}$$

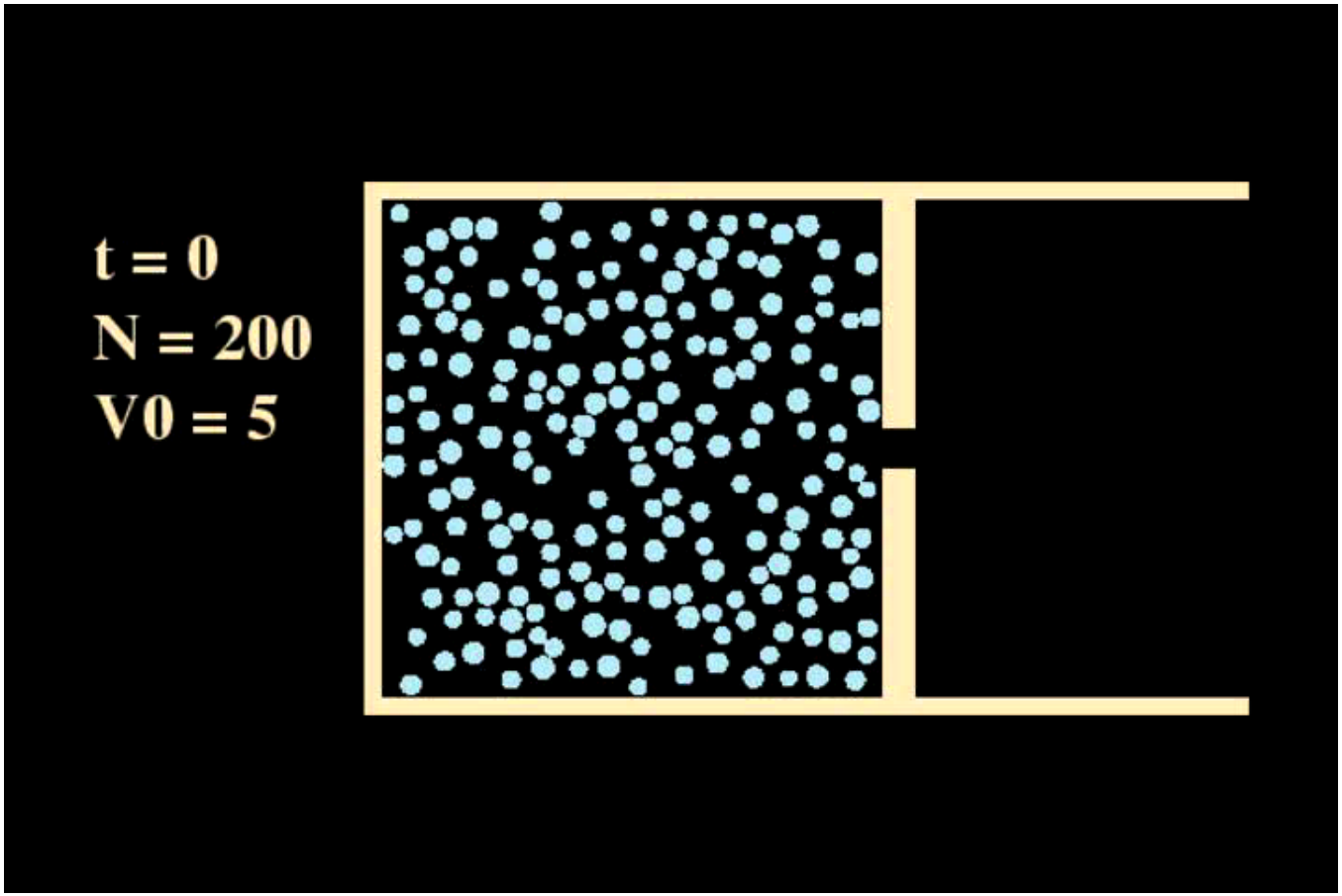
Panic video examples

No Panic 200 people (v = 1)



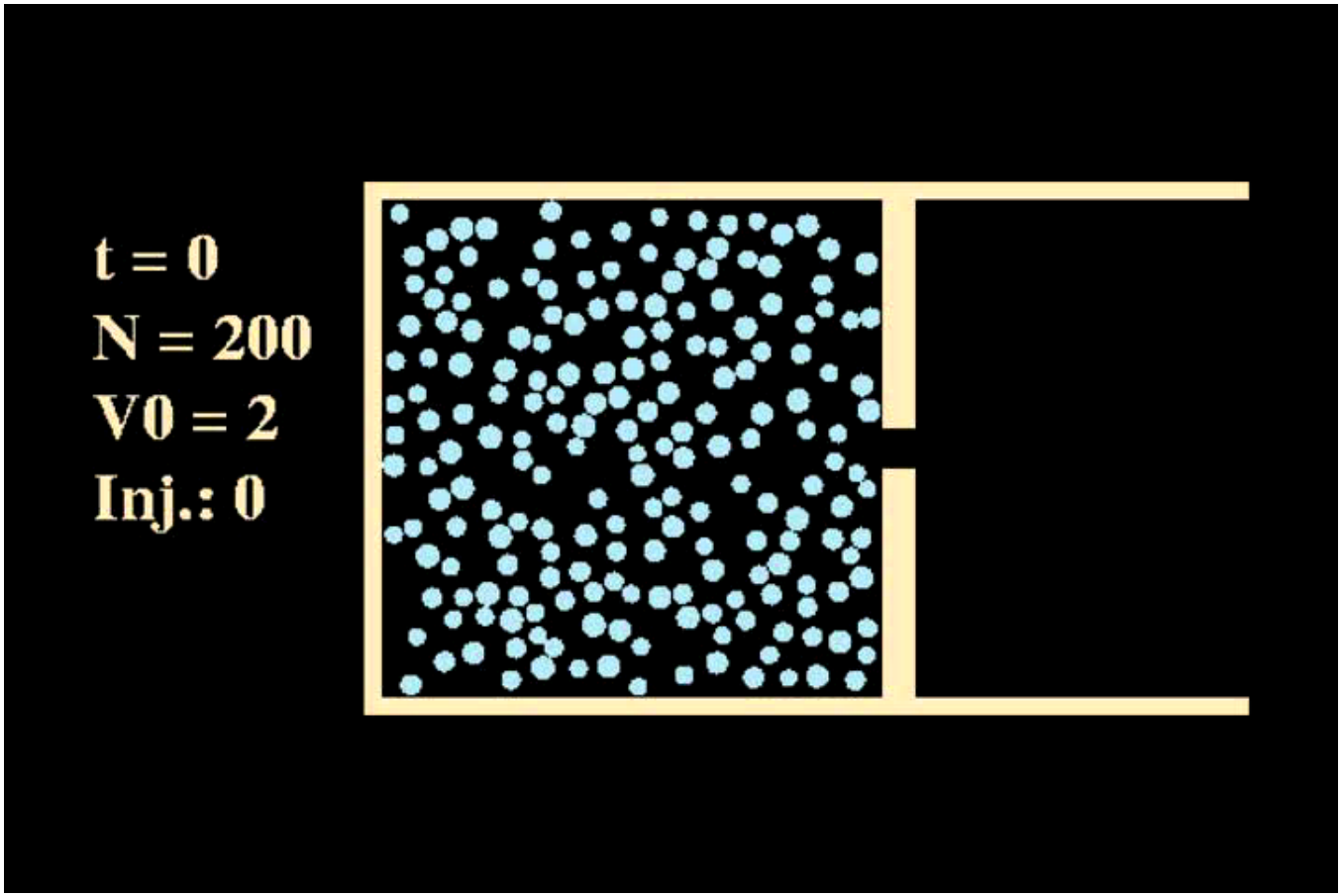
Panic video examples

Panic 200 people, go faster (v=5)



Panic video examples

Fire 200 people, v=2 & introduce injuries



Problem solving

- Lots of people say “physics is hard”.
- It can evoke feelings similar to filling in your forms for university registration
  - You don’t know if you’re doing it correctly, and you’re worried that a single mistake will invalidate the whole process!

1. By far, the biggest mistake people make is giving up before you even get started

2. A second pitfall is thinking that physics is formulaic
   - If you’ve done a problem throwing a ball from a window, then you’ve done them all, and they all solve the same way

Problem solving

1. By far, the biggest mistake people make is giving up before you even get started
   - There are always things that can be done to start a problem
   - Write down what you know, and what you are asked to find
   - Draw a picture of what's going on in the problem

2. A second pitfall is thinking that physics is formulaic
   - Physics is not about memorizing formulas and jamming numbers into them

The real skills that we would like you to develop are:

- Assess what is going on in a problem
- Decide what's relevant
- Know what tools would be needed to solve the problem
- Be able to break the problem down into small steps, and approach the problem systematically

Problem solving

To repeat

- Physics is NOT about memorizing a lot of complicated equations
  - If you take this approach, you will do poorly

- Physics is about understanding a very small number of simple natural laws and learning to apply them to a wide variety of problems
  - We will encounter perhaps 10 important rules/ideas over the course

Closing Comments

- Watch the module T1M1
- **Next class:**
  - Units and unit conversion
  - Dimensional analysis
  - Proportionality
  - Vectors
    - If you have never worked with vectors, watch the additional **Vector Module** for an introduction
    - If you have vector experience, take a quick look through the **Vector Review Notes** posted
- **In one week:**
  - We will begin class with a clicker quiz on T1M1

Module Dos and Don'ts

- Writing stuff down:
  - Build your own formula sheet
  - Consider writing down formulas, and even write down what each symbol is in the formula.
  - Ex: $v_f = v_i + a\Delta t$

    v_i initial velocity
    v_f final velocity
    a acceleration
    Δt time interval
  - You'll notice that there are often Checkpoints on slides immediately afterwards, which build your understanding of the formulas (so, write them down!)
  - Evaluate your comfort/understanding level after watching the module
  - **ENJOY!!!**