# Laboratorio 1

Universidad de Buenos Aires –
Exactas
**departamento de física**

Agosto 2021

CATEDRA

Verónica Raspa

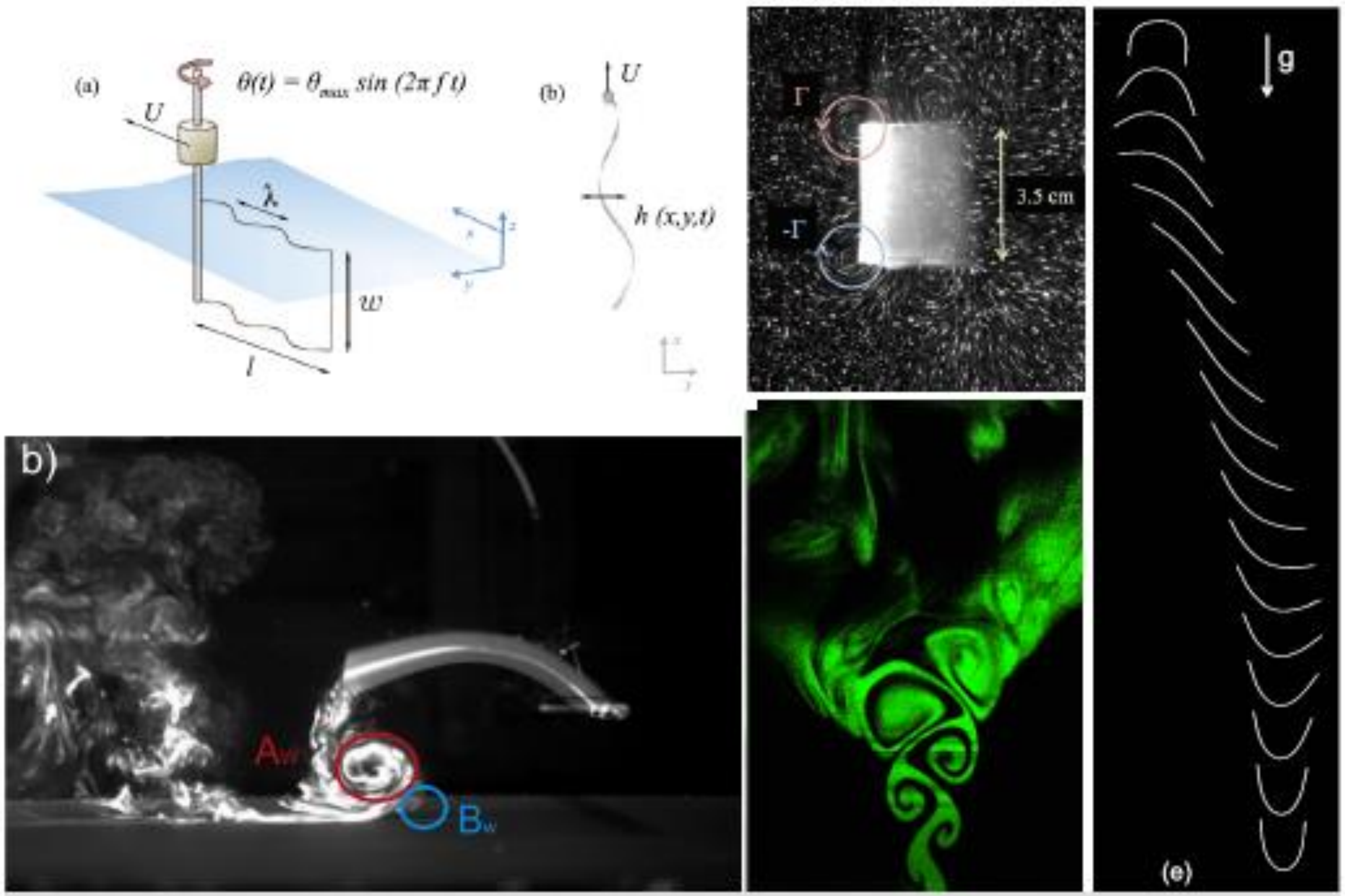
Gianni Moretti

Melisa Vinograd

Laura Steren

# Laboratorio de Interacción Fluido – Estructura

IFIBA, UBA-CONICET

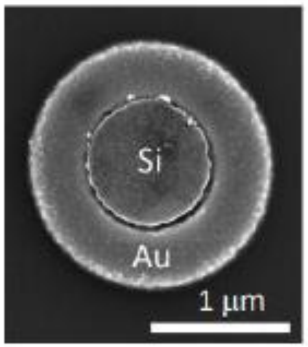



Transporte y dinámica de estructuras flexibles en fluidos.
Biomimética.

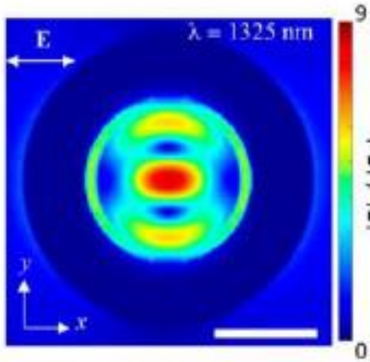
Verónica Raspa

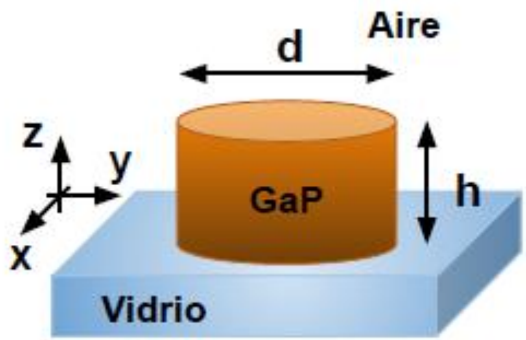
# Laboratorio de electrónica cuántica

Imagen SEM




Simulaciones

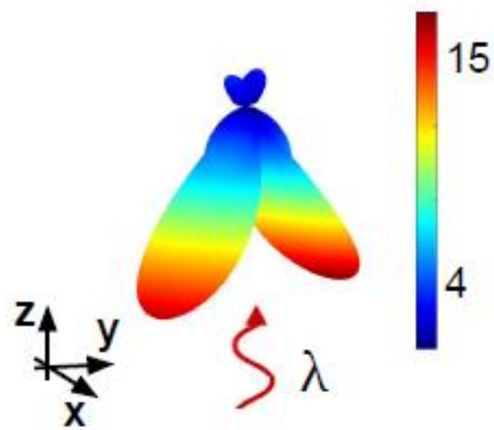


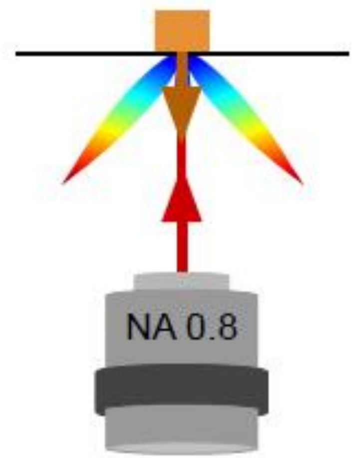





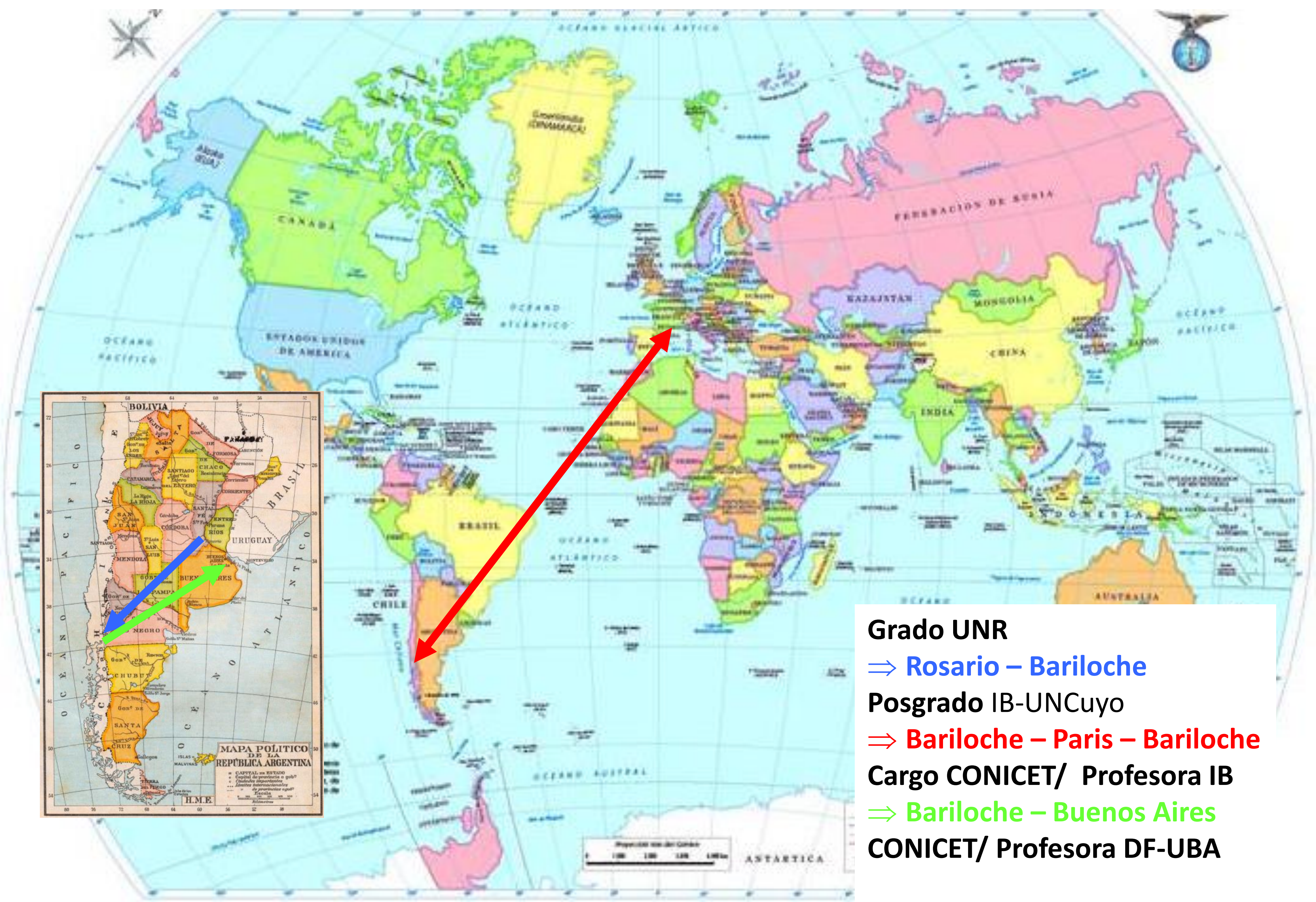
Gianni Moretti

Diseño de experimentos con asistencia de simulaciones numéricas




Inicio / Ministerio de Economía / Energía / Comisión Nacional de Energía Atómica / XIX Encuentro de Superficies y Materiales Nanoestructurados
XIX Encuentro de Superficies y Materiales Nanoestructurados
Con ponencias y conferencias plenarias, investigadores de distintas disciplinas del sector científico argentino se reúnen en la CNEA y en el INTI para escuchar los últimos avances en el área de la nanociencia y la nanotecnología.




**Grado UNR**

⇒ Rosario – Bariloche

**Posgrado** IB-UNCuyo

⇒ Bariloche – Paris – Bariloche

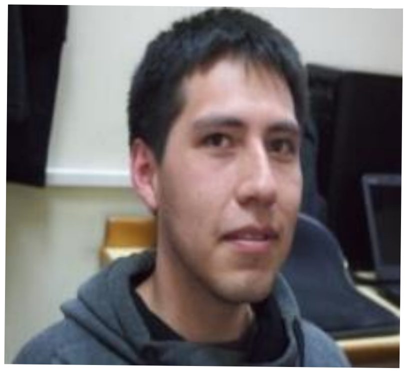
**Cargo CONICET/ Profesora IB**

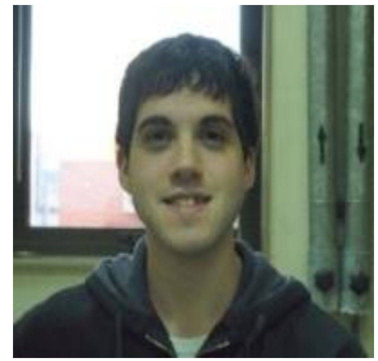
⇒ Bariloche – Buenos Aires

**CONICET/ Profesora DF-UBA**

**Laboratorio de Nanoestructuras Magneticas y Dispositivos**

Instituto de Nanociencia y Nanotecnologia CNEA-CONICET



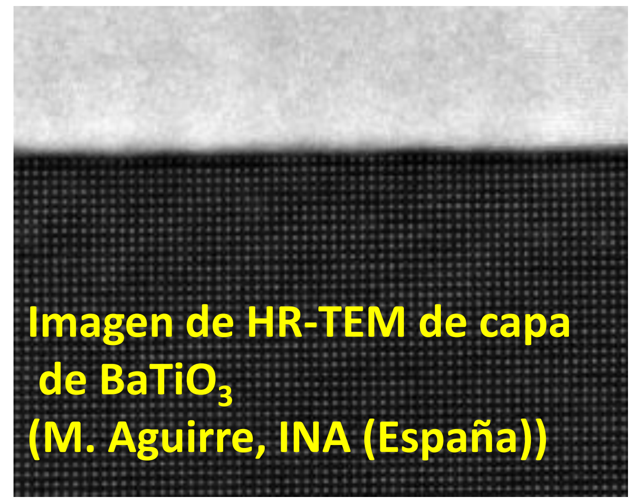


# Magnetismo y electrónica de espin en la nanoescala

Antes que nada, contarles que el magnetismo es un fenómeno cuántico

Que las distancias interatómicas son del orden de decimas de nm y las interacciones magnéticas/ electrónicas ocurren en esas escalas

Además que la longitud característica del transporte eléctrico es del orden de decenas a centenas de nm en películas y heteroestructuras

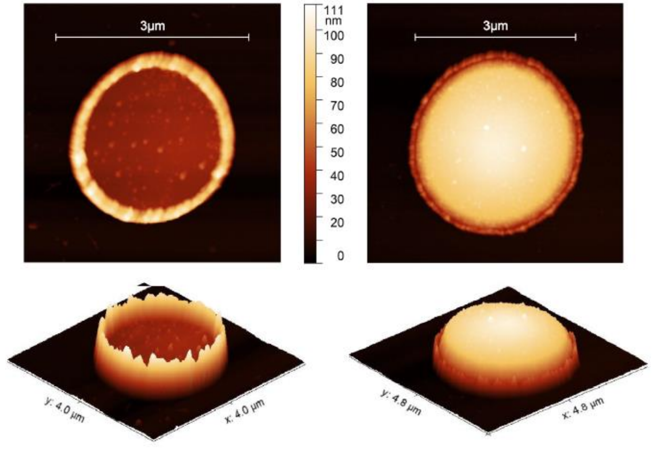


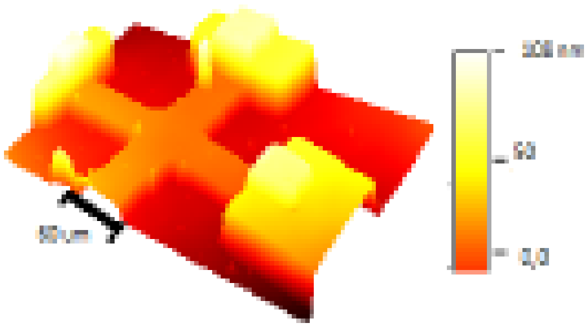

+ Ciencia fundamental

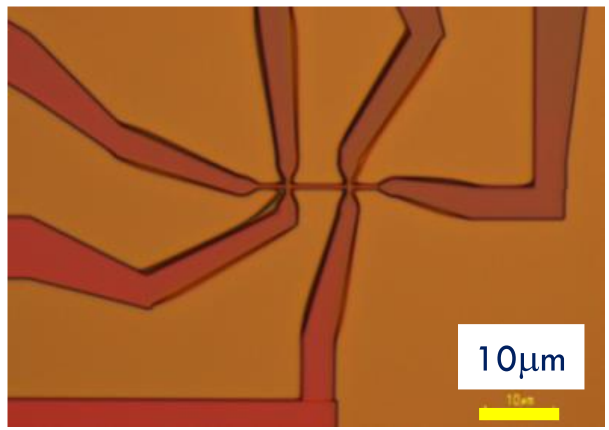
- Introducción de nuevos conceptos
- Descubrimiento de fenómenos
- Diseño  de materiales a medida para la investigación de un fenómeno en particular

+ Física aplicada

- Diseño de materiales artificiales multifuncionales
- Sensores de campo magnético
- Plataformas tipo “lab-on-a-chip” para  diagnostico de enfermedades infecciosas

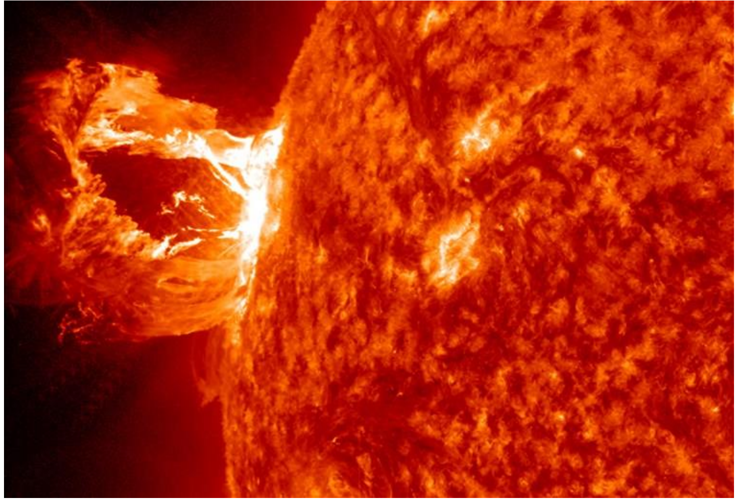


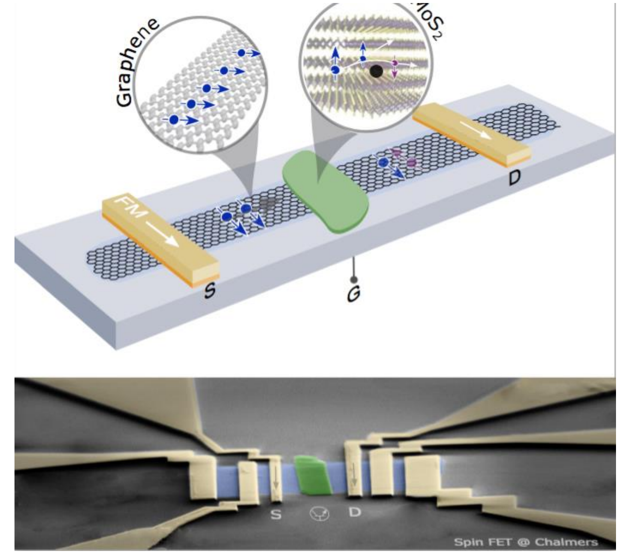





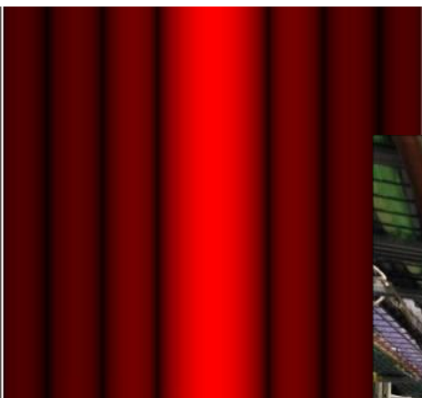

**Sala Limpia CAC  Fabricacion de dispositivos micro y nanoestructurados**

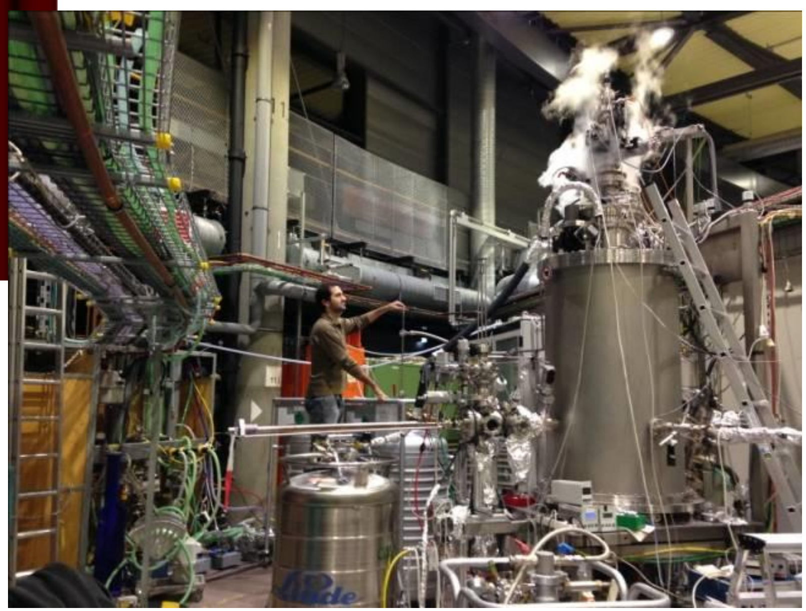
Instituto de Nanociencia y Nanotecnologia CNEA-CONICET

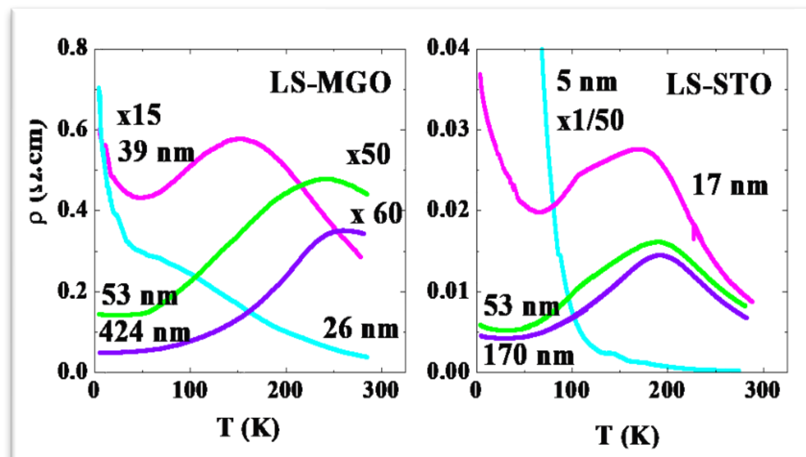





# Física Experimental







## El sentido de la física experimental

## que dice Feynman sobre ello.....

**No importa cuan bella sea tu teoría, no importa cuan inteligente seas. Si la teoría no coincide con los experimentos, esta mal. En esa simple declaración esta la clave de la ciencia.**

It doesn´t matter how beautiful your theory is, it doesn´t matter how smart you are. If it doesn´t agree with experiment, it´s wrong. In that simple statement is the key to science

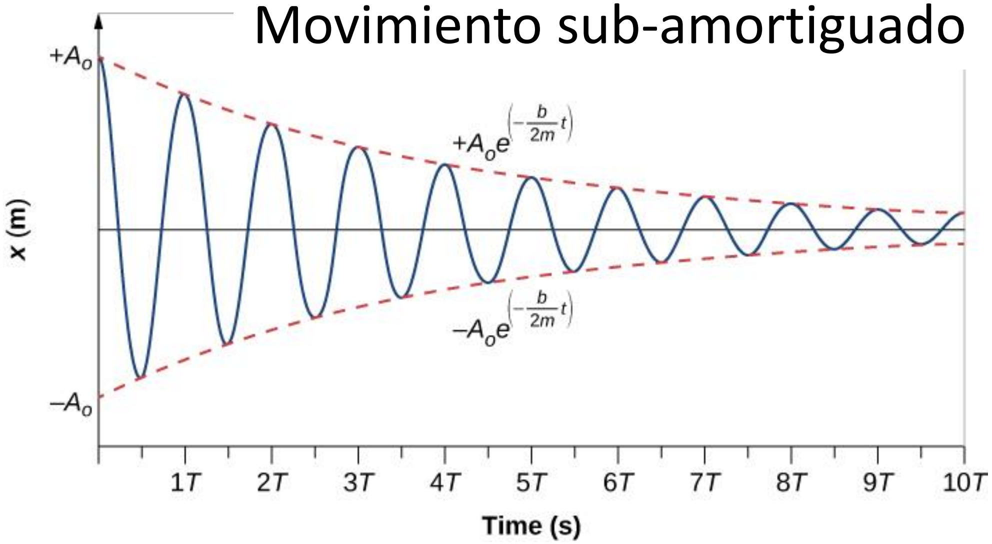
Richard Feynman, Cornell University Lecture 1964

## Como se hace física experimental  en un laboratorio de investigación fundamental o aplicada

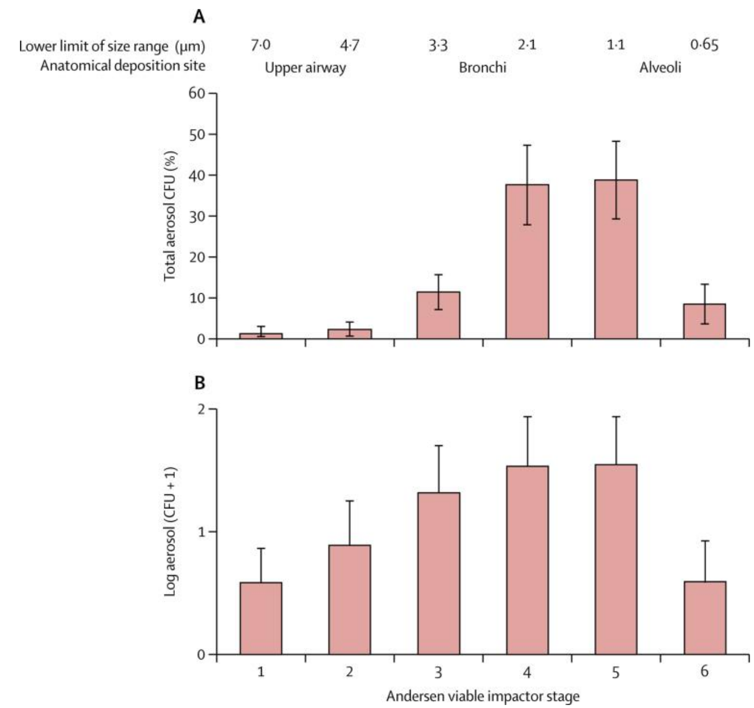
- Define del problema a investigar/ resolver
- Evalúan estrategias para encarar el problema (plan A, plan B)
- Diseña y se pone a punto el (o  los) experimento(s) para resolver el problema
- Se realiza(n) los experimentos, obteniendo resultados
- Se analizan e interpretan  de los resultados
- Se extraen conclusiones sobre el trabajo realizado

# Como se miran y analizan los resultados

Movimiento sub-amortiguado




Tamaño aerosoles enfermedades infecciosas




## Chemicals & Substances

| Substance | BP (C) | BP (F) |
|---|---|---|
| Acetaldehyde | 20.8 | 69 |
| Acetic Acid Anhydride | 139 | 282 |
| Acetone | 50.5 | 133 |
| Acetylene | -84 | -119 |
| Alcohol - allyl | 97.2 | 207 |
| Alcohol - butyl-n | 117 | 243 |
| Alcohol - ethyl (grain, ethanol) | 79 | 172.4 |
| Alcohol - methyl (wood, methanol) | 64.7 | 151 |

# Como se comunica la ciencia

**Artículos / Patentes** (u otra herramienta de protección de propiedad intelectual)

**Charlas**

ARTICLE

https://doi.org/10.1038/s41586-018-0770-2

## Scalable energy-efficient magnetoelectric spin-orbit logic

Sasikanth Manipatruni[1]*, Dmitri E. Nikonov[1], Chia-Ching Lin[1], Tanay A. Gosavi[1], Huichu Liu[2], Bhagwati Prasad[3], Yen-Lin Huang[3,4], Everton Bonturim[3], Ramamoorthy Ramesh[3,4,5] & Ian A. Young[1]

**Since the early 1980s, most electronics have relied on the use of complementary metal-oxide-semiconductor (CMOS) transistors. However, the principles of CMOS operation, involving a switchable semiconductor conductance controlled by an insulating gate, have remained largely unchanged, even as transistors are miniaturized to sizes of 10 nanometres. We investigated what dimensionally scalable logic technology beyond CMOS could provide improvements in efficiency and performance for von Neumann architectures and enable growth in emerging computing such as artifical intelligence. Such a computing technology needs to allow progressive miniaturization, reduce switching energy, improve device interconnection and provide a complete logic and memory family. Here we propose a scalable spintronic logic device that operates via spin-orbit transduction (the coupling of an electron's angular momentum with its linear momentum) combined with magnetoelectric switching. The device uses advanced quantum materials, especially correlated oxides and topological states of matter, for collective switching and detection. We describe progress in magnetoelectric switching and spin-orbit detection of state, and show that in comparison with CMOS technology our device has superior switching energy (by a factor of 10 to 30), lower switching voltage (by a factor of 5) and enhanced logic density (by a factor of 5). In addition, its non-volatility enables ultralow standby power, which is critical to modern computing. The properties of our device indicate that the proposed technology could enable the development of multi-generational computing.**

Transistor technology scaling[1-3] has been enabled by controlling the conductivity of a semiconductor using an electric field applied across

### Beyond-CMOS devices for replacing or enhancing the electronic transistor

### Gmr sensor

**Abstract**

A system includes a first sensor, a field source, and a processor. The first sensor includes a surface and has an electrical resistance determined by a magnetic field at the surface. The field source is configured to provide a biasing magnetic field to the surface. The biasing magnetic field is aligned parallel to the surface and aligned perpendicular relative to the surface. The magnetic field has a frequency. The processor is coupled to the sensor and is configured to determine a parameter based on a measure of a change in the resistance. The change in the resistance corresponds to the resistance at a time before onset of a magnetic field perturbance at the surface and a time after the onset of the magnetic field perturbance at the surface.

**Classifications**

- G01N27/72 Investigating or analysing materials by the use of electric, electrochemical, or magnetic means by investigating magnetic variables

*View 3 more classifications*

WO2012068139A1
WIPO (PCT)

Download PDF | Find Prior Art | Similar

**Other languages:** French

**Inventor:** Jian-Ping Wang, Yuanpeng Li

**Worldwide applications**

2011 · US WO US WO

**Application PCT/US2011/060828 events**

- **2010-11-15** • Priority to US41388410P
- 2010-11-15 · Priority to US61/413,884
- **2011-11-15** • Application filed by Regents Of The University Of Minnesota
- **2012-05-24** • Publication of WO2012068139A1

**Info:** Patent citations (82), Non-patent citations (1), Cited by (12), Legal events, Similar documents, Priority and Related Applications

**External links:** Espacenet, Global Dossier, PatentScope, Discuss

Description

Claims

Hide Dependent


istance determined
d to the surface, the
ligned perpendicular
cy; and
mine a parameter

# Laboratorio 1

- Introducción a la física experimental. Medidas, estadística, errores
- Experimentos de Mecánica Clásica FISICA

  Cinemática

  Dinámica

  Elasticidad

  Rodamiento

Definición de estrategia(s) para abordar el problema

Diseño y montaje del experimento

Mediciones

Análisis de datos

Conclusiones

- Comunicar por medio de informes
- Charlas / presentaciones

## METAS

- Aprender Fisica desde los experimentos
- Diseñar y montar experimentos. Aprender a “medir”
- Comunicar  (discusiones a lo largo del curso, informes, charlas)
- Trabajar en equipo

# Practicas

- Estadistica
- Caida libre
- Pendulo Simple
- Trayectoria
- Rozamiento
- Ley de Hooke, estatica y dinamica
- Momento de inercia
- Practica especial

**Bibliografía pagina web de la materia**
**Preparación previa a la clase**

https://www.df.uba.ar/es/docentes/paginas-de-materias

# Organización de las clases

**Miércoles**

08:00 -10:00
* Introducción teórica al experimento
* Materiales y programas necesarios

10:00 -14:00#
* Trabajo en los experimentos. Consultas y discusiones

Todas las clases habrá dos grupos que presenten lo hecho en el día, antes del corte de clases (11:30hs, 10' por grupo)

En las oportunidades en que no haya que entregar informes, todos los grupos harán una presentación informal de los resultados obtenidos la semana precedente, discutiéndolos con nosotros dentro de cada grupo y a lo largo de la clase.

# Organización del curso

# CRONOGRAMA

| Fecha | Tema | Actividad | Exp. nº | Entrega |
|---|---|---|---|---|
| 3/9 | Presentación. Organización del curso.<br>Horarios, distribución de grupos.<br>Condición de aprobación de la materia. | • Presentación.<br>• Formación de los grupos de a tres estudiantes.<br>• Determinación de horarios de consulta<br>• Materiales necesarios<br>• Programas para adquisición y análisis de datos.<br>• Esquema de informe: ejemplo<br>• Evaluación de la materia | | |
| 10/9 | Introducción a la Física Experimental.<br>Incertidumbres.<br>Clasificación de errores.<br>Errores absolutos, relativos y porcentuales<br>Diferencias significativas | **Mediciones. Incertidumbres. Tipo de errores.**<br>Resolución, precisión. Mostrar regla/ otros instrumentos para medir longitud….<br>Cifras significativas cuando definís incertezas<br>Planificación del experimento.<br>**Experimento:** Medición de longitud de diferentes objetos. Criterio de exclusión de datos<br><br>Introducción al IMAGE J | 1 | |
| 17/9 | Estimadores. Determinación de incertezas estadísticas. Distribución Gaussiana. | Histogramas. Superposición. Histograma de los promedios. Confección de histograma. Análisis distribuciones (ejemplos).<br><br>Introducción herramientas básicas para el análisis estadístico de datos. | | |
| 24/9 | Mediciones directas.<br>Caída libre | **Propagación de errores.**<br>**Experimento: Caída libre .**<br>Planificación del experimento: importancia de las variables, análisis de riesgo, discusión de instrumental a usar y su implicancia en el resultado.<br><br>Introducción PhyPhox | 2 | Informe 1 |
| 1/10 | Mediciones indirectas.<br>Péndulo simple | **Ajustes por mínimos cuadrados**<br>**Experimento: Péndulo simple**<br>Determinar la constante *g* a partir de la medición de períodos del péndulo montando con hilos de distinta longitud. | 3 | Informe 2 |

⋮

# Evaluación

**+ Trabajo en clase** – participación / grupo

**+ Informes** (R: 4-5 , B: 6-7, MB: 8-9, S: 10)
La corrección de los informes será realizada por los distintos integrantes de la catedra

Se valora pendiente y no el promedio necesariamente.

**+ Presentaciones**

**+ Exposición final por grupos**


## Vamos a trabajar en equipo

**Hasta el viernes 20/8 recibiremos propuestas de grupos de cuatro personas. Luego, los grupos se organizaran desde la categra**

## TRABAJO EN EQUIPO

**Porque? Es la manera de optimizar nuestro trabajo**

**Suma de ideas / trabajo**

**Es la manera en que se trabaja en Ciencia**

**Porque en Labo 1? Es necesario aprender a trabajar en equipo**

* Discutir con compañeros (intra e inter grupos )
* Escuchar/ aprender/ construir
* Todos trabajan!!

# Acerca de los informes

<u>**Presentacion de cinco informes**</u>

**1) Estadistica**
**2) Pendulo simple**
**3) Trayectoria**
**4) Ley de Hooke**

**5) Practica especial**

<u>**Formato**</u> **pdf, a una columna, separacion entre renglones 1.5 lineas**

**Envio por email**

## Contenido del Informe

- Titulo
- Lista de autores
- Resumen

1. Introducción teórica/ antecedentes problema
2. Detalles Experimentales
3. Resultados  y discusión

   Gráficos

   Tablas

4. Conclusiones
5. Bibliografía/ Referencias

Algo así....

# A comparison of gravitational acceleration measurement methods for undergraduate experiment

N Suwanpayak*[1], S Sutthiyan[2], K Kulsirirat[3], P Srisongkram[1], C Teeka[4] and P Buranasiri[2]

[1] Department of General Science, King Mongkut's Institute of Technology Ladkrabang, Prince of Chumphon Campus, Chumphon, Thailand
[2] Department of Physics, King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand
[3] Department of General Science Education, Faculty of Education, Rajabhat Rajanagarindra University, Chachoengsao, Thailand
[4] Department of Teaching Physics, Faculty of Science and Technology, Suan Dusit University, Thailand

Email: ksnathap@gmail.com

**Abstract.** This research aimed to determine the acceleration due to gravity (*g*), by using the methods of free fall, simple pendulum, physical pendulum and an Atwood's machine in the undergraduate laboratory. The experiments were designed for students to explore, analyze the data and interpreting the results by using the principle of a Physics laboratory. The mean experimental values of acceleration due to the gravity of free fall, simple pendulum, physical pendulum and the Atwood's machine were 9.64 m/s$^2$, 9.67 m/s$^2$, 10.88 m/s$^2$ and 10.47 m/s$^2$, respectively.

## 1. Introduction

Acceleration due to the gravity of the Earth is denoted by the symbol *g* which is the acceleration of a body caused by the gravitational field acting on the body towards the center of the Earth, neglecting air resistance and mass. Gravitational acceleration (*g*) was first determined by Galileo Galilei in 1604. The law of gravitational attraction was formulated by Sir Isaac Newton (1642-1727) and published in 1687. The magnitude of *g* varies over the surface of the Earth in which many measurements were undertaken at different locations on the earth [1]. JS Clark [2] and AH Cook [3] measured the absolute *g* constants by using a reversible pendulum and free motion experiments, respectively. Both the experiments of *g* values were very close to the mean of *g* absolute determination by using other methods. After that, the absolute *g* value was determined by Cook [4] using the British Fundamental Gravity Station in the N.P.L. getting 981181.75 mgal and the National Bureau of Standards near Gaithersburg, Maryland getting 980.1018 cm/s$^2$ [5] with a standard deviation of 0.0005 cm/s$^2$. Recently, gravity was investigated to obtain the local ...r of a test mass in the KRISS Watt balance system. The mean ... mass in the KRISS Watt balance was (979 832 568.9 ± 5.0) ...3±0.001) m [6]. The numerical value of the acceleration of ...9.8 m/s$^2$. On the moon, the gravitational acceleration is one-

Siam Physics Congress 2018 (SPC2018) : A Creative Path to Sustainable Innovation IOP Publishing
IOP Conf. Series: Journal of Physics: Conf. Series **1144** (2018) 012001 doi:10.1088/1742-6596/1144/1/012001

**Titulo**

# Strain-gradient effects in nanoscale-engineered magnetoelectric materials

**Autores**

Aliona Nicolenco,[1,2] Muireann de h-Óra,[3] Chao Yun,[3] Judith MacManus-Driscoll,[3,a)] and Jordi Sort[1,4,a)]

**Resumen (max. 100 palabras)**

ABSTRACT

Understanding strain gradient phenomena is of paramount importance in diverse areas of condensed matter physics. This effect is responsible for flexoelectricity in dielectric materials, and it plays a crucial role in the mechanical behavior of nanoscale-sized specimens. In magnetoelectric composites, which comprise piezoelectric or ferroelectric (FE) materials coupled to magnetostrictive (MS) phases, the strain gradient can add to any uniform strain that is present to boost the strength of the coupling. Hence, it could be advantageous to develop new types of functionally graded multiferroic composites (for information technologies) or magnetic-field-driven flexoelectric/magnetostrictive platforms for wireless neurons/muscle cell stimulation (in biomedicine). In MS or FE materials with non-fully constrained geometries (e.g., cantilevers, porous layers, or vertically aligned patterned films), strain gradients can be generated by applying a magnetic field (to MS phases) or an electric field (to, e.g., FE phases). While multiferroic composites operating using uniform strains have been extensively investigated in the past, examples of new nanoengineering strategies to achieve strain-gradient-mediated magnetoelectric effects that could ultimately lead to high flexomagnetoelectric effects are discussed in this Perspective.

 https://doi.org/10.1063/5.0037421

## 1. Introduccion  Antecentes del tema, teoria

Todas las formulas incluidas deben estar numeradas y citadas en el texto

$$\boldsymbol{E} = \rho_{\perp}(B)\boldsymbol{J} + [\rho_{\parallel}(B) - \rho_{\perp}(B)][\boldsymbol{\alpha} \cdot \boldsymbol{J}]\boldsymbol{\alpha} + \rho_{\mathrm{H}}(B)\boldsymbol{\alpha} \times \boldsymbol{J}\,, \tag{3}$$

## 2. Detalles experimentales

Esquema del experimento - montaje y detalles de elementos utilizados

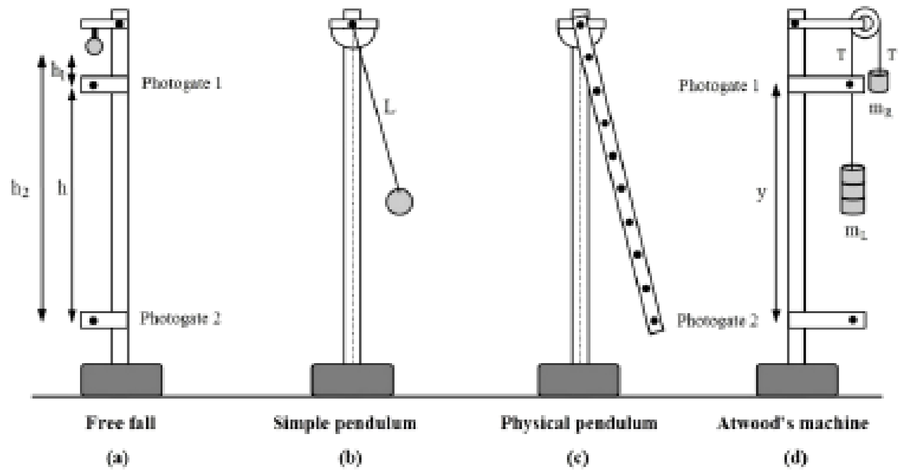



**Figure 1.** Free body diagram of the experiments set up to measure gravitational acceleration.

# 3. Resultados y discusiones

Figuras y descripcion de las mismas
(comportamiento observado, rangos de validez de modelos, etc)

tures vary while no hysteresis is observed. Compressive strain (on LAO) induces three distinct insulating regions. Between 70 K and 400 K, little difference is observed in the insulating behavior. Below ∼200 K, the magnetoresistance (MR), defined as $MR = [(R_0 - R_H)/R_H] \times 100\%$, where $R_H$ and $R_0$ are, respectively, the resistances under field = H and 0, has a weak temperature dependence (Fig. 2(d)), which then increases sharply below 70 K. Since the sample resistance exceeded measurable ranges below 60 K, the absolute MR at low temperatures may be much higher than the 40% value shown. The nominally matched LSAT sample shows four insulating regions below 400 K, while presenting the strongest MR response with a maximum of 140% at 10 K. It is worth noting that unlike other manganite compositions exhibiting colossal magnetoresistance in which MR presents itself in a

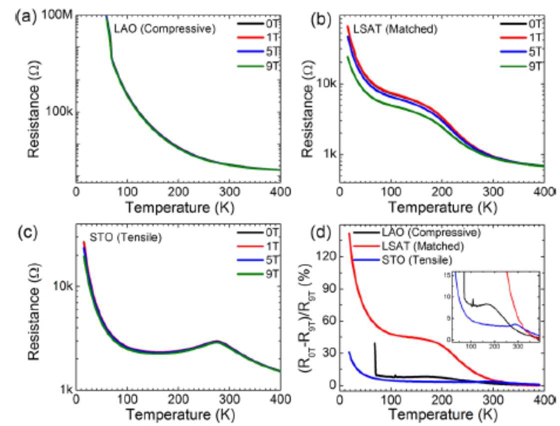



FIG. 2. Resistance as a function of temperature loops under increasing out-of-plane magnetic fields for (a) compressively strained film on LAO, (b) lattice matched film on LSAT, and (c) tensile strained film on STO. (d) MR at 9 T for each of the three films.

Si los datos se vuelcan sobre una figura NO hace falta agregar tabla de esos mismos datos

Las tablas tambien van numeradas

TABLE 3 Analysis Data and Calculation Results of True Boiling Point Distillation

| Boiling Point Range, °C | Yield of Each Fraction, m% | | Density (20°C), g/cm³ | | |
|---|---|---|---|---|---|
| | Analysis | Before Adjustment | Analysis | Estimation | Relative Error |
| ∼60 | 2.77 | 2.58 | 0.655 | 0.6441 | 0.0167 |
| 60∼80 | 2.2 | 2.94 | 0.7096 | 0.6989 | 0.0150 |
| 80∼100 | 3.78 | 2.57 | 0.74 | 0.7200 | 0.0270 |
| 100∼130 | 6.07 | 5.77 | 0.7599 | 0.7329 | 0.0355 |
| 130∼150 | 4.19 | 5.2 | 0.7841 | 0.7505 | 0.0428 |
| 150∼180 | 5.56 | 5.96 | 0.7991 | 0.7649 | 0.0428 |
| 180∼200 | 2.92 | 3.21 | 0.8112 | 0.7680 | 0.0533 |
| 200∼230 | 4.39 | 5.05 | 0.8224 | 0.7821 | 0.0490 |
| 230∼250 | 4.34 | 5.48 | 0.848 | 0.7933 | 0.0645 |
| 250∼275 | 8.67 | 6.93 | 0.8765 | 0.8026 | 0.0843 |
| 275∼300 | 6.2 | 6.26 | 0.8617 | 0.8115 | 0.0582 |
| 300∼320 | 3.28 | 2.56 | 0.8605 | 0.8199 | 0.0471 |
| 320∼350 | 5.02 | 4.2 | 0.8604 | 0.8217 | 0.0449 |
| 350∼370 | 2.91 | 2.92 | 0.8652 | 0.8288 | 0.0421 |
| 370∼395 | 6.07 | 5.13 | 0.8678 | 0.8321 | 0.0412 |
| 395∼425 | 2.73 | 3.29 | 0.8762 | 0.8388 | 0.0427 |
| 425∼450 | 2.74 | 3.26 | 0.8818 | 0.8414 | 0.0458 |
| 450∼470 | 6.39 | 5.8 | 0.8827 | 0.8515 | 0.0353 |
| 470∼500 | 5.36 | 5.94 | 0.9044 | 0.8587 | 0.0506 |
| >500 | 14.41 | 14.94 | — | — | — |

## 4. Conclusiones Texto breve donde se indican las conclusiones/ resultados mas relevantes del trabajo

**4. Conclusions**

The values of the gravitational acceleration experiments were determined by using four methods, the results showed that the acceleration results due to gravity values of free fall, simple pendulum, physical pendulum and Atwood's machine had the percentage errors of 0.41%, 1.43%, 10.91% and 6.73%, respectively. Therefore, the percentage error of the free fall was the least percentage error and the physical pendulum had the highest percentage error owing to the fixed point of rotation which had a little friction force.

## 5. Referencia

Todas las referencias deben estar citadas en el algun lugar del texto con el [XX]

1727) and published in 1687. The magnitude of $g$ varies over the surface of the Earth in which many measurements were undertaken at different locations on the earth [1]. JS Clark [2] and AH Cook [3] measured the absolute $g$ constants by using a reversible pendulum and free motion experiments, respectively. Both the experiments of $g$ values were very close to the mean of $g$ absolute determination by using other methods. After that, the absolute $g$ value was determined by Cook [4] using the British Fundamental Gravity Station in the N.P.L. getting 981181.75 mgal and

**References**


[1] MacDougal D W 2012 *Newton's Gravity: An Introductory Guide to the Mechanics of the Universe* (New York: Springer–Verlag) chapter 2 pp 17–36

[2] Clark J S 1939 *Philos. Trans. Royal Soc. London* **238**(787) 65–123

[3] Cook A H 1965 *Metrologia* **1**(3) 84–114

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[6] Choi I M, Lee K C, Lee S, Kim D and Lee H Y 2017 *IEEE Trans. Instrum. Meas.* **66**(6) 1317–22

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[11] Sirisathitkul C, Glawtanong P, Eadkong T and Sirisathitkul Y 2013 *Rev. Bras. Ensino Fis.* **35**(1) 1–6

## Diseño y montaje del experimento

**Materiales**

Pelotas tenis, ping pong, canicas, ….

Monedas

Varilla/tubo

Tanza, hilo de coser, hilo dental

Tabla

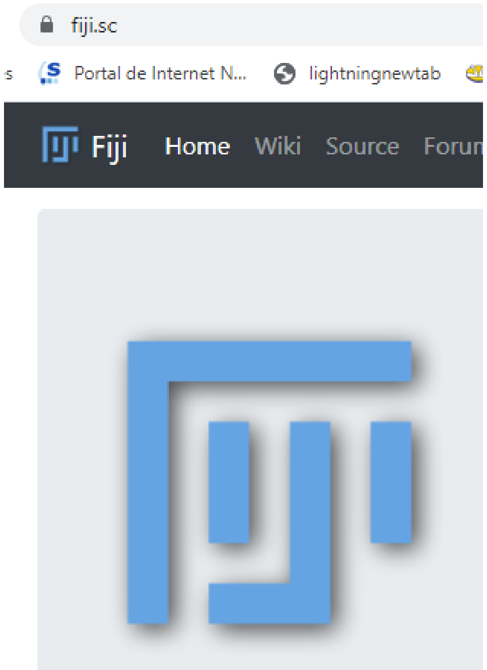
Resorte de expansión 6cm  a 8cm de longitud.
“Blando”

**<u>Análisis de resultados</u>**

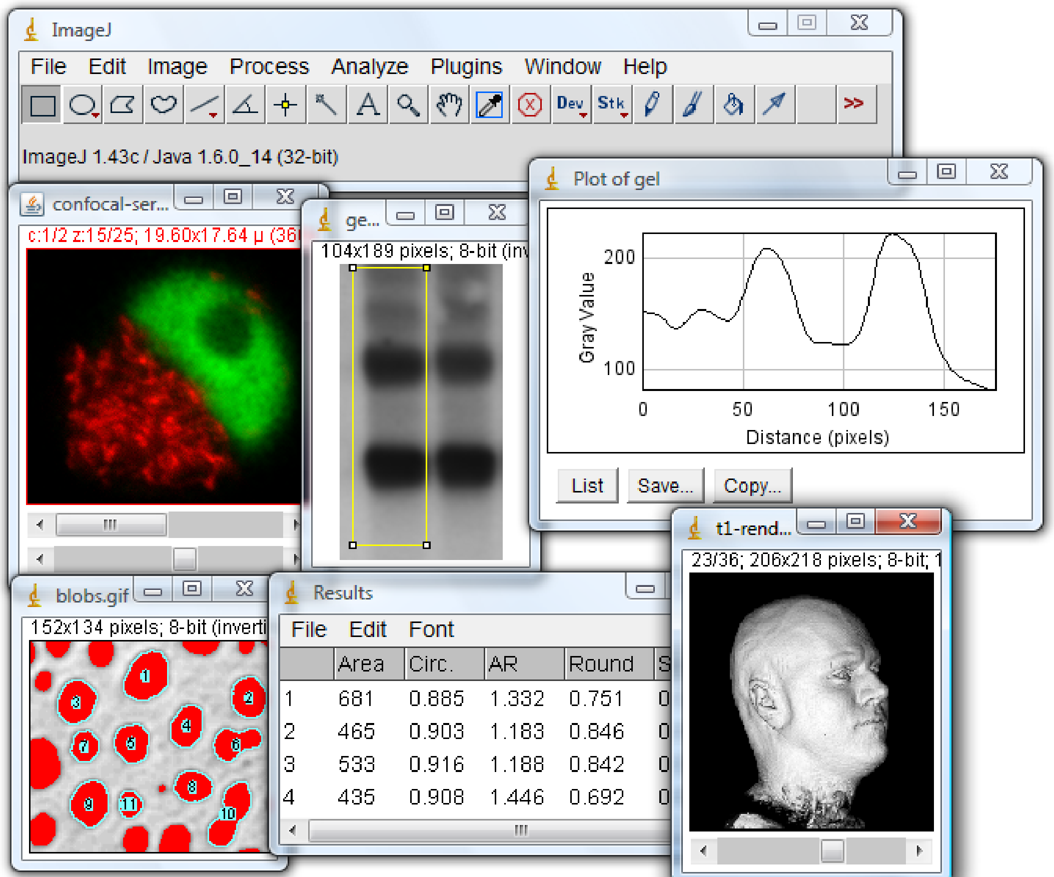
**Herramientas**

**De uso libre**

- Fiji
- Tracker
- Python
- Phyphox (app smartphone**)**



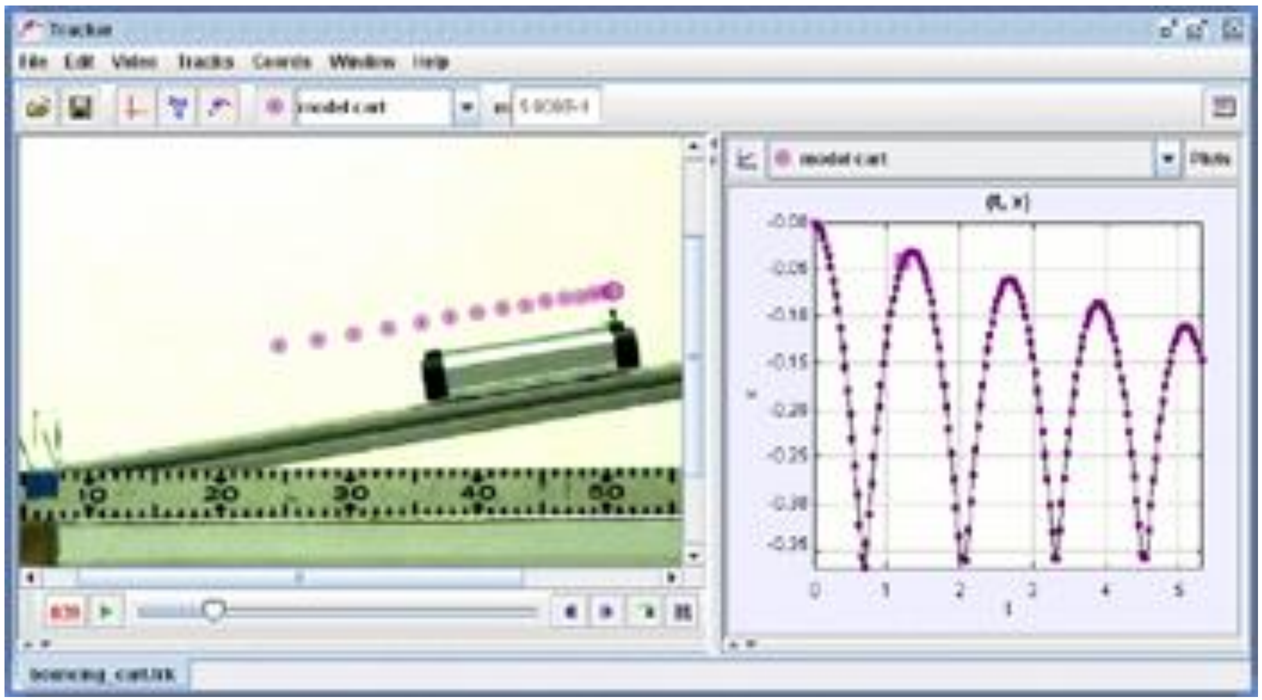

# ANALISIS DE IMAGENES



Tracker
*Video Analysis and Modeling Tool*

# Digitalización de videos

https://physlets.org/tracker/



App smartphones

phyphox.org

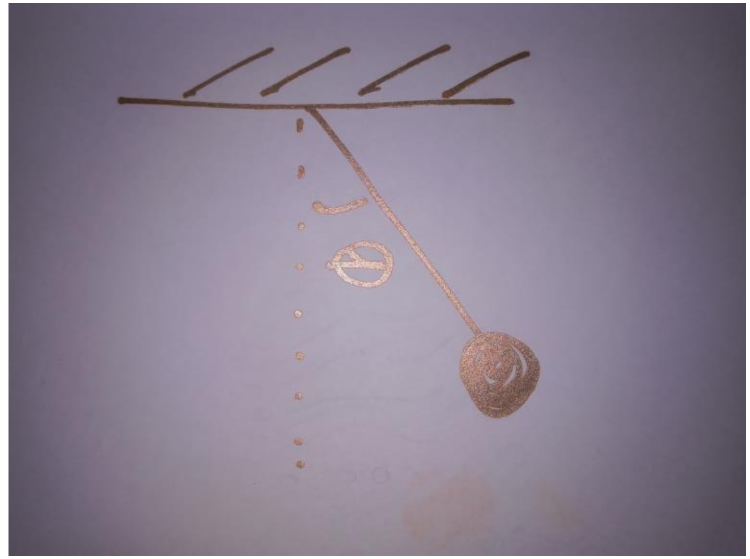
Desarrollado en la Universidad de Aachen, Alemania

**Experimentos de mecánica**

- Cronómetros
- Ángulos , etc.

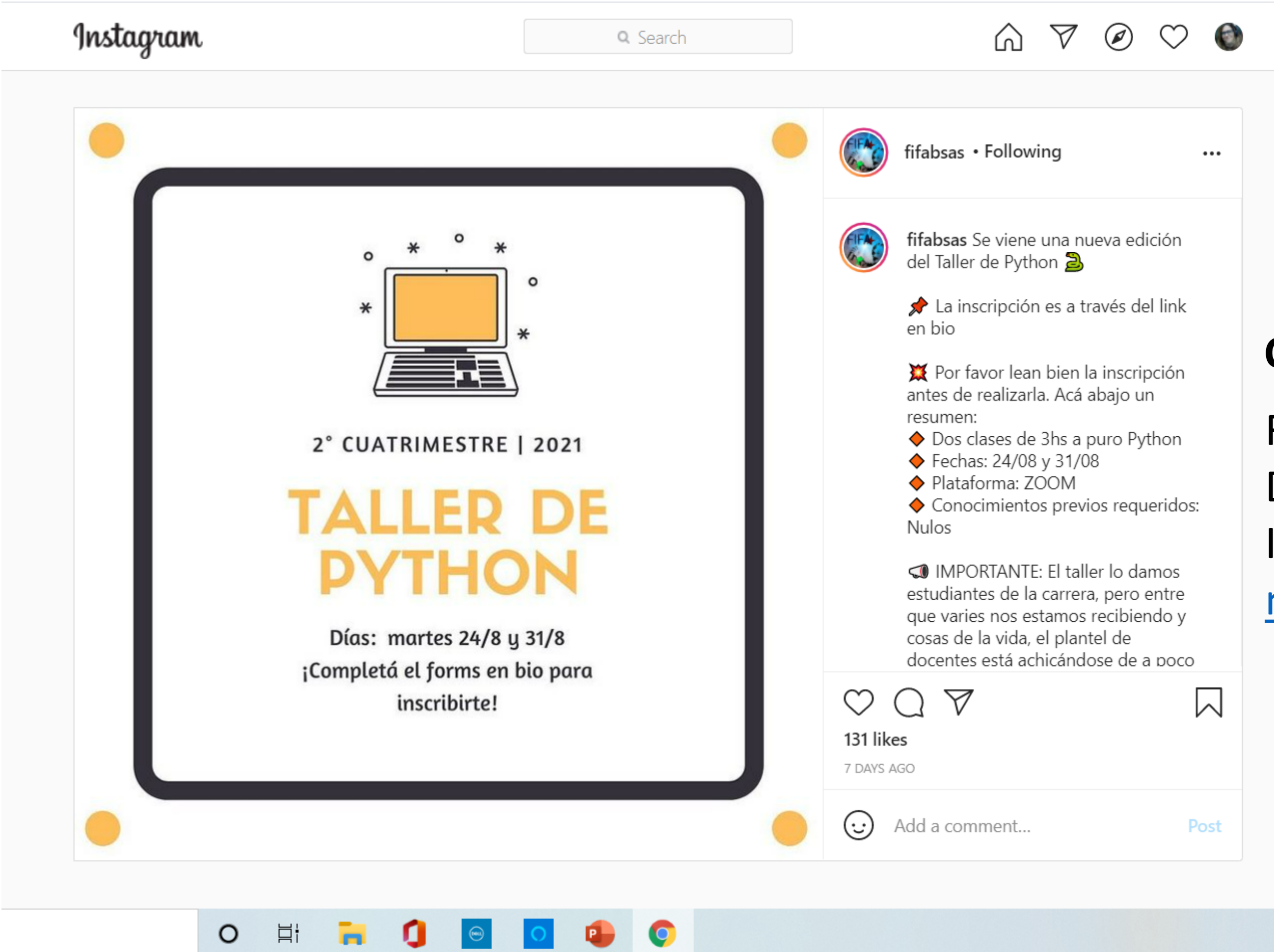
# INTRODUCCIÓN A PYTHON

```
class Bob():
    """ This class holds all of pendulum variables such as
    position, velocity, length, mass, and energy.
    """
    def __init__(self,length, mass, initial_angle):
        self.l = length
        self.m =         # FIX ME!  Set this line to be equal to the mass variable
        self.theta = initial_angle
        self.v =        # FIX ME!  Set the v variable equal to 0
        self.x = 0
        self.y = 0
        self.p = 0
        self.a = 0
        self.energy = 0
        self.ke = 0
        self.pe = 0
        self.display_values()
    def display_values(self):
        # FIX ME!
        # Print out the initial length, mass, and angle on the lines below
        # Use the self.l, self.m, and self.theta variables
        print
```



Talleres FIFA previos

http://fifabsas.github.io/talleresfifabsas/




## Contactos

FIFA: fifabsas@gmail.com
DISCORD: https://discord.gg/bN2KeTu
INSTAGRAM: https://www.instagram.com/fifabsas/

* Dos clases de 3hs a puro Python.
* Fechas: 24/08 y 31/08.
* Plataforma: ZOOM.
* Conocimientos previos requeridos: Nulos.

LINK: https://forms.gle/Fqq9aWKLn65qb9W87

## Mas informacion util

DISCOR  Melisa y Gianni estaran a cargo de esta herramienta para intercambiar informacion, bibliografia, consultas especificas.

- Drive de estudiantes con bibliografía (origin dentro de Laboratorios/Software) https://drive.google.com/drive/folders/0B44rUJS97SSubDB3VGIyaEdmc2M?usp=sharing

**During a pandemic, Isaac Newton had to work from home, too. He used the time wisely.**

Durante una pandemia, Isaac Newton tuvo que trabajar desde su casa, también. Usó su tiempo sabiamente ….

Click to add text

Enunció

**La ley de gravitacion universal**

Epidemia peste bubónica, Inglaterra  1655-1656

The Washington Post
Marzo 12, 2020


**La cursada es de ASISTENCIA OBLIGATORIA**

**Anoten su nombre+ apellido y número de libreta en su usuario zoom - por favor**

**Fundamental**

**CONVIVENCIA en la virtualidad y fuera de ella**

**Marco de absoluto respeto y tolerancia**

**estudiante <-> estudiante**

**estudiante <-> docente**