

PH 103: PHYSICS

INTRODUCTION

Course Instructor



Dr. Jobin Jose
Faculty in Physics
Department of Physics
Indian Institute of Technology
Patna

G7, G8, G9

Tutors: Dixit M, Indranil Maity, Rohit Kumar, Samayun Saikh, Saumyashree Baral, Subhadeep Sarkar, Vivek Mehta

First Year TT, Batch of 2021, SEM 2, March 2022 - July 2022

Day	Lecture Slots	Lecture Slots	Lecture Slots	1PM - 2PM	Tut/Lab Slots	Tut/Lab Slots	Tut/Lab Slots
	10AM - 10:55AM	11AM - 11:55AM	12PM - 12:55PM		2-3pm	3-4pm	4-5pm
MONDAY	E/F	D	C	L	TA1	TB1	TC1
TUESDAY	A	E/F	D	U	L-B1		
WEDNESDAY	B	A	E/F	N	L-D1		
THURSDAY	C	B	A	C	L-E1/L-F1		
FRIDAY	D	C	B	H	TE1/TF1		

Course Syllabus

- Orthogonal coordinate systems and frames of reference, conservative and non-conservative forces, work-energy theorem, potential energy and concept of equilibrium; Rotation about fixed axis, translational-rotational motion, vector nature of angular velocity, rigid body rotation and its applications, Euler's equations; Gyroscopic motion and its application; Accelerated frame of reference, centrifugal and Coriolis forces.
- Harmonic oscillator, damped and forced oscillations, resonance, coupled oscillations, small oscillation, normal modes, longitudinal and transverse waves, wave equation, plane waves, phase velocity, superposition wave packets and group velocity, two and three dimensional waves.
- Failure of classical concepts, Black body radiation, photo-electric effect, Compton effect, Davison and Germer's experiment, Frank-Hertz experiment, Bohr's theory, Sommerfeld's model, correspondence principle, Planck hypothesis, De Broglie's hypothesis, Hilbert space, observables, Dirac notation, principle of superposition, wave packets, phase and group velocities, probability & continuity equation, eigenvalues and eigen-functions, orthonormality, expectation values, uncertainty principle, postulates of QM, Schrodinger equation & its applications to 1D potentials, field quantization, periodic potential wells: Kronig Penny model and origin of band gap.

Text Books and References

- **Textbooks:**
- D. Kleppner and R. J. Kolenkow, An introduction to Mechanics, Tata McGraw-Hill, New Delhi, 2000.
- David Morin, Introduction to Classical Mechanics, Cambridge University Press, NY, 2007
- Frank S. Crawford, Berkeley Physics Course Vol 3: Waves and Oscillations, McGraw Hill, 1966.
- Arthur Beiser, Concepts of Modern Physics, McGraw Hill, 2003
- Eyvind H. Wichmann, Berkeley Physics Course Vol 4: Quantum physics, McGraw Hill, 1971.
- P. C. Deshmukh, Foundations of Classical Mechanics, Cambridge University Press, 2019
- **References:**
- R. P. Feynman, R. B. Leighton and M. Sands, The Feynman Lecture in Physics, Vol I, Narosa Publishing House, New Delhi, 2009.
- R. P. Feynman, R. B. Leighton and M. Sands, The Feynman Lecture in Physics, Vol III, Narosa Publishing House, New Delhi, 2009.
- R. Eisberg and R. Resnick, Quantum Physics of atoms, molecules, solids, nuclei and particles, John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
- A. J. Dekker, Solid State Physics, Macmillan Pub. India Ltd., New Delhi, 2009
- David J. Griffith, Introduction to Quantum Mechanics, Pearson Education Ltd, New Delhi, 2009.
- B.H. Bransden & C.J. Joachain, Quantum Mechanics, Pearson Education Ltd, New Delhi, 2008.

How to find the course materials?

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Physics

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Physics at IIT Patna was established in 2009. In July 2009, the department of Physics and Nanotechnology has been established. The department of Physics from July 2016. The department is committed to engage in high quality research. The department are actively involved in research and development. Currently, the main research emphasis



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Email

Teaching

M. Sc.

- Ph427: Numerical Techniques
- Ph428: Computational Physics
- PH421: Mathematical Physics
- PH420: Quantum Mechanics II
- PH608: Atomic Collision Physics

Ph. D.

- PH701: Mathematical Physics and Numerical Methods (1/2)

Techn

- [PH103: Physics 1](#)

Professional Experience

- Assistant Professor: Manipal Centre for Natural Sciences, Manipal University, Manipal, Karnataka 576104 (April 2015-Dec 2015)
- Postdoc: Department of Chemistry, Texas A&M University, College Station, Texas 77840 (Apr 2012-March 2015)
- Postdoc: Department of Physics, Indian Institute of Technology Mandi, Kamand, Himachal Pradesh, 175005 (Sept 2011-Feb 2012)

Member of Professional bodies

- Life time member: Indian society of atomic and molecular physics (ISAMP)
- Adjunct member: Center for Atomic, Molecular and Optical Sciences & Technologies (CAMOS)

Evaluation Scheme*

Evaluation pattern	Number of examination	Weightage (%)
Small weightage quizzes	4-6	30
Mid Semester Evaluation (A) (Real time quiz/any other mode to be decided by course instructor)	1	10
Mid Semester Evaluation (B) (Assignment based, one day time to be given for submitting the assignment)	1	15
End Semester Evaluation (A) Real time quiz/any other mode to be decided by course instructor	1	15
End Semester Evaluation (B) (Assignment based, one day time to be given for submitting the assignment)	1	20
Day to day performance and sincerity to be decided by the course instructor	On regular basis	10

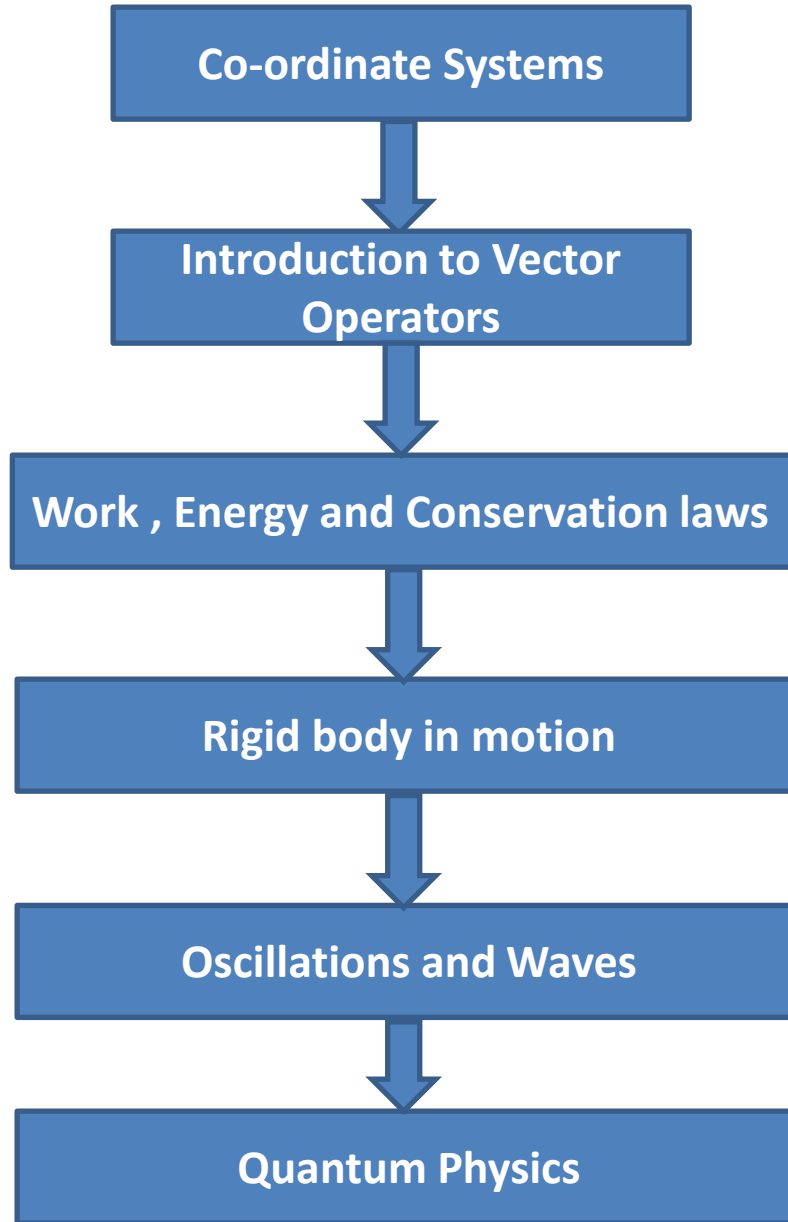
Note: Both evaluation schemes [(A) and (B)] of mid and end semester supposed to be on the same day. Instructor can take evaluation scheme (A) first, followed by (B).

*** Subjected to change**

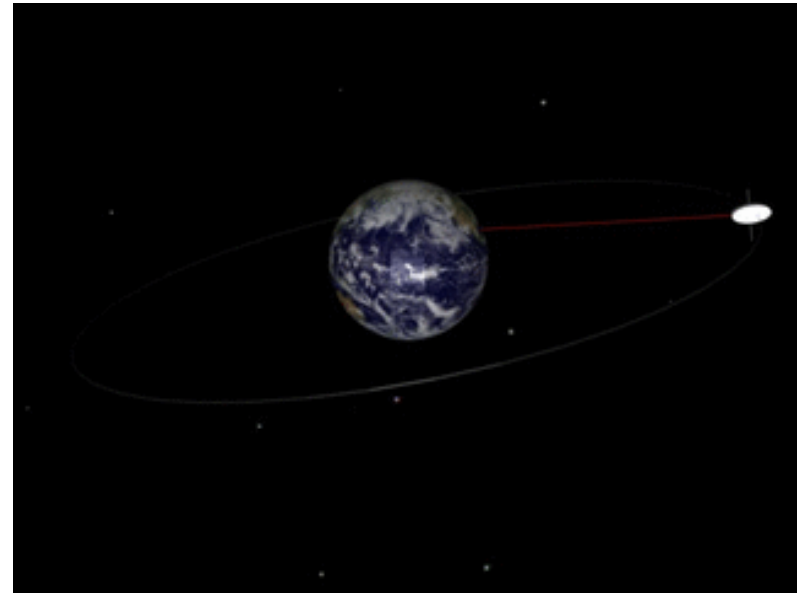
What have you learned so far?

- Scalars and Vectors
- Motion in straight line
- Laws of Motion
- Torque and Angular momentum
- Harmonic Motion
- Dual Nature of Matter and Radiation

Highlights of the course

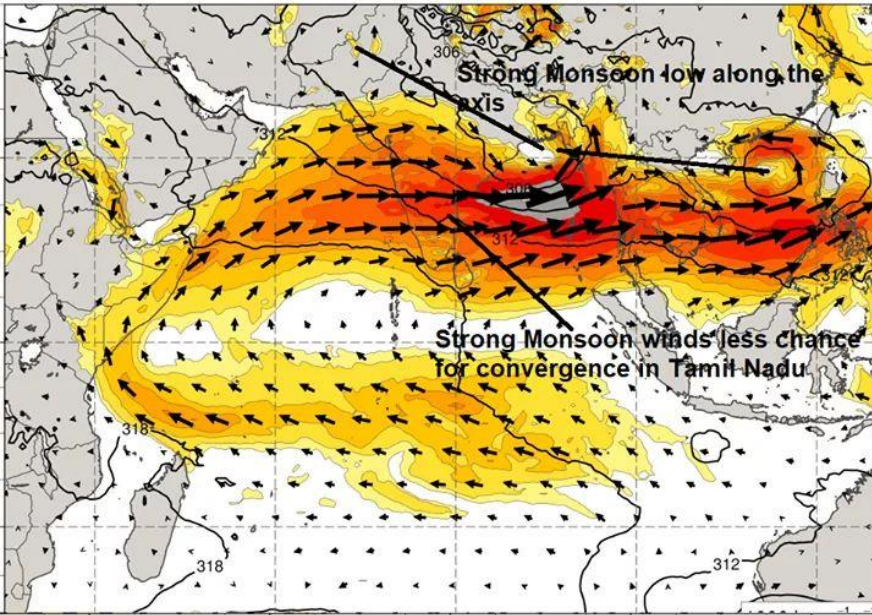


Co-ordinate Systems

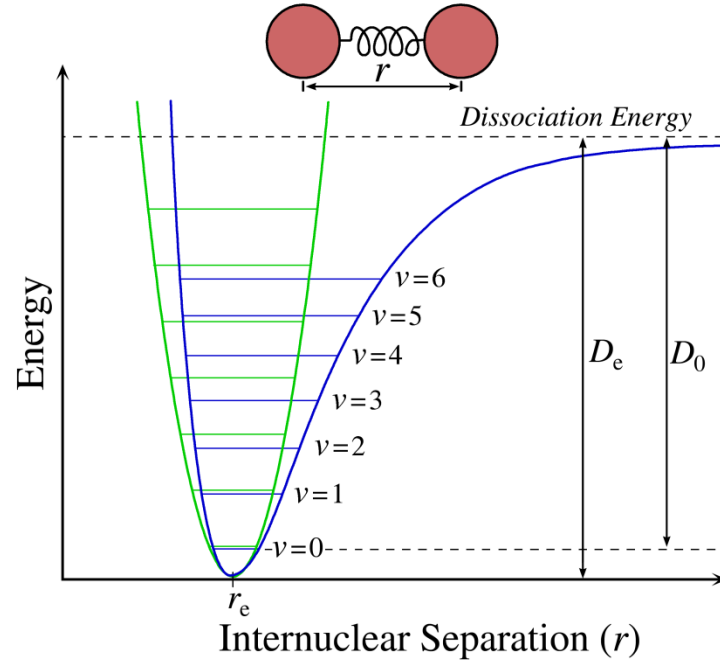


Introduction to Vector Operators

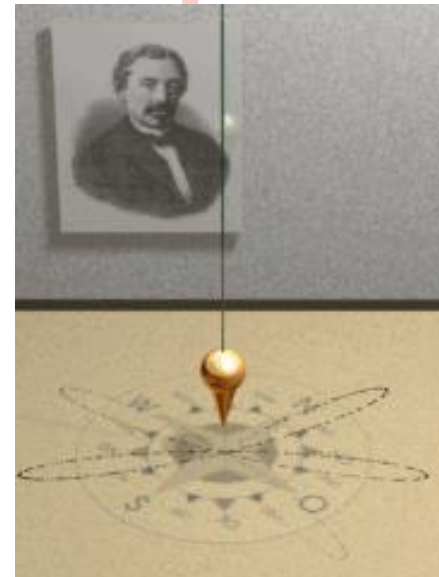
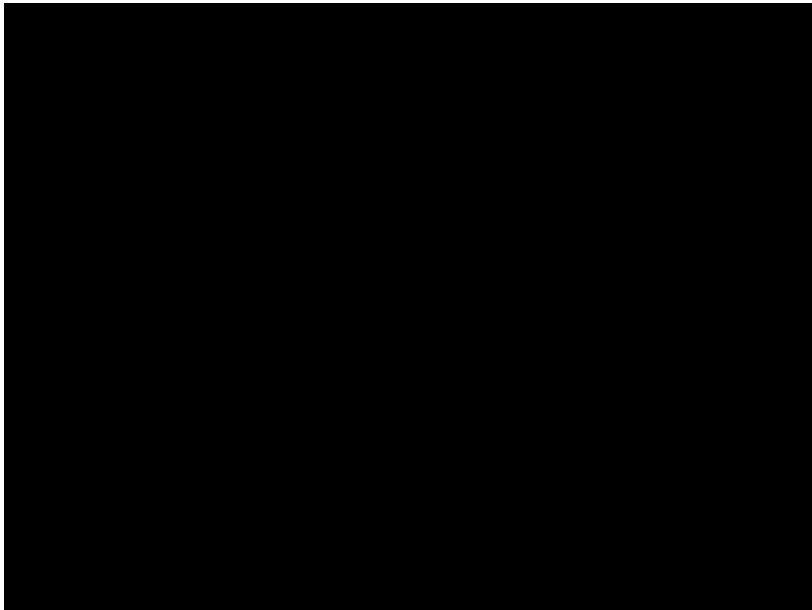
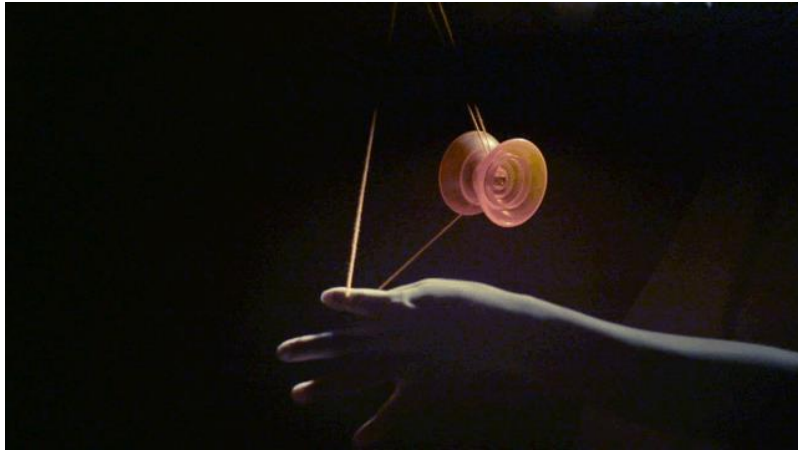
Integrated water vapor transport [IVT] (shaded, kg/m/s) (vectors, kg/m/s)
Initialized: 1800 UTC 31 Jul 2019 | Forecast hour: 120 | Valid: 1800 UTC 5 Aug 2019



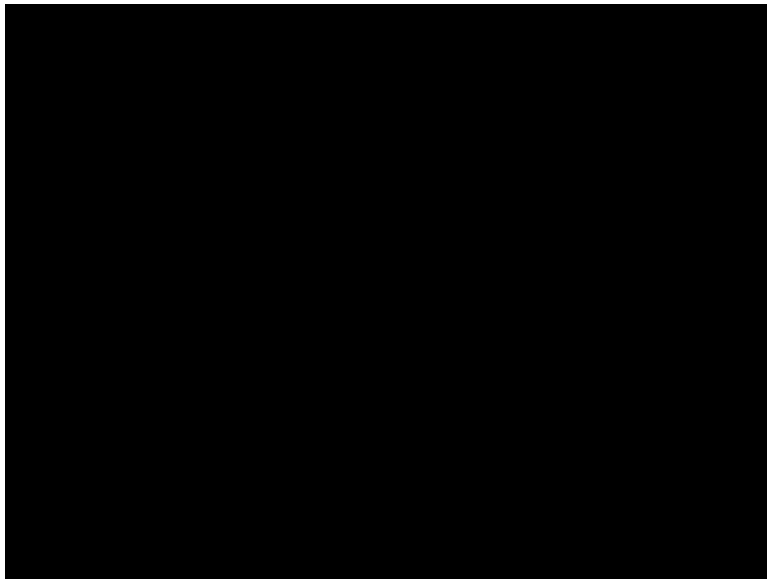
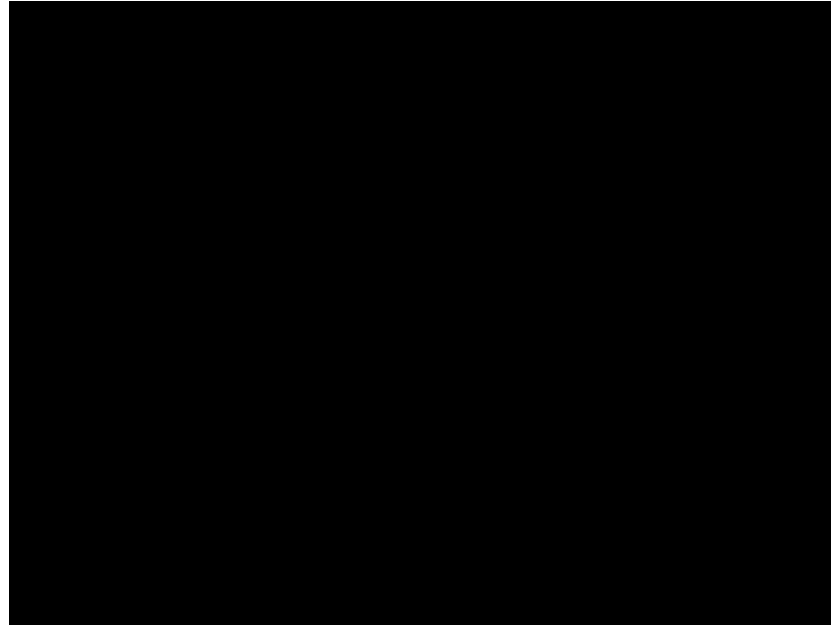
Work , Energy and Conservation laws



Rigid body in motion



Oscillations and Waves

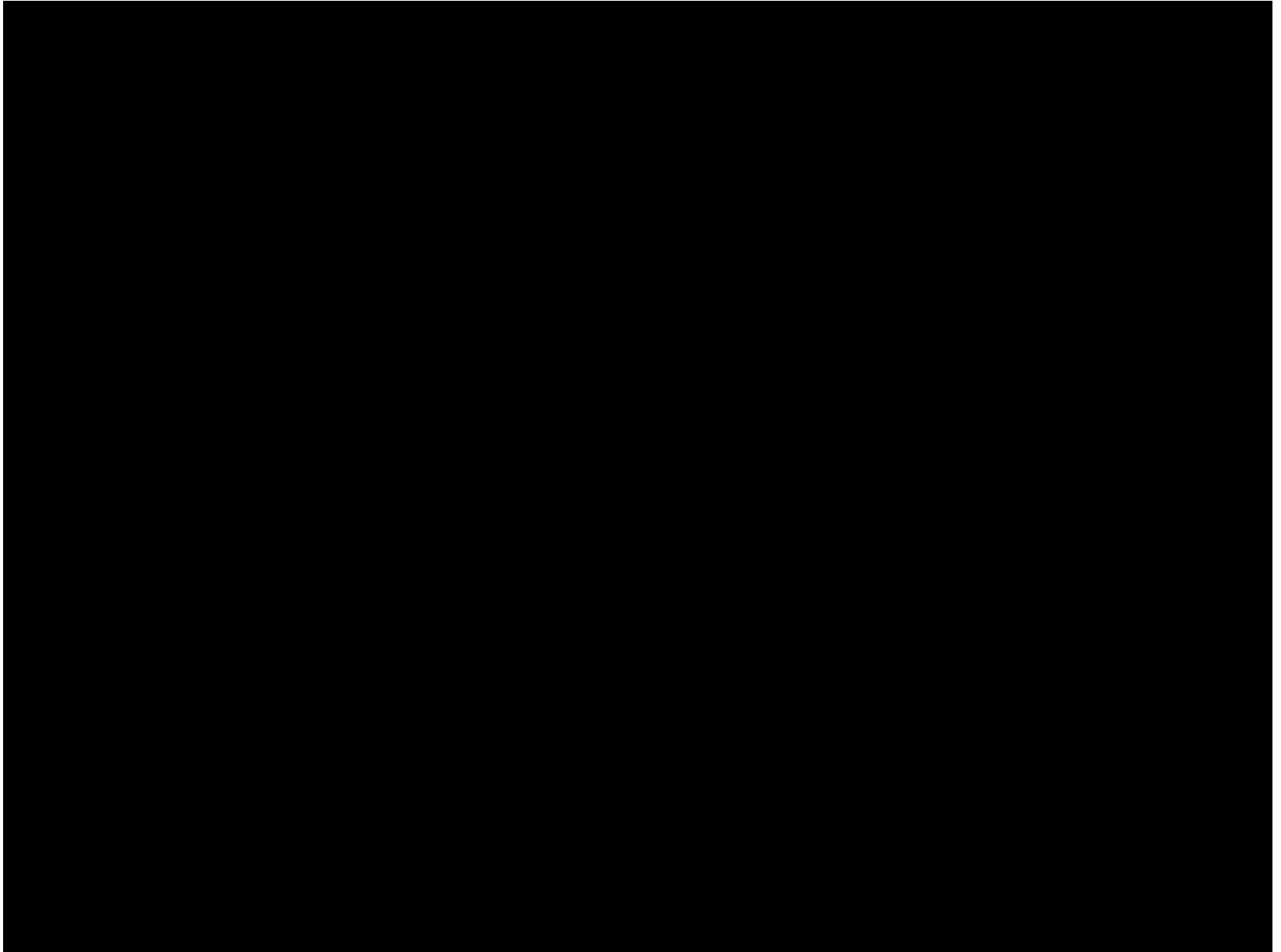


Mechanical effects of sound

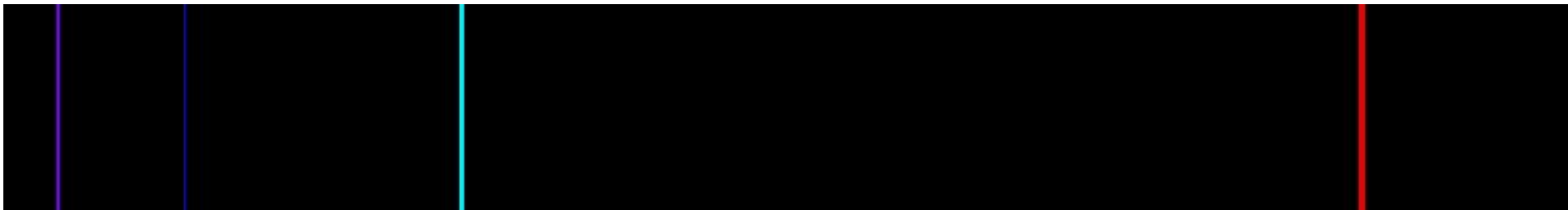
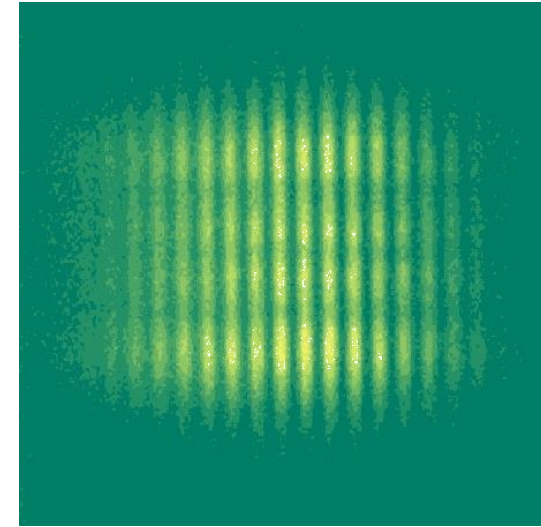
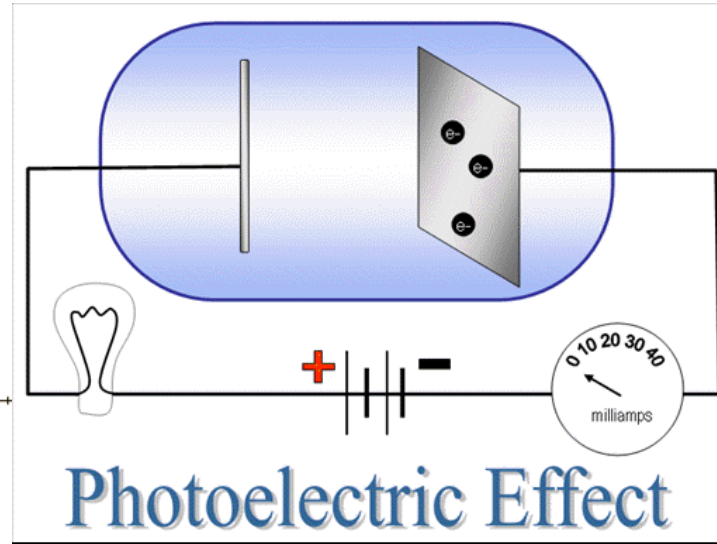
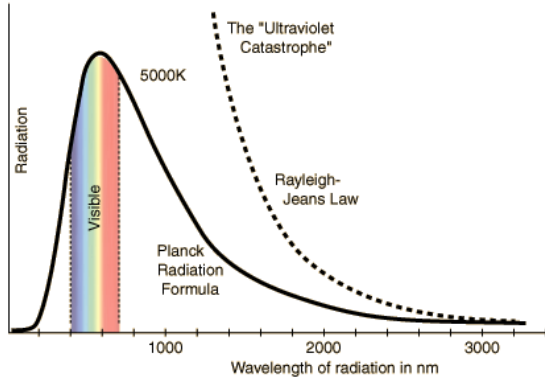


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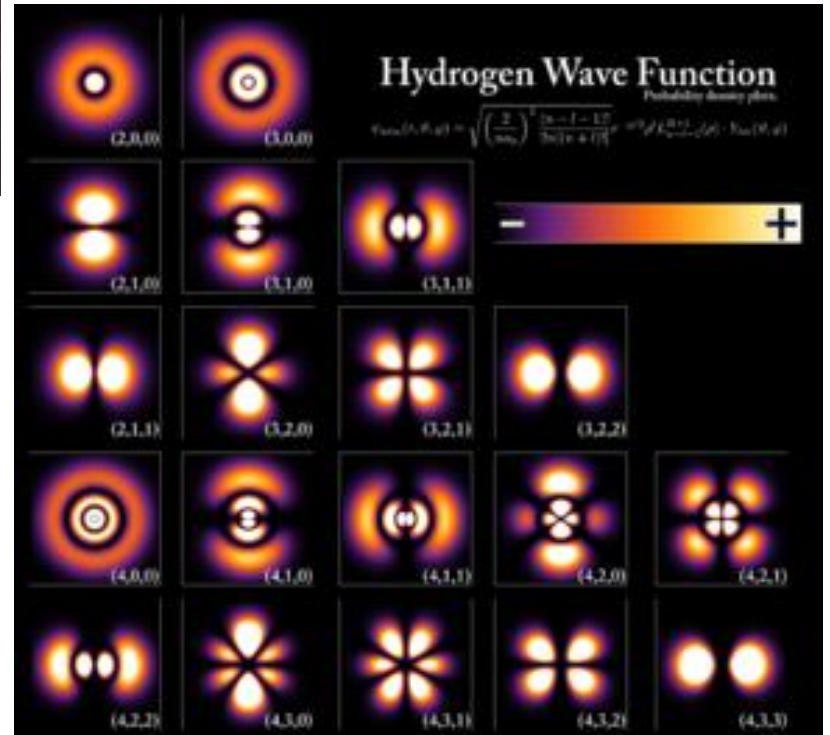
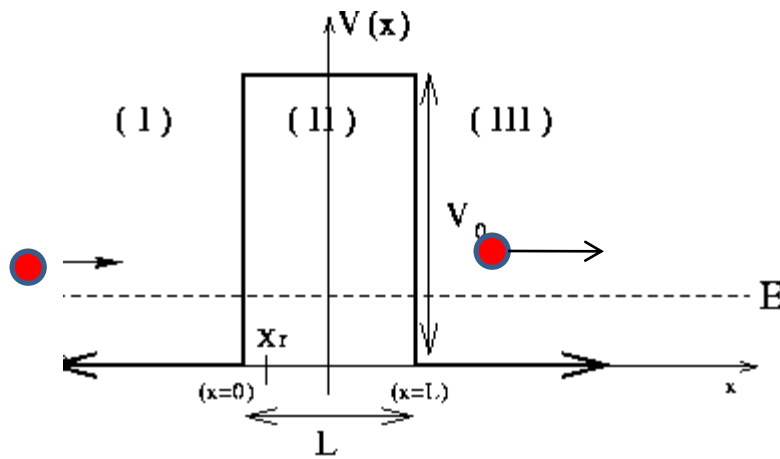
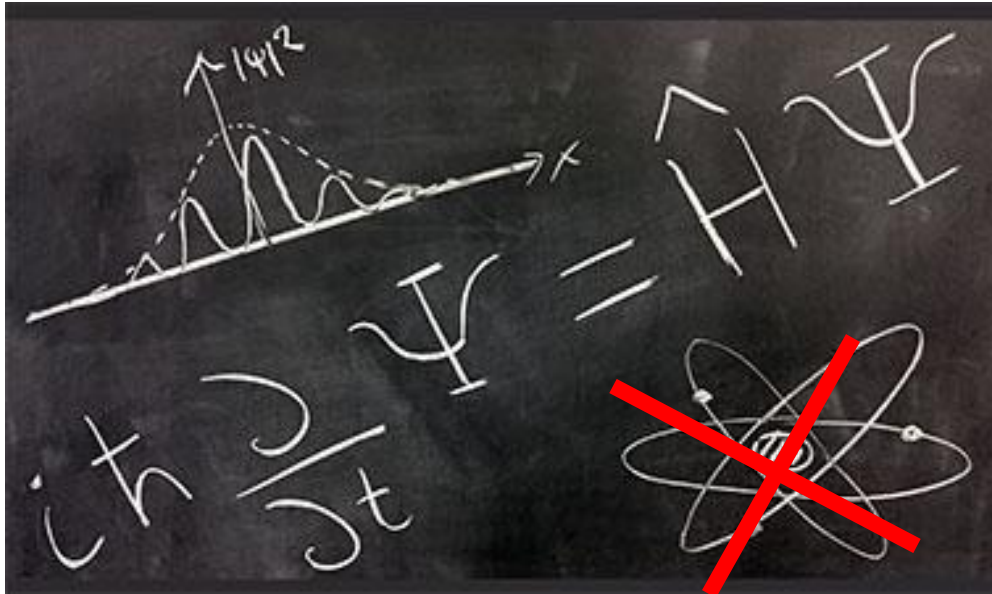
Classical physics in modern era



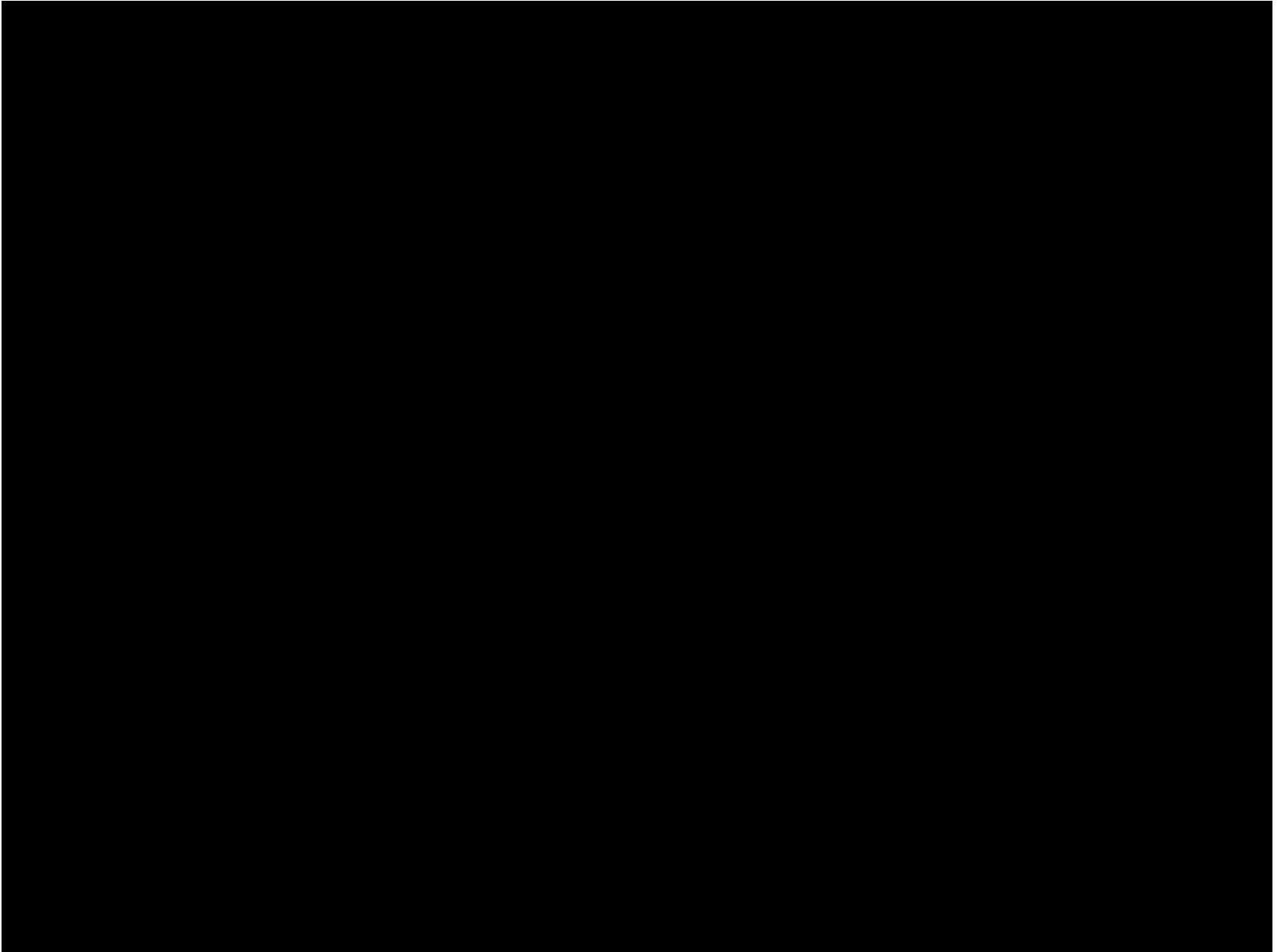
Limitations of Classical Physics



Quantum Physics



A boy and his atom (Quantum)



Thank you