PHYS4801

Preparing a Scientific Presentation

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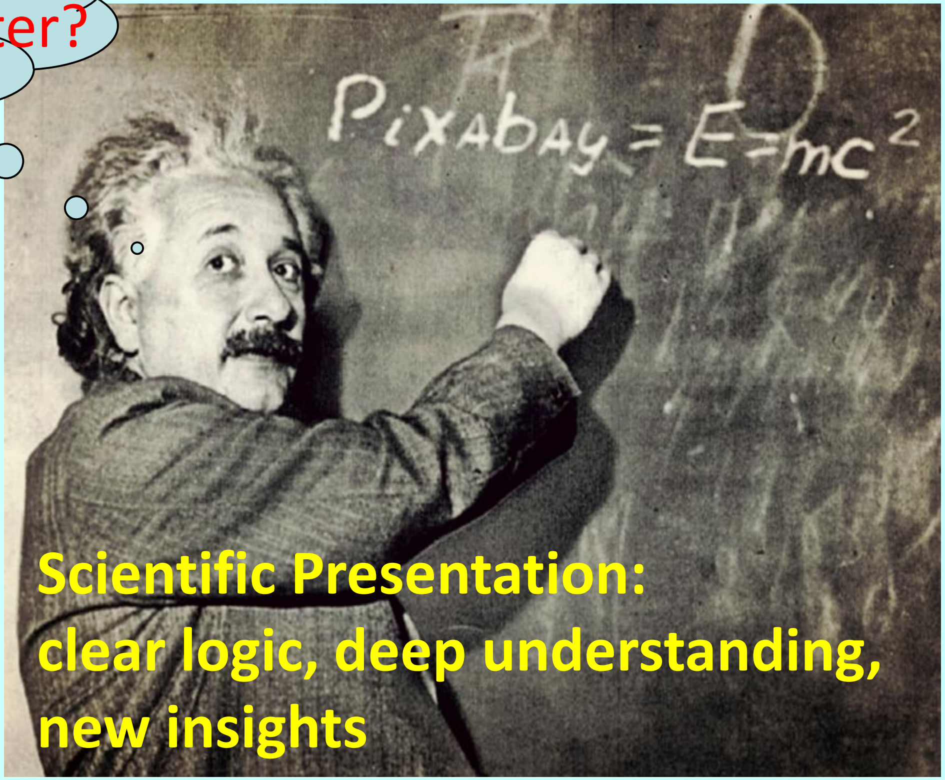
Cf. Prof. C. K. Law's powerpoint

Scientific Presentation

Why does it matter?

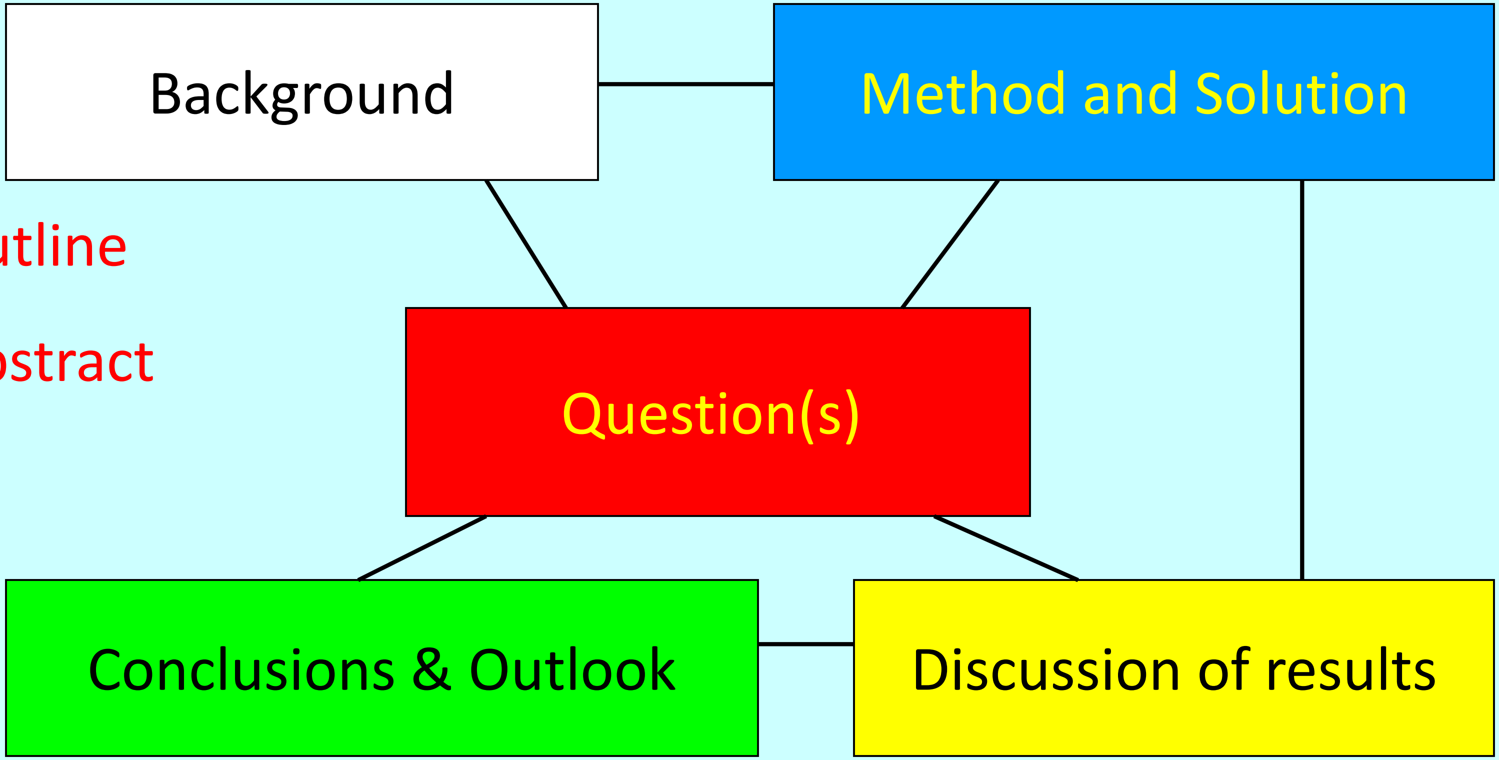


Your work are judged by your presentations (written, oral)

Forces you into thinking clearly about your work

Also important if you don’t stay in science

Organizing the materials (logically)

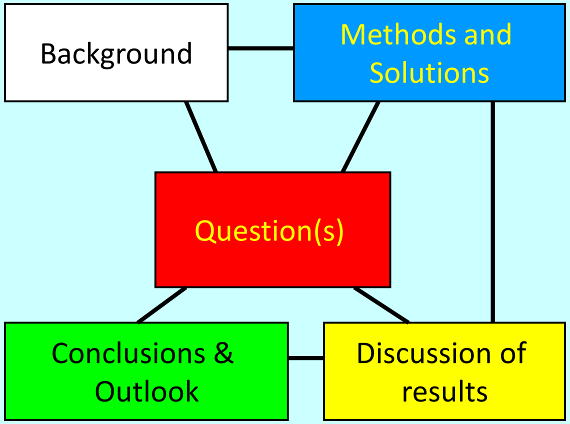


- Write an outline

- Write an abstract

Eg.: http://www.cuhk.edu.hk/cpr/nobel/

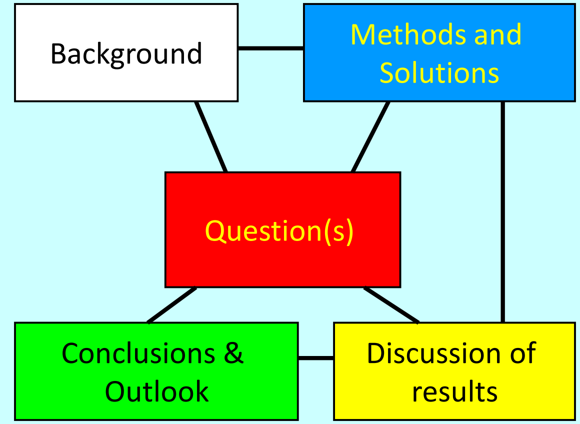
http://nobelprize.org/nobel_prizes/physics/video_lectures.html



Key Question(s)

- Indicate **clearly** the question(s)
- Why important and interesting
- Implications if solved

Eg.: Prof. Frank Wilczek's Nobel Lecture
http://nobelprize.org/nobel_prizes/physics/laureates/2004/wilczek-lecture.html



Methods and Solutions

- Difficulties
- Ideas/tricks
- What’s new in the solutions

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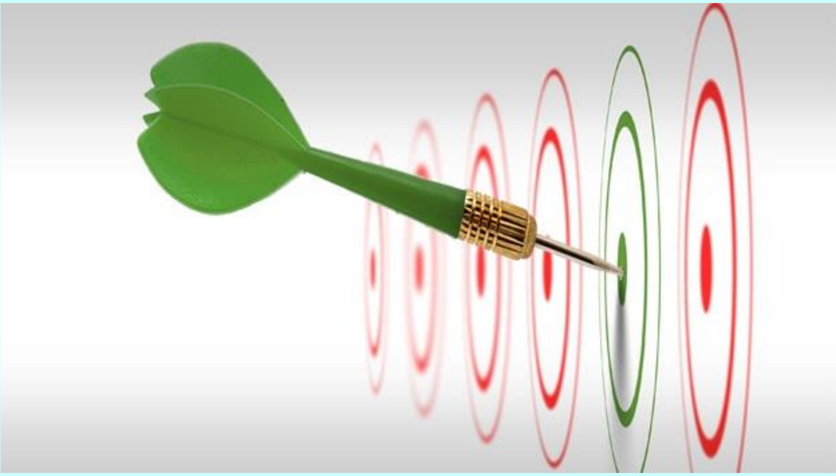
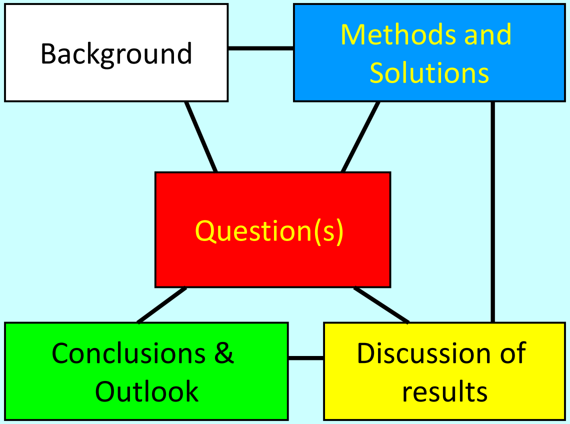




Discussion of results

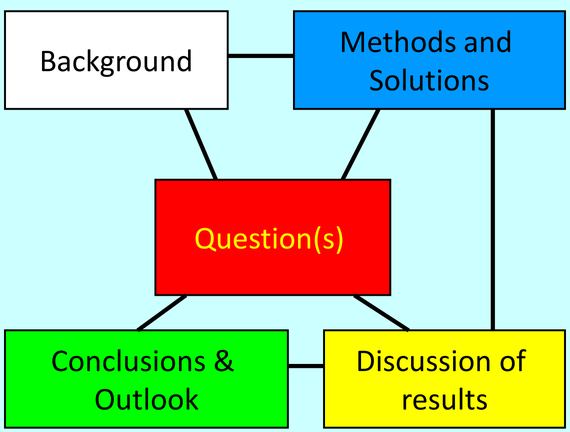
- Focus on the key results, not details
- Connect to the question(s) asked
- Discuss the significances

Eg.: Prof. Frank Wilczek's Nobel Lecture
http://nobelprize.org/nobel_prizes/physics/laureates/2004/wilczek-lecture.html

Outline

- how you organize your materials and collaborate

- reminds you the logical structure of your talk



An example from past students

"Possible corrections to the Newtonian Law of gravity"

1. Historical background of Newtonian law of gravity
   a. Kepler's laws of planetary motion (Solar scale, $10^6 \sim 10^{11}$m)
   b. The birth of Newtonian law of gravity
   c. G_L determined by Cavendish-typed experiment (Lab scale, 1cm ~ 1m)

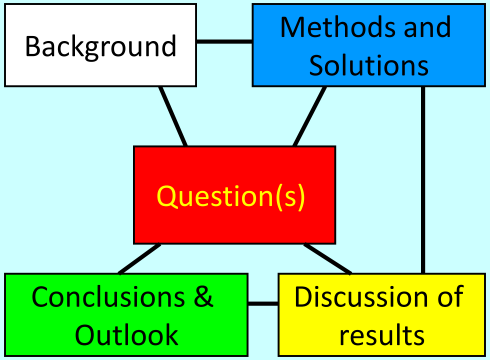
2. Possible corrections to the Newtonian law of gravity
   a. Form of Yukawa potential
   b. The corrected gravitational potential

3. Introduction to 2 experiments in intermediate range ($1 \sim 10^6$m)
   a. Expected deviation of the experiments
      (1) Tower experiment
      (2) Mine experiment
   b. Geophysical knowledge of the earth
      (1) The earth is not stationary, but rotating
      (2) The earth is not a perfect sphere
      (3) The earth density is not uniform
   c. Tower experiment
      (1) Test on the WTVD towers in Garner, North Carolina in 1988
      (2) Test on the BREN tower on Jackass Flats, Nevada .
   d. Mine experiments
      (1) Test of Newton's Inverse-Second Law in the Greenland Ice Cap in 1989
      (2) Testing of Inverse-Second Law of Gravity in Boreholes at the Nevada Test Site in 1990
   e. Future Tests

4. Implications from studying this topic

Abstract

= a concise summary of what you will cover in your talk.



Eg.: Prof. Carl Wieman's lecture abstract

http://www.cuhk.edu.hk/nobellectures/2008-05/synopsis.html

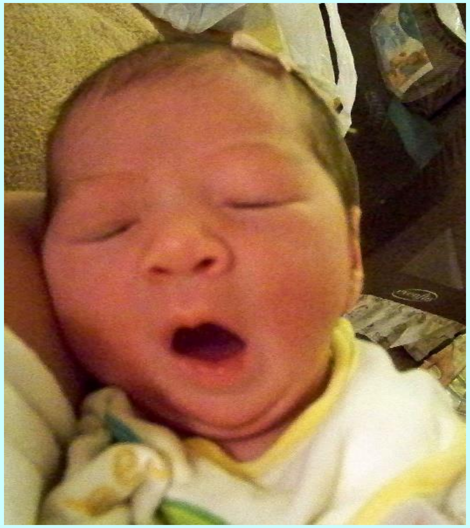
"Science Education in the 21st Century: Using the Tools of Science to Teach Science"

Professor Carl E. Wieman, 2001 Nobel Laureate in Physics

Guided by experimental tests of theory and practice, science has advanced rapidly in the past 500 years. Guided primarily by tradition and dogma, science education meanwhile has remained largely medieval. Research on how people learn is now revealing how many teachers badly misinterpret what students are thinking and learning from traditional science classes and exams. However, research is also providing insights on how to do much better. The combination of this research with modern information technology is setting the stage for a new approach that can provide the relevant and effective science education for all students that is needed for the 21st century. I will discuss the failures of traditional educational practices, even as used by "very good" teachers, and the successes of some new practices and technology that characterize this more effective approach, and how these results are highly consistent with findings from cognitive science.

Some common pitfalls

- Technical level not right for the audience
- Focus lost: buried under details
- Logic not clear
- Too many/few words/equations
- Rely too much on audio (visual more effective)
- Shows little interest/confidence/sincerity
- Plots not clear: labels too small, poor resolution, no explanation of symbols/plots
- Sources not quoted
- Poor time management
- ….



Know your audience …what would your audience want ?

--- To learn something new/useful/interesting …………

What are the issues ?
Why the issues are important/interesting ?
How the issues may be solved – the tricks
What's really new?

What would your audience NOT want ?

--- Getting lost in the middle/beginning ….

Too much details but very little insights
Too many slides without focus
Too few examples
Too few explanations

Game time:

What improvements can be made in the following simulated examples……

Reason for concentrating on terrestrial scale

- In Fig. 1, the plot of $\log(\dfrac{F}{m_1 m_2})$ vs $\log r$ is shown.
- The slopes for both laboratory and solar scale results are -2; however the gap between seems not supporting the validity of Newton's law (dashed line).

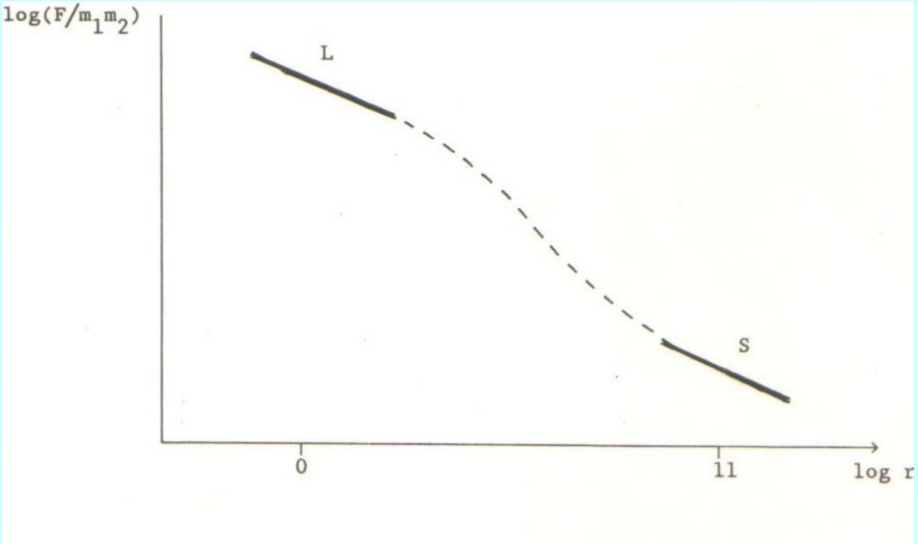
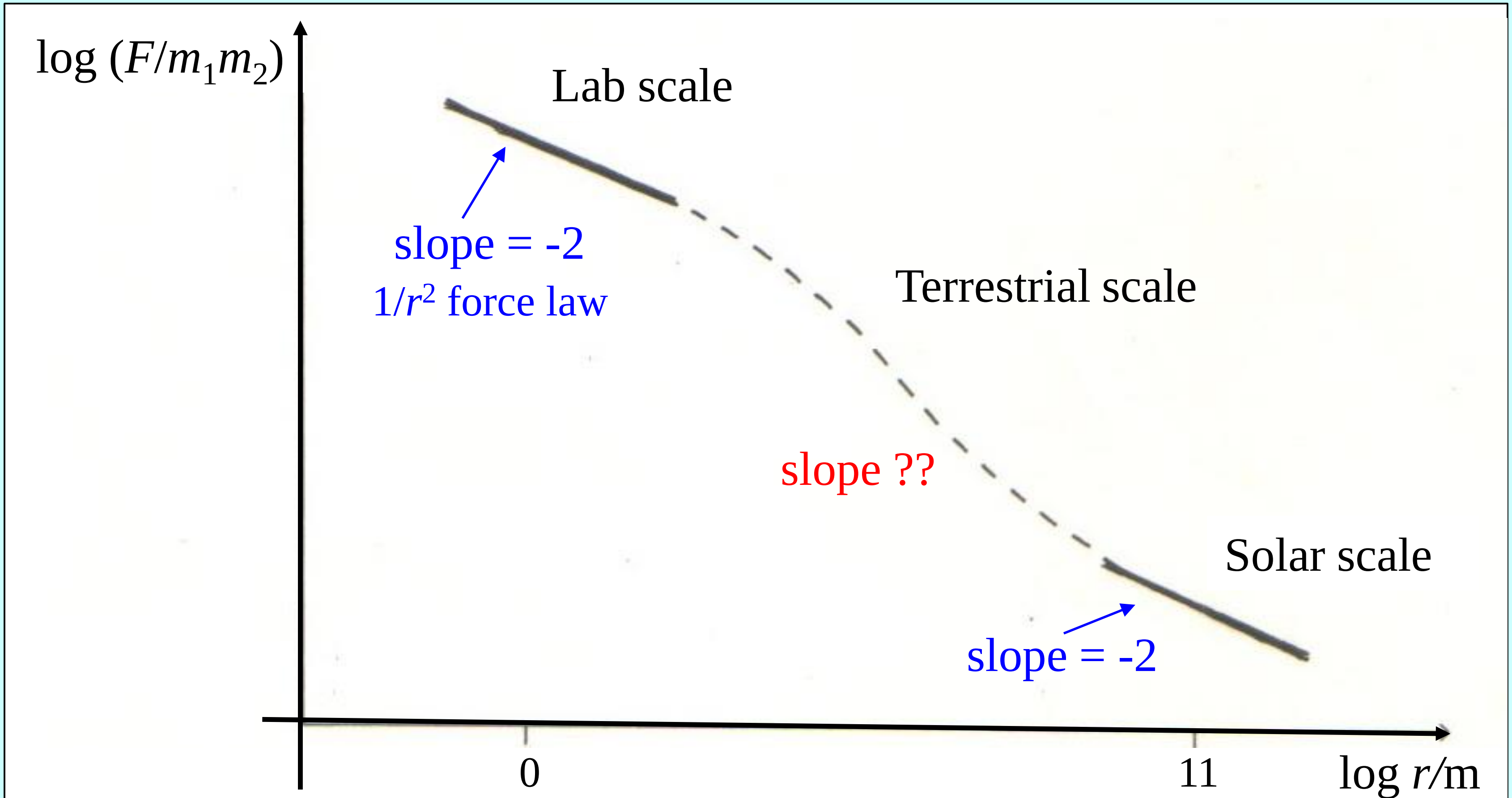


Figure 1 Plot of $\log(F/m_1m_2)$ vs $\log r$ (r in meters), showing $1/r^2$ dependence (straight line with slope −2) at laboratory scales and at solar scales S, but with possible departure from $1/r^2$ behaviour at intermediate distances.

Why terrestrial scale?



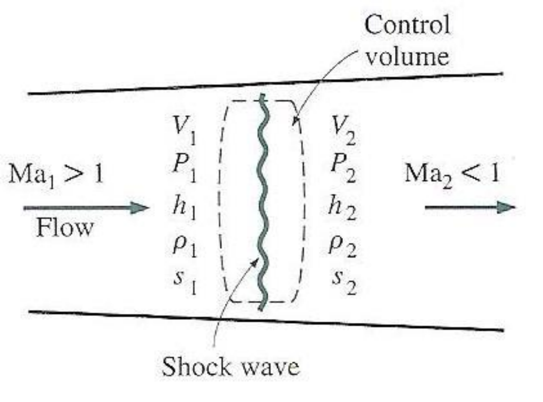
Adapted from: ….

Terrestrial scale: possibly slope ≠ -2?

Properties of Fluid passing through a shock wave

- By solving equation (1)-(5), the following relations are obtained.

- For Mach number,



$$M_2{}^* = \frac{1}{M_1{}^*} \qquad (6)$$ *Prandtl relation*

$$M^{*2} = \frac{(\gamma+1)M^2}{(\gamma-1)M^2+2}$$

$$\therefore M_2{}^2 = \frac{1+\frac{\gamma-1}{2}M_1{}^2}{\gamma M_1{}^2 - \frac{\gamma-1}{2}} \qquad (7)$$

- For density,

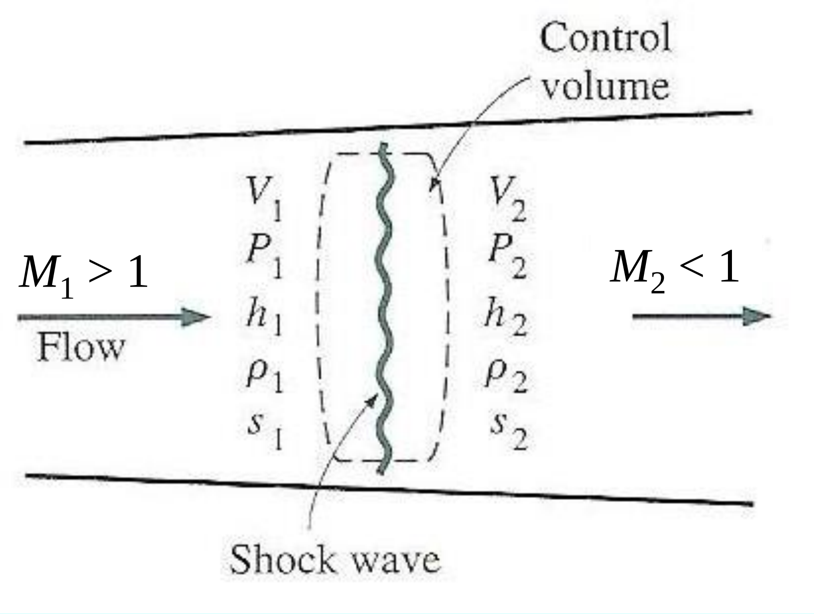
$$\frac{\rho_2}{\rho_1} = \frac{(\gamma+1)M_1{}^2}{(\gamma-1)M_1{}^2+2} \qquad (8)$$

γ: adiabatic index = $\frac{c_p}{c_v}$

M: Mach number

Properties of Fluid passing through a shock wave

Conservation of mass, energy and momentum (Eq.s 1-5) $\rightarrow$ relations of Mach numbers ($M_{1,2} \equiv V_{1,2}$/speed of sound) and densities $\rho_{1,2}$ across the shock:



$$M_2^2 = \frac{2 + (\gamma - 1)M_1^2}{2\gamma M_1^2 - (\gamma - 1)} \qquad (7)$$

$\gamma \equiv$ adiabatic index = c_p/c_v

$$\rho_2 = \rho_1 \frac{(\gamma + 1)M_1^2}{(\gamma - 1)M_1^2 + 2} \qquad (8)$$

Discovery of quantum (integer) hall effect

First observed: 1980.

1. e- in 2D material
2.Large magnetic field **B**

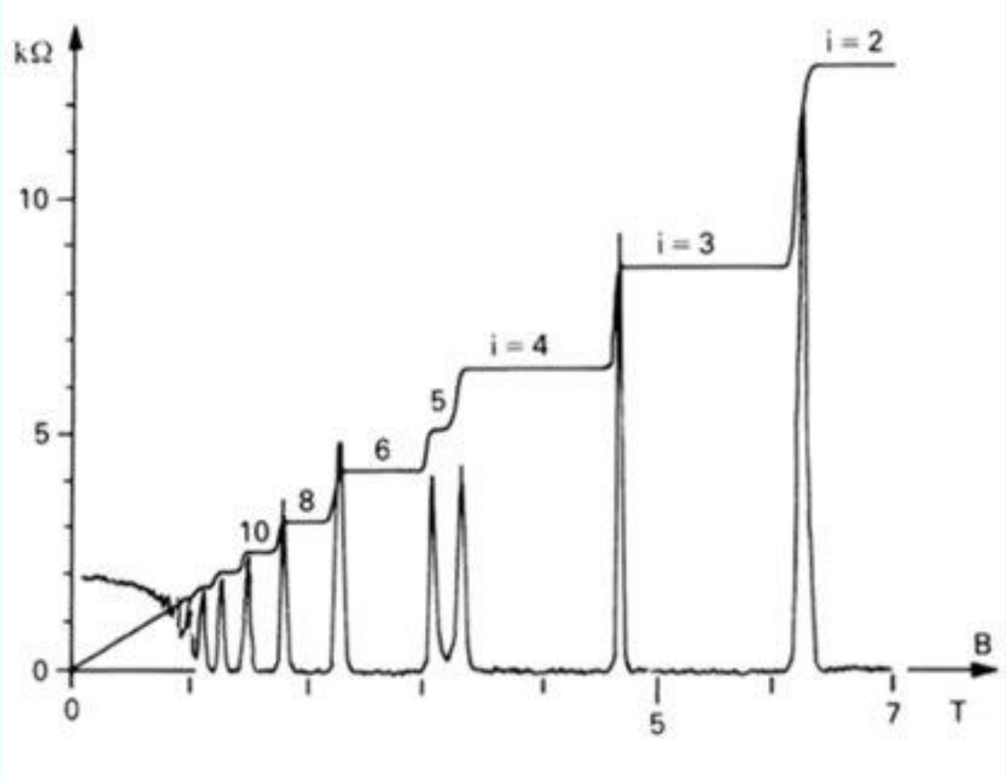


Fig. Experiment result

Combining mine experiment and tower experiment

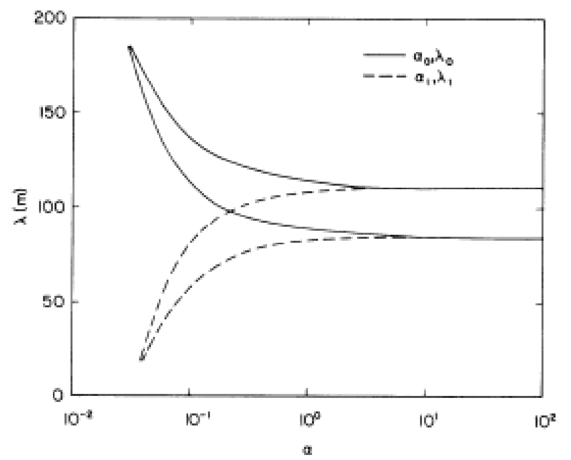


FIG. 2. Parameter bounds of a scalar-vector model consistent with the RET experimental results. The parameters are constrained by $\alpha_1 - \alpha_0 = 0.007$ and $\alpha_0\lambda_0 - \alpha_1\lambda_1 = 5.1$ m (implied by $g_0 - g_m \rightarrow 500$ μGal for $\zeta \rightarrow \infty$), thus halving the parameter's degrees of freedom. Given a value of α_0 (or α_1), the value of λ_0 (or λ_1) is bounded between the solid (or dashed) lines and the constraints determine the other pair of parameters.

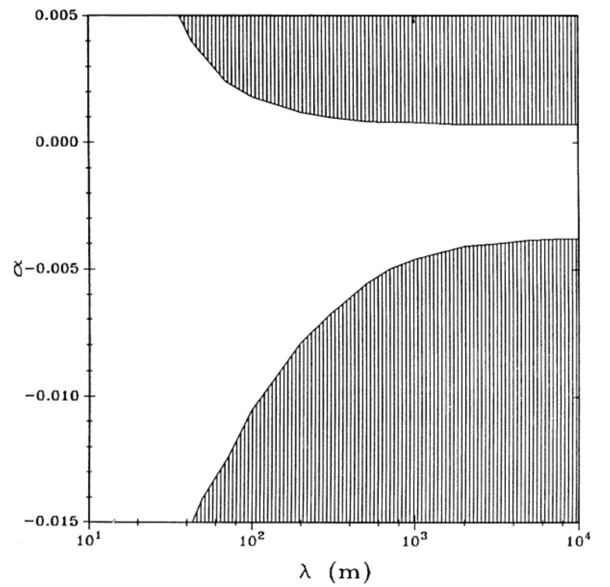


FIG. 2. The strength (α) and range (λ) of a hypothetical Yukawa interaction are highly constrained by the BREN tower data. The allowed, nonhatched region, is obtained by requiring the curve generated by Eq. (3) to lie within the envelope created by the error bars on $\Delta g(z,0,0)_{\text{observed}} - \Delta g(z,0,0)_{\text{predicted}}$.

–F.D. Stacey et al, “Geophysics and the Law of gravity”, Rev. Mod. Phys. **59**, 157 (1987).

–D.H. Eckhardt et al, “Tower Gravity experiment: Evidence for Non-Newtonian Gravity”, Phys. Rev. Lett. **60**, 2567 (1988).

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