Developing Videos for an Introductory Course on Physics

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Examples and Experiences for Motivation, Demonstration and Exercises

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MPTL 8

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Content

- FiPS - Physics Distance Education Project
- Multimedia Material in Teaching Physics
- Developing Videos (Techniques and Examples)
- Using Videos
- Problems
- Future Plans

FiPS study guide

How Distance Education Works

Chapter		Topic	Page	Time
6		Electromagnetic oscillation and waves	163	3h05'
6.1	❺	**The electromagnetic oscillation circuit**	163	45'
	➔	**ISE:** Damped oscillations of a RLC-circuit Examine swinging condition (damped), creeping condition and aperiodic borderline case by varying the ohmic resistance	164	☐
		The perfect analogy of chapter 6.1.1 and chapter 11.4 in volume 1 is explained by the structural equality of the diferential equations. Compile a table of analogous values.	164	☐
	➔	**Applet:** Oscillating series circuit	165	☐
6.2	❹	**Coupled oscillating circuits**	166	20'
		Compare the the differential equatons of the inductively coupled oscillating circuits (6.12) with those of two coupled spring pendulums (vol. 1, 11.8.1). *Why is there a splitting in two eigenfrequencies despite the slightly different terms?*	167	☐

http://fernstudium-physik.de/fips/teilnehmer/index.html
(german)

FiPS vs. Lectures

No live experiments like in the lectures!

Therefore lack of:

- motivation
- demonstration
- exemplification of correlations
- exercise
- ...

Multimedia Material on the Web

MPTL 7:

Jodl, H.-J.: „Report on Available Multimedia Material for a Lecture in Quantum Mechanics“

MPTL 8:

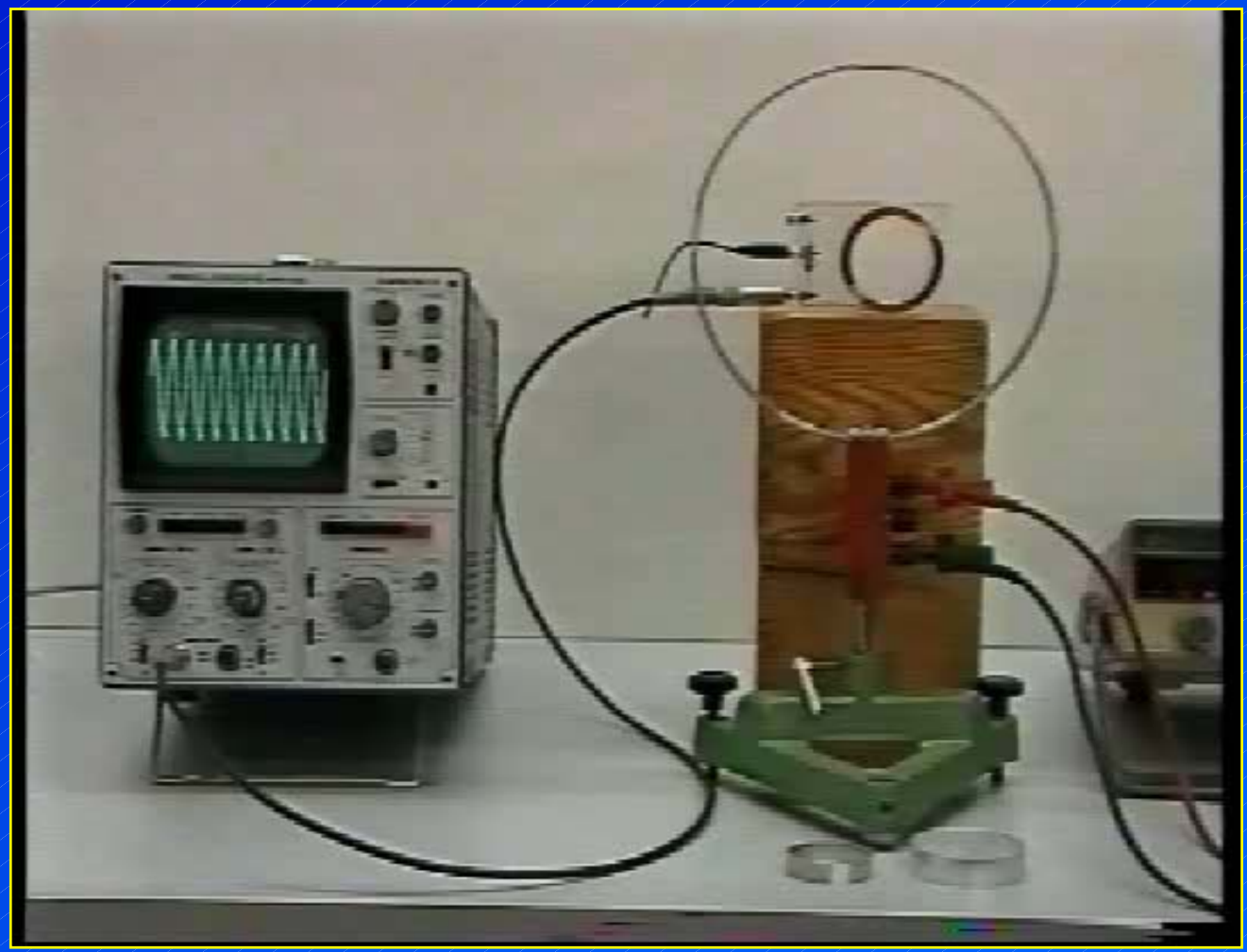
Debowska, E., Jodl, H.-J.: „Report on Available Multimedia Material for Teaching Optics at School and University Level“

Short Summary:

- 80-90% standard topics
- the material is often too simple and not instructive
- most media are at best of mediocre quality
- and so on...

Experiments in FiPS

Shooting videos of lecture experiments (0:37min)



(Video not available online)

Experiments in FiPS

Problems:

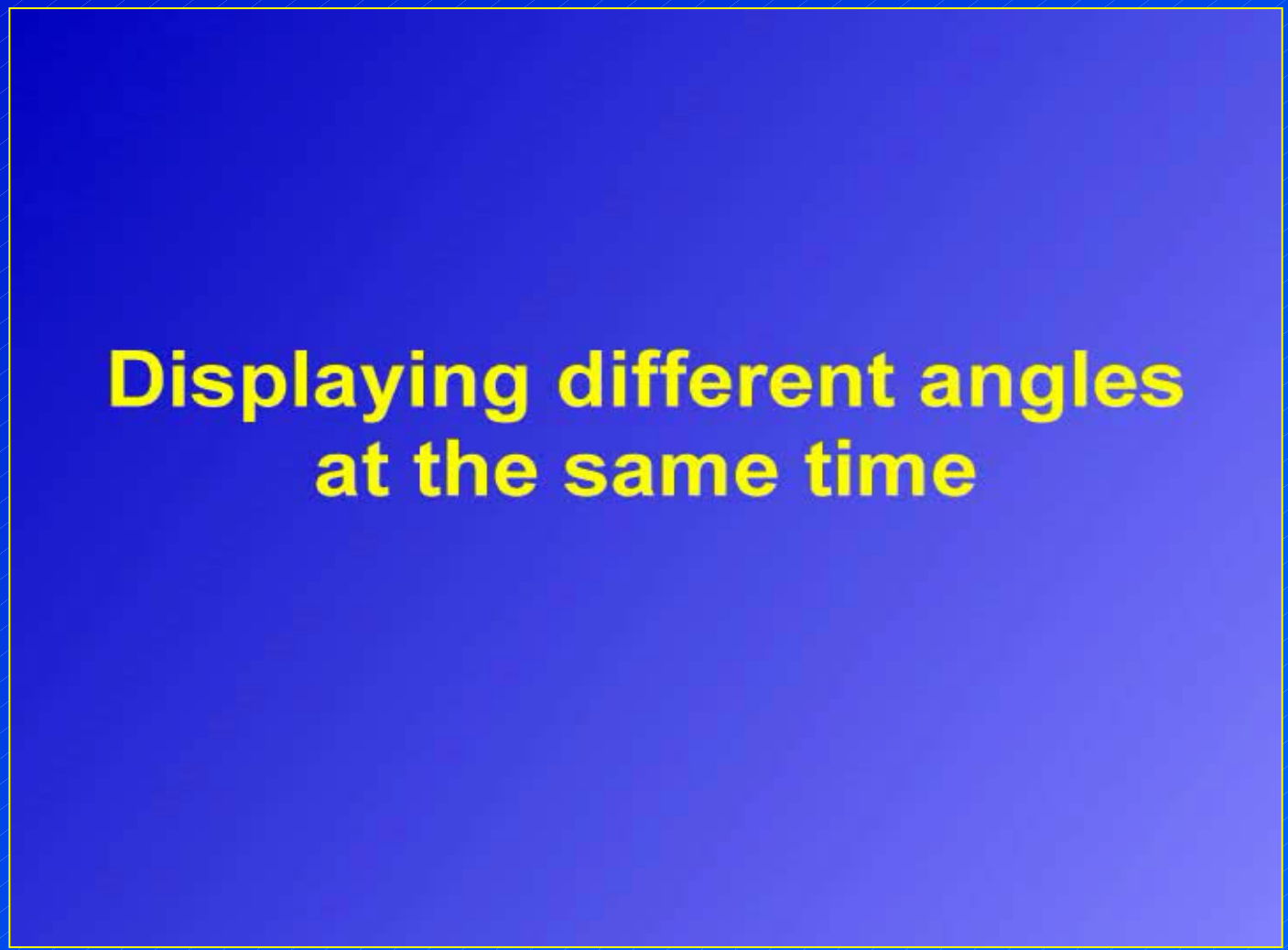
- boring
- not much to see
- „mediocre“ quality
- no help in understanding the subject

- **Simple videos of lecture experiments do not serve the intended purpose!**

Thus: Make videos better!

Developing Videos for FiPS

Some Techniques (3:10)



(Video not available online)

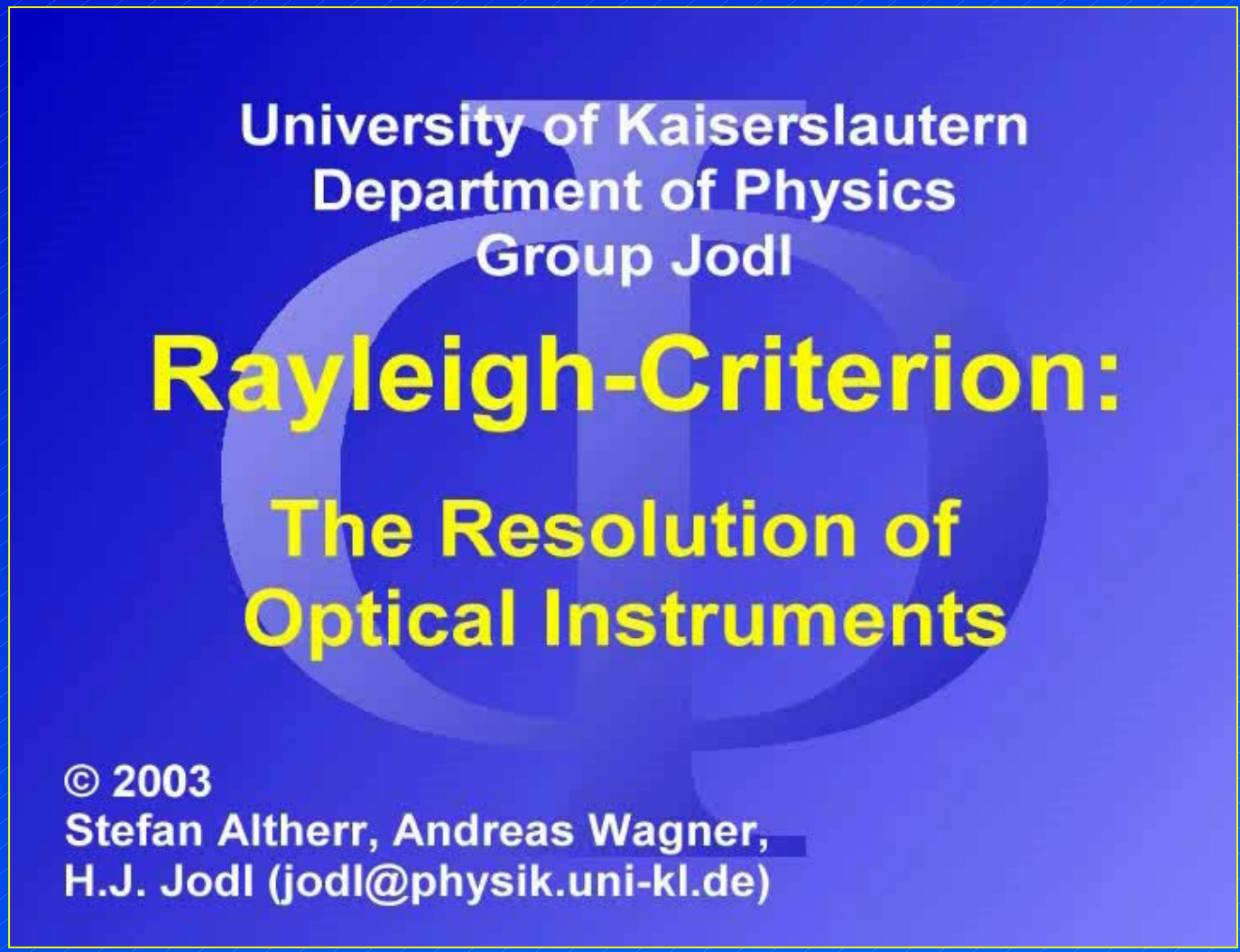
Temporary Resumee

Now that we are able to produce videos suitable for distance teaching we aim at different targets:

- Motivation and Demonstration
- Learning Difficulties
- Exercises

Motivation & Demonstration

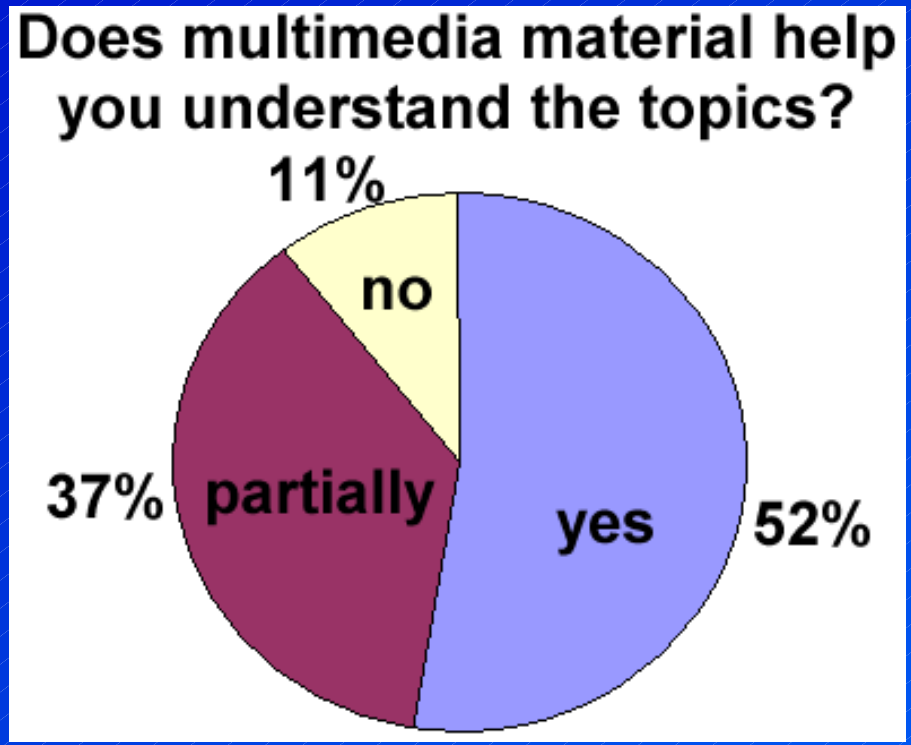
Rayleigh-Criterion: The Resolution of Optical Instruments (3:55min)

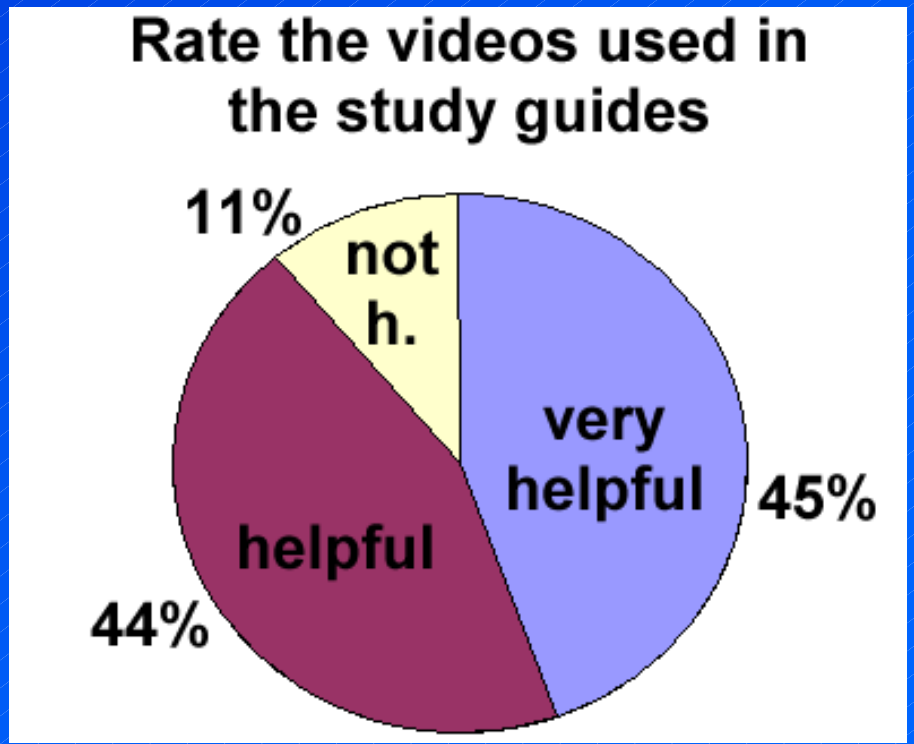


Video available online at: http://pen.physik.uni-kl.de/medien/MM_videos/

Statistics

Selected Results from FiPS Evaluation in SS 2003





Adressing Learning Difficulties

Coriolis- and Centrifugal Force in a Rotating Frame of Reference (5:56min)

Video available online at: http://pen.physik.uni-kl.de/medien/MM_videos/

Evaluation

How to Evaluate Material?

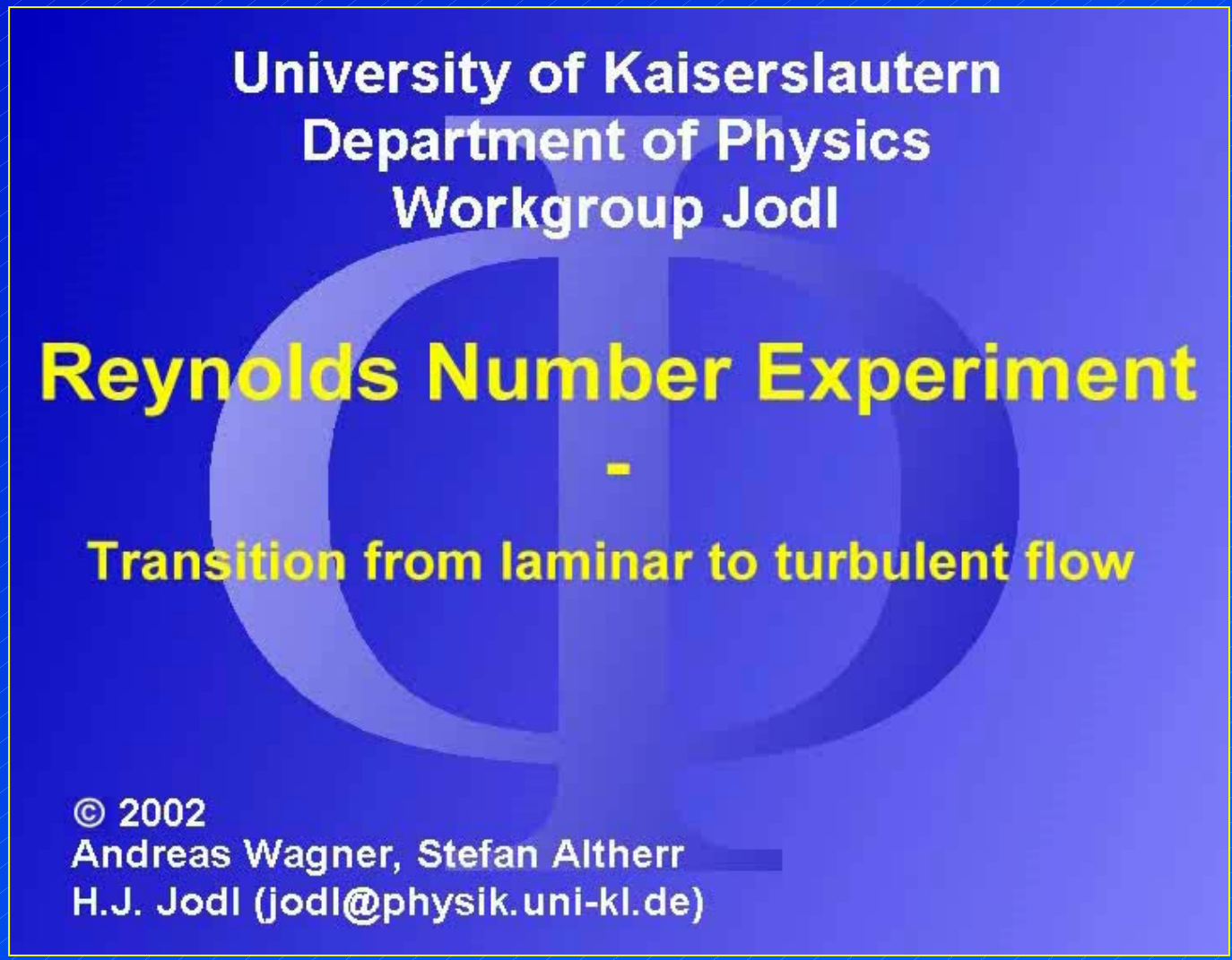
Motivation	Content	Method
· user-friendliness · attractiveness · clear description of purpose and work assignment	· relevance · scope · correctness	· flexibility · matching to target group · realization · documentation

- Jodl, H.-J.: „Criteria to Evaluate Multimedia Material“, Tuesday, 9.15 a.m.

- Altherr, S. et al.: „Multimedia Material for Teaching Physics (search, evaluation and examples)“, European Journal of Physics, 2003

Exercises

Reynolds Number Experiment (4:16min)



Video available online at: http://pen.physik.uni-kl.de/medien/MM_videos/

Exercises

06 **Übungen zur Experimentalphysik 1 (SS 2003)**

Prof. Dr. Jodl, Prof. Dr. Korsch, Dr. Berbenni 03.06.2003

Aufgabe 23(T):

Gegeb

a) Ber

b) Ber

Aufgabe

Zeigen
tor $\hat{r}$ =

a)

b)

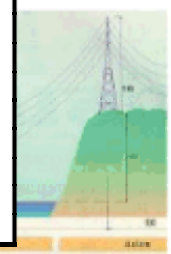
a) Leiten Sie aus der Definition der Reynoldszahl als Verhältnis der Trägheitskraft zu Reibungskraft, bezogen auf ein Massenelement, die Gleichung

$$\mathrm{Re} = \frac{\rho \cdot (2r) \cdot \bar{u}}{\eta}$$

für die Durchströmung eines kreisförmigen Rohres mit Innendurchmesser 2r her.

b) Bestimmen Sie für die im Video „Farbfadenversuch nach Reynolds - ohne Auswertung“ gezeigte Rohrströmung die kritische Reynoldszahl Re_{krit}. Nehmen Sie für den Umschlag von laminarer zu turbulenter Strömung den Zeitpunkt an, an dem der Farbfaden abzureißen beginnt.

c) Der Literaturwert für die kritische Reynoldszahl der Wasserströmung durch ein Rohr mit kreisförmigem Querschnitt beträgt etwa 2300. Geben Sie zwei Gründe für eine im Versuch festgestellte Abweichung an.



zontalen Gerade $2s$ gestreckt.

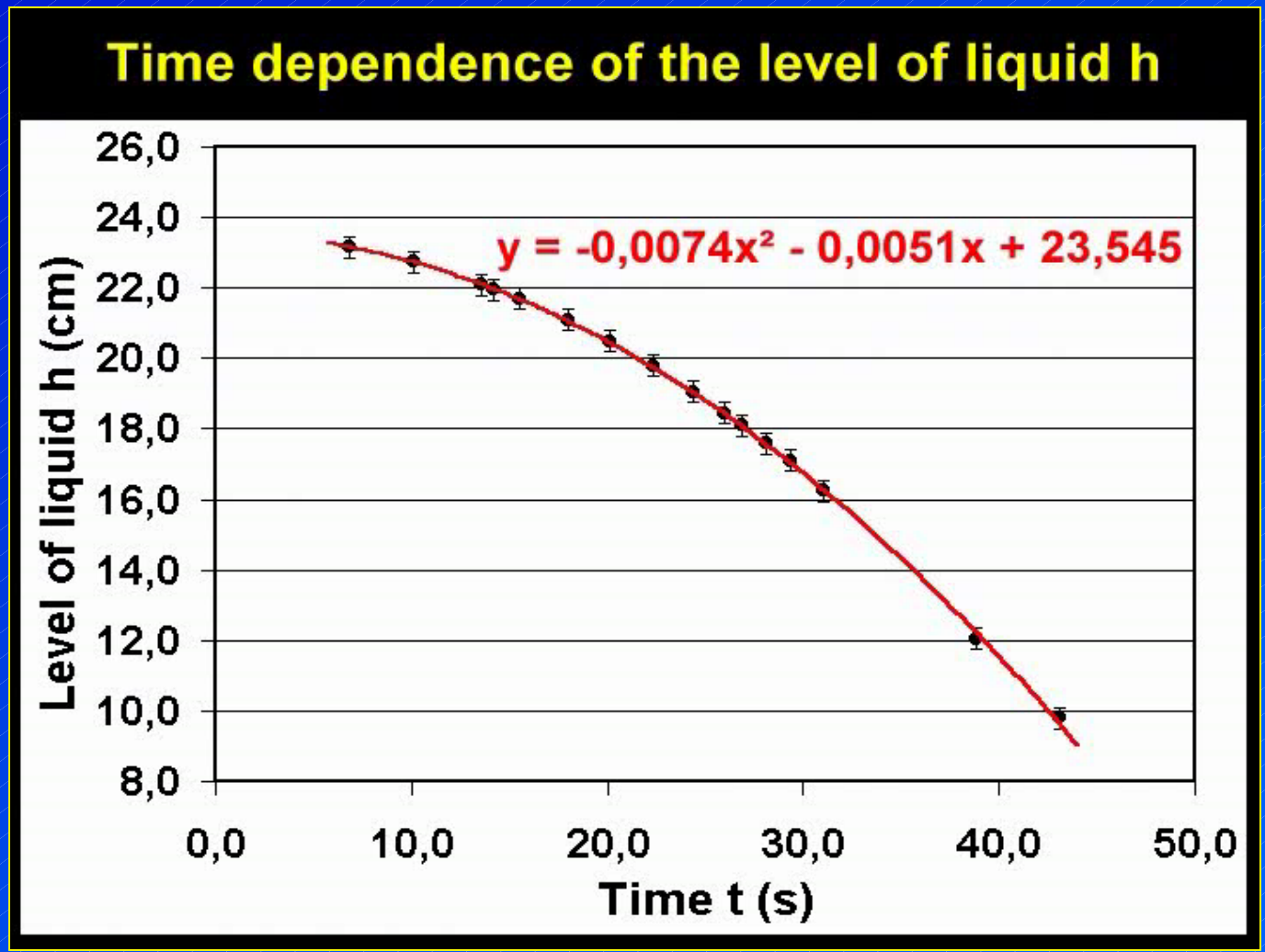
a) Von diesen Annahmen ausgehend stelle man die Gleichung für den Durchhang als Funktion der Temperaturdifferenz auf und berechne dann den Durchhang, den eine Kupferleitung bei +30°C haben muss, wenn sie bei -20°C gestreckt sein soll mit $2s = 20\mathrm{m}$.

b) Warum wird der Durchhang in Wirklichkeit viel größer gewählt?

(7 Punkte)

Exercises

Reynolds Number Experiment - Analysis (1:18min)



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Problems

- Students and lecturers are reluctant to use multimedia material at first
- Extra time and work for students and lecturers
- Technical difficulties
- Costs
- Know-how

Future

- FiPS grows
- Use multimedia material in regular lectures
- Collect and evaluate material of good quality (Jodl, H.-J.: „Criteria to Evaluate Multimedia Material“, Tuesday, 9.15 a.m.)
- Produce own material according to our needs
- Build collection of material

Resources

Videos:

http://pen.physik.uni-kl.de/videos/

FiPS:

http://fernstudium-physik.de (german)

Email:

altherr@rhrk.uni-kl.de