universitätbonn

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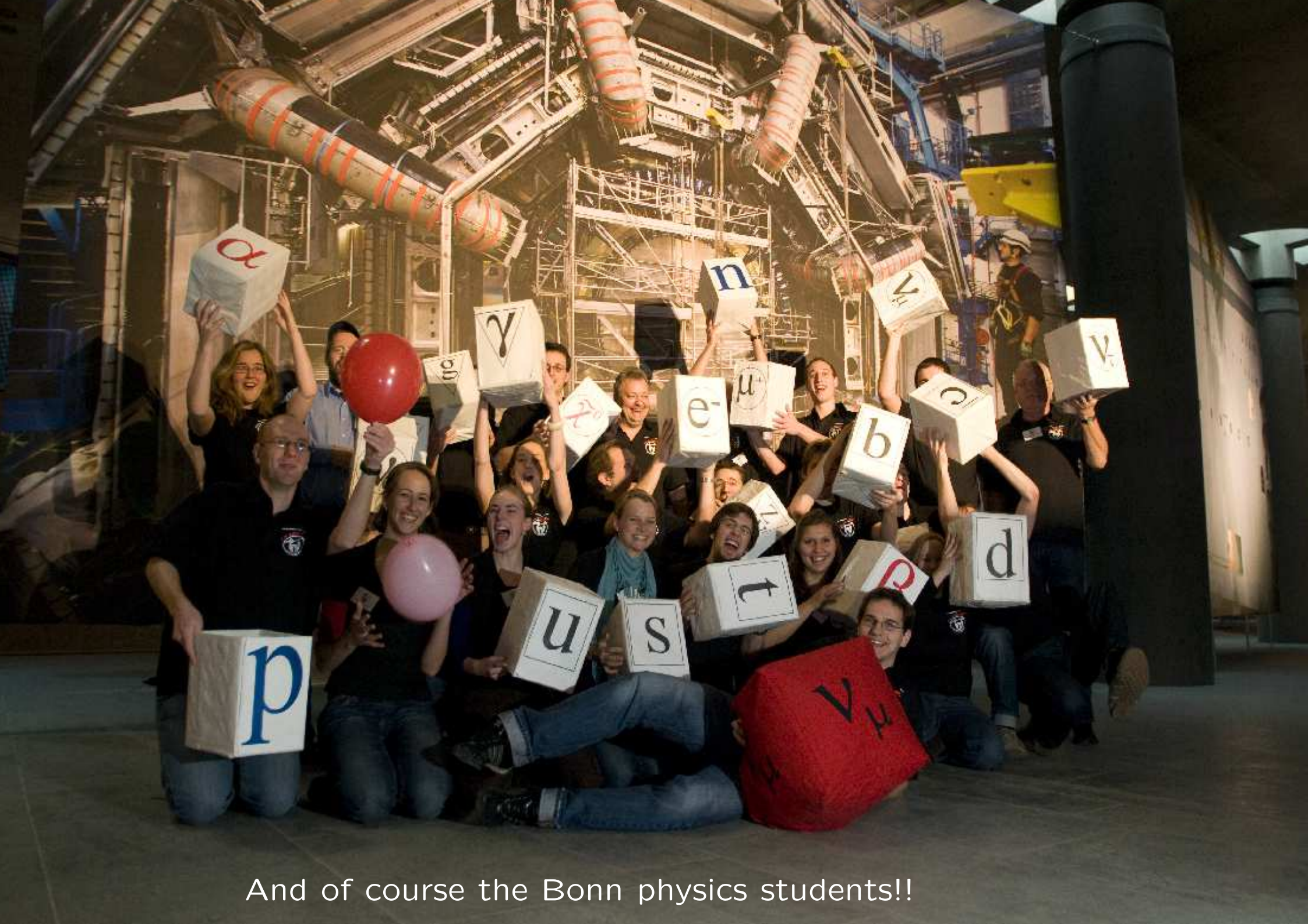
The Bonn Physikshow:

By Students, for Kids

Herbi Dreiner
Universität Bonn

and Michael Kortmann



And of course the Bonn physics students!!

Overview – Physikshow Bonn

- This is an Outreach project ... (that is how most people see it)

- ... and then it is not

- For ME it is an educational project ...
- A special opportunity for the Bonn University physics students ....


Or it is simply FUN!!

Outline

- Personnel and Historical Origins
- Beginnings of the Bonn Show
- How the Show works
- Extensions
- Particle Physics Show

Literature

- **A Physics Show performed by Students for Kids: from Mechanics to Elementary Particle Physics**;
  e-Print: physics/0701344
  The Physics Teacher **46** *(2008) 358*

- **It's Physikshow time in Germany**
  CERN Courier, October 2007 (available online)

- **Fun Physics in School: Students perform for Students**
  Science in School **9** *(2008) 46*

Personal History

- I grew up in Williamstown Mass.
- My dad is a physicist and worked in an industrial research lab.
- Worked part time at Williams College.
- I got to play around in the demonstration experiment collection!
- It turns out the students love it as much as I did.

Historical Origins

- Wisconsin: Prof. Shakhashiri "Chemistry is fun" lectures (since about 1970)
- >1984 Wisconsin: "Wonders of Physics", Prof. Clint Sprott
  - Show for kids: 10+
  - Presented by Prof. Sprott

- I went to grad school at the University of Wisconsin 1984–89

Historical Origins II

- > 2000 @ Bonn University: first teaching position
- Since Wisconsin the idea of a show had been milling in my head
- Winter sem. 2001/02: teaching 2nd year students (class. mechanics)
- Dec 2001: Without a clear plan, decided to take the plunge
- 35 Students signed up
- 10 months of preparation
- 15 students remained
- November 2002: 1st Show

Crew of the first Show

Basic Idea of the Bonn PHYSIKSHOW

- **STUDENTS** themselves present entertaining and educational Experiments for Kids aged 10–99

Target group of the Physikshow $\longrightarrow$ Physics students

- Students can apply their physics (and other) knowledge very early

- Students develope and present every show themselves

  $\longrightarrow$ they can completely identify with it

- Students do this in their free time
  - no credit points
  - just for fun

- Considerable technical support: **Michael Kortmann** & machine shop

Student Activities

- Every year a new group of students!
- Every year a completely new show!
- 3–4 shows in September; repeat with 3–4 shows following March
- Choose a theme or a story for the upcoming show
- Choose experiments from the extensive demonstration collection
- Build completely **new experiments!** $\longrightarrow$ Examples
- These are added to our collection

Tsunami Pool

Superconducting Train

Superconducting Train

Superconducting Train II


Wolfgang

Wolfgang

Target group of the Physikshow $\longrightarrow$ Physics students

Success – Public Impact

- Since 2001: now the 8th "class" of students
- About 20 – 25 Students per year

$\Longrightarrow$ almost 200 Students trained in outreach activities

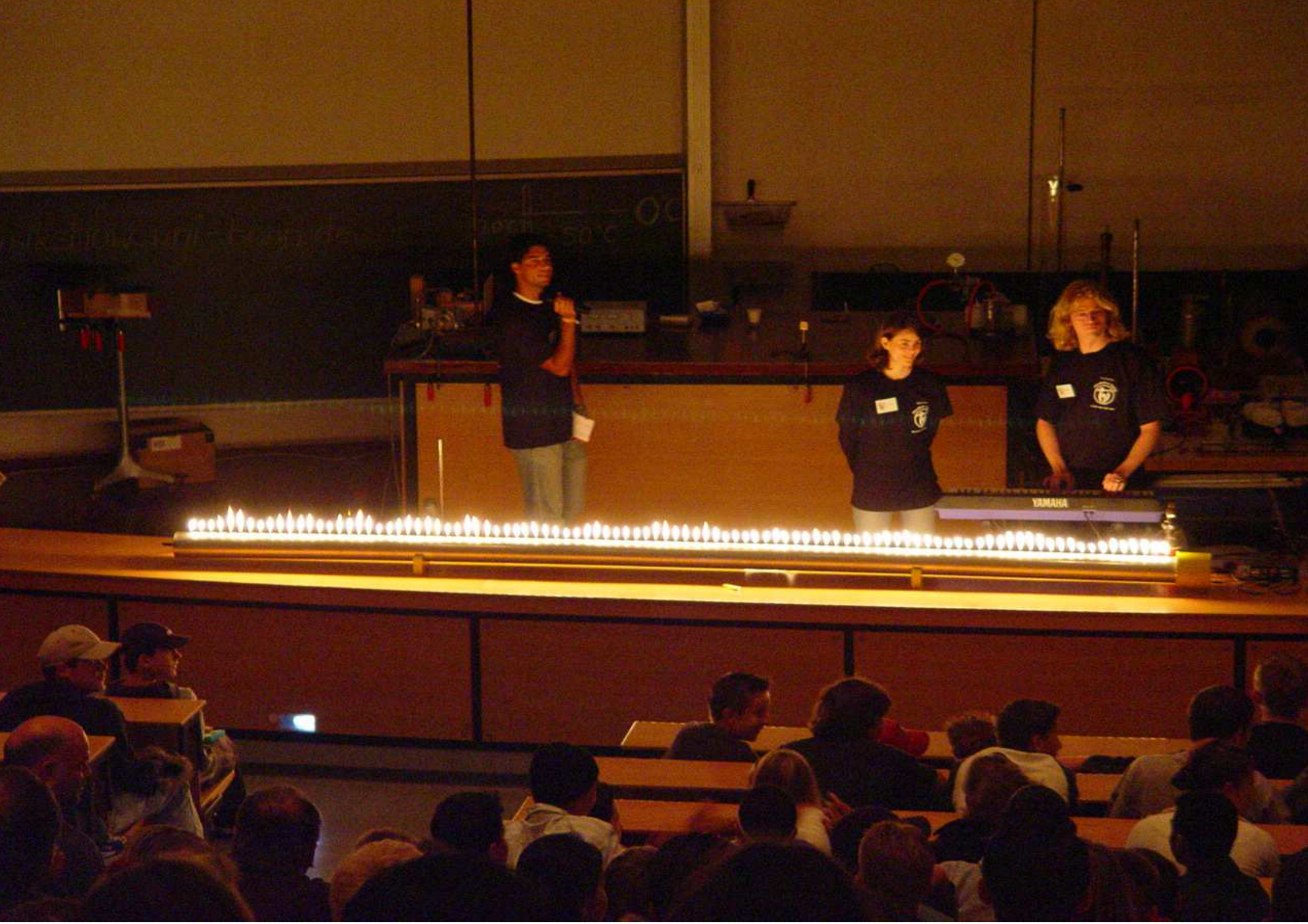
- >50 Shows in Bonn, "sold" out; 550 seats: Wolfgang-Paul lecture hall

$\Longrightarrow$ $\gtrsim$ 28.000 spectators in physics

- For me personally a unique and wonderful interaction with the students.....also I again get to play in the demonstration collection!
- Two prizes:
  - 2006 Alumni Prize of Bonn University for Student Initiatives
  - 2009 European Physical Society High Energy Physics Outreach Prize

What happens in a show?

- Short intro by me (2min)
- 1 woman, 1 man moderate the show (MC) and explain experiments
- Other students present experiments
- Show takes 2h, incl. 20min intermission
- Intermission: Kids can try out experiments in the lecture hall and in the reception area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Show II

- Split show into 4 or 5 topics (e.g. Mechanics, E&M, low temp., ...)
  introduced by self–made films $\longrightarrow$

- Show Themes:
  - Physikshow
  - Odyssey through Physics
  - "Wer nicht fragt bleibt dumm" (Sesame Street)
  - Time Travel through Physics
  - Episode V (Computer game) $\longrightarrow$
  - Everyday Physics
  - Hitchhikers Guide to Physics

What do you need if you want to do this?

"If you build it he will come"

- If you offer the students the opportunity, they will come
- Can start small: e.g. 30min show on an open day
- Just use stuff in demo collection
- If you advertise, the public will come

Other Activities

- We have a pool of over 50 experienced and eager students

  $\longrightarrow$ other activities

- Films [YouTube: $>$ 5 mill. viewings!; WDR TV]

- External shows (2 vans full of equipment, 2 vans for people)

  - Bonn University main building
  - Bad Godesberg, Göttingen, Solingen, Köln, Wuppertal
  - Elementary Schools (small scale)
  - **Deutsches Museum München** (twice: '06 & '09)

- 10 part courses in elementary schools (thrice)

Bonn University Main Building

Highlight Two Activities

- Physikshow by High school students in their own school
  - We took our experiments to them
  - The students performed for their fellow students
  - They had a "professional" in–house sound and lighting crew
- Particle Physics Show

Particle Physics Show

- Most ambitious project to–date: how to perform modern physics?
- Started 2004: 50 years of CERN, launched with Profs. M. Kobel and E. Paul
- Spring 2008: BMBF ask us for a show at the national LHC exhibit in Berlin in the special down town subway station

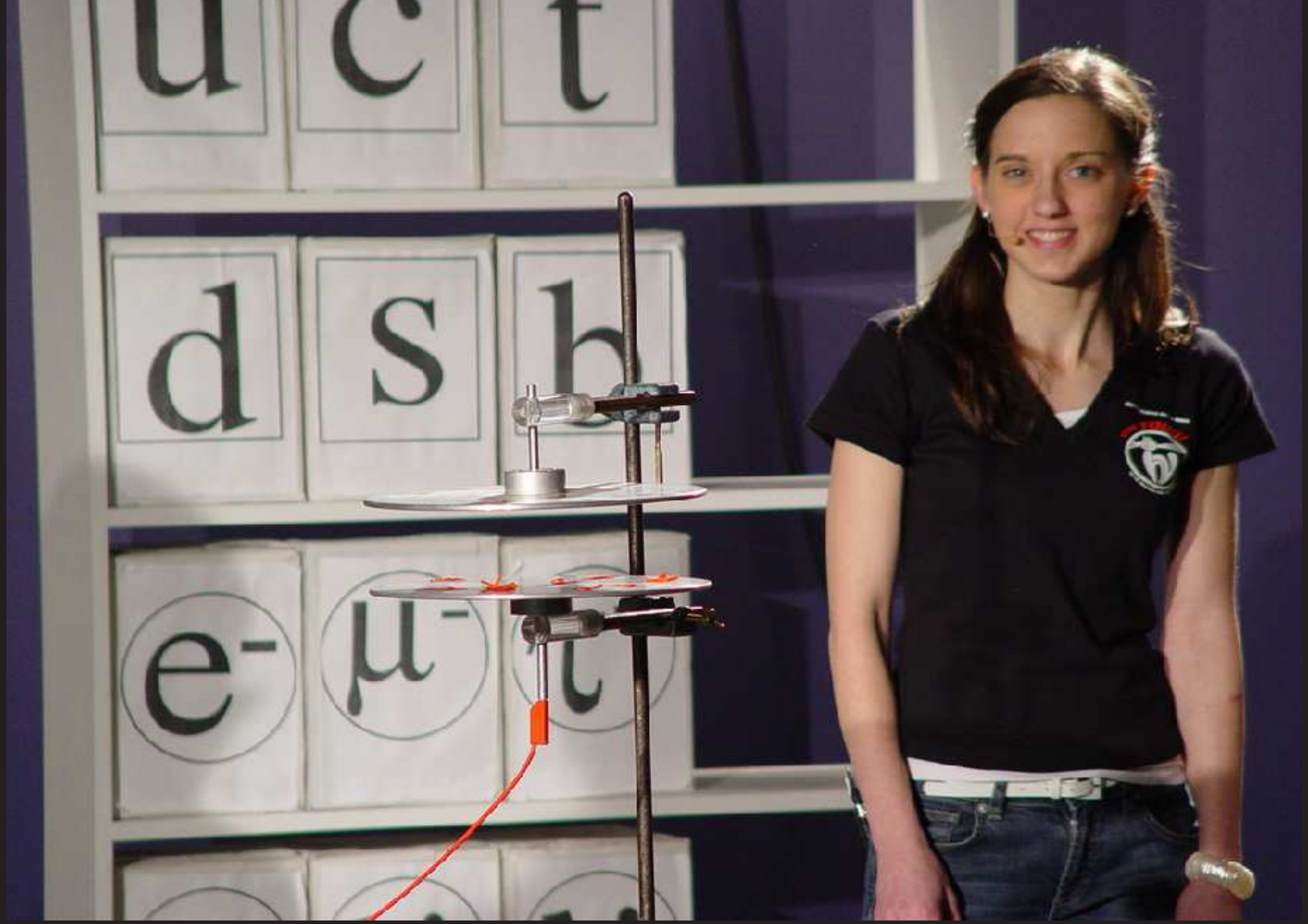
Teilchenphysik Show: Content

- Target group: age 14+
- Split show into four topics:
  - **Atoms & Nuclei**
  - **Particle Physics**
  - **Forces and Symmetries**
  - **Astrophysics and Cosmology**
- Some experiments

$\longrightarrow$

Atoms & Nuclei

- Atom size by drop forming thin film on liquid
- Home–made Geiger–Müller counter
- Hg–spectrum, including UV part
- Radioactivity with various absorbers: α, β, γ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Particle Physics

- Single photon counter
- Muons in coffee thermos with photomultiplier
- Vacuum accelerator with "Quark" target
- Anti–matter: ^{22} Na beta+ emitter, bend in magnetic field
- Particle mass comparison:
  - electron: ping pong ball
  - ⋮
  - top quark: elephant


γ

Forces and Symmetries

- Students built Tesla transformer
- Forces and Annihilation: exchanging medicine ball on roller blades
- Gauge analogy with scales and medicine ball
- Higgs: magnet/non-magnet in metal tube

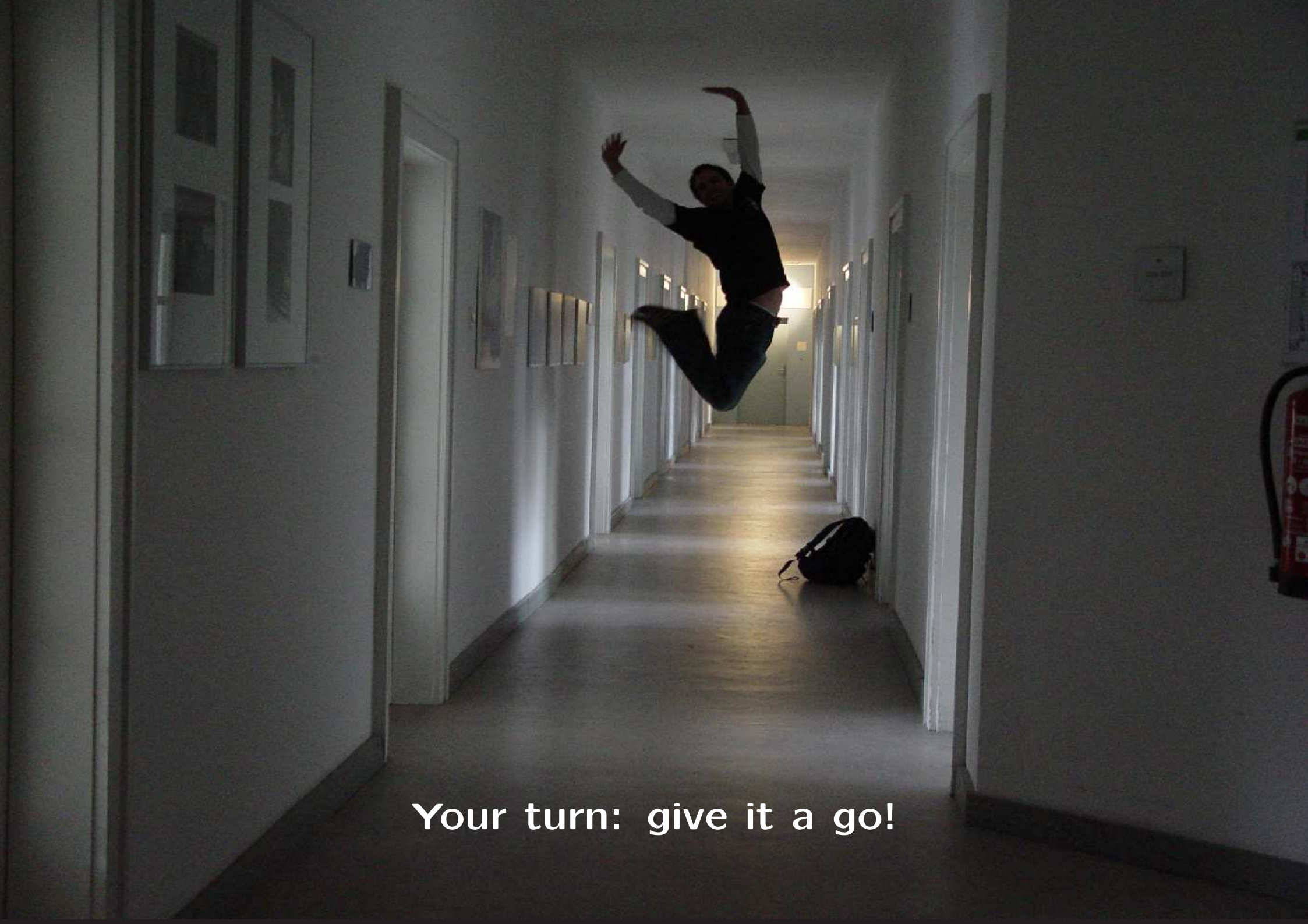
Astro & Cosmology

- Einstein lensing with broken–off wine glas
- Curved space–time on dental–damm drum (Santa Cruz)
- Expanding giant balloon (galaxies and waves) with confetti inside

On Tour

- Nov. 2008: **Subway Station Berlin: Weltmaschine Exhibit**
- March 2009: **Deutsche Museum München**
- Sept. 2009: **DESY Hamburg**
- Dec. 2009: **Heidelberg**
- Sept 2010: **CERN** ... in French

- **WATCH THE MOVIE!!**


Your turn: give it a go!