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The Bonn Physikshow:
By Students, for Kids

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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

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

- Fun Physics in School: Students perform for Students
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 → Physics students

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

• Students develop and present every show themselves

  → 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!
- These are added to our collection
  → Examples
Tsunami Pool
Superconducting Train
Superconducting Train
Superconducting Train II
Wolfgang
Target group of the Physikshow → Physics students
Success – Public Impact

- Since 2001: now the 8th “class” of students
- About 20 – 25 Students per year
  \[ \Rightarrow \text{almost 200 Students trained in outreach activities} \]
- >50 Shows in Bonn, “sold” out; 550 seats: Wolfgang-Paul lecture hall
  \[ \Rightarrow \sim 28,000 \text{ spectators in physics} \]
- 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
Show II

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

• Show Themes:
  • Physikshow
  • Odyssey through Physics
  • “Wer nicht fragt bleibt dumm” (Sesame Street)
  • Time Travel through Physics
  • Episode V (Computer game) →
  • 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
- 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)
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
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: $\alpha$, $\beta$, $\gamma$
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
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 glass
- 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!