

Das Standardmodell der Teilchenphysik

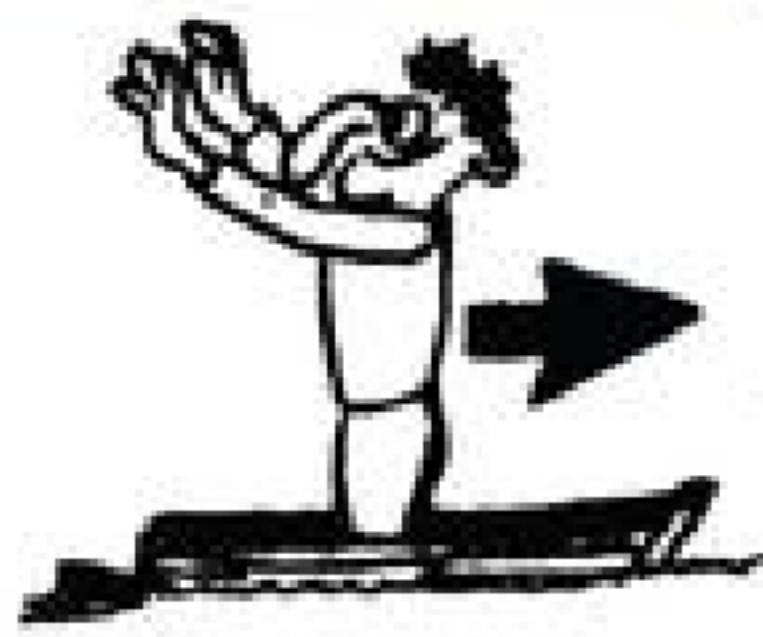
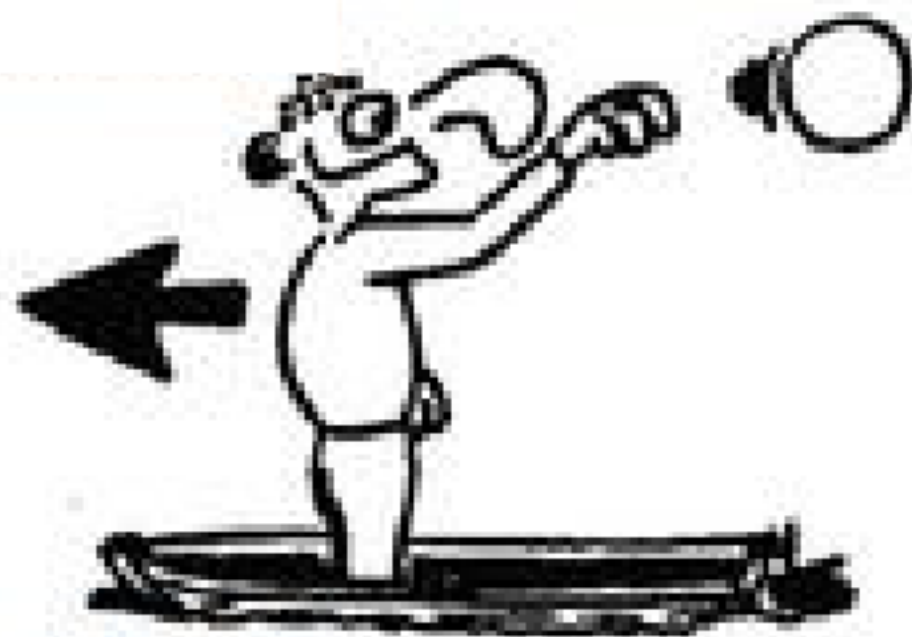
Drei Generationen
der Materie (Fermionen)

	I	II	III		
Masse →	2,3 MeV	1,275 GeV	173,07 GeV	0	125,9 GeV
Ladung →	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	0	0
Spin →	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	0
Name →	u up	c charm	t top	γ Photon	H Higgs Boson
Quarks	4,8 MeV $-\frac{1}{3}$ $\frac{1}{2}$ d down	95 MeV $-\frac{1}{3}$ $\frac{1}{2}$ s strange	4,18 GeV $-\frac{1}{3}$ $\frac{1}{2}$ b bottom	0 0 1 g Gluon	
	<2 eV 0 $\frac{1}{2}$ ν_e Elektron- Neutrino	<0,19 MeV 0 $\frac{1}{2}$ ν_μ Myon- Neutrino	<18,2 MeV 0 $\frac{1}{2}$ ν_τ Tau- Neutrino	91,2 GeV 0 1 Z⁰ Z Boson	
	0,511 MeV -1 $\frac{1}{2}$ e Elektron	105,7 MeV -1 $\frac{1}{2}$ μ Myon	1,777 GeV -1 $\frac{1}{2}$ τ Tau	80,4 GeV ±1 1 W[±] W Boson	Eichbosonen
Leptonen					

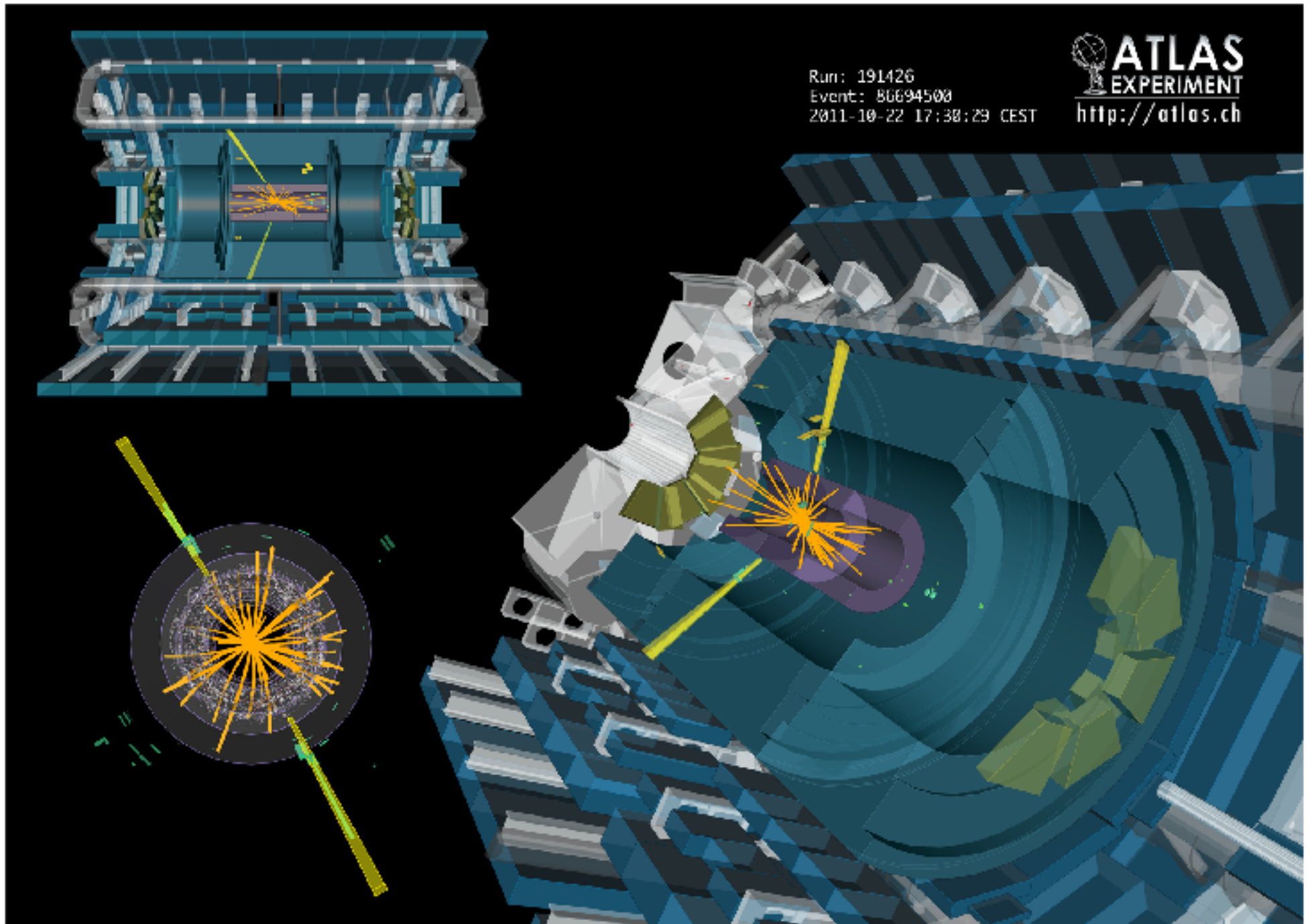
Fundamentale Wechselwirkungen (WW)

WW	rel. Stärke	Austauschboson	Spin	Masse	Reichweite
starke	1	8 Gluonen	1	0	$< 1 \text{ fm}$
EM	$\sim 10^{-2}$	Photon	1	0	∞
schwache	$\sim 10^{-7}$	W^{\pm}, Z	1	80 GeV/c^2 91 GeV/c^2	$\sim 10^{-3} \text{ fm}$
Gravitation	$\sim 10^{-39}$	Graviton*	2	0	∞

*noch nicht entdeckt.



$H \rightarrow \gamma\gamma$ - Zerfall in 2 Photonen

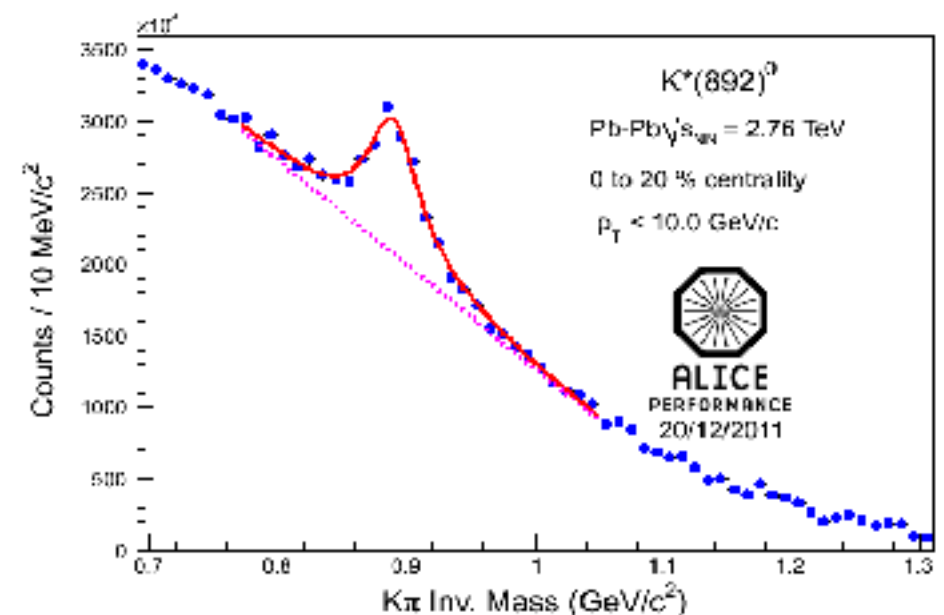
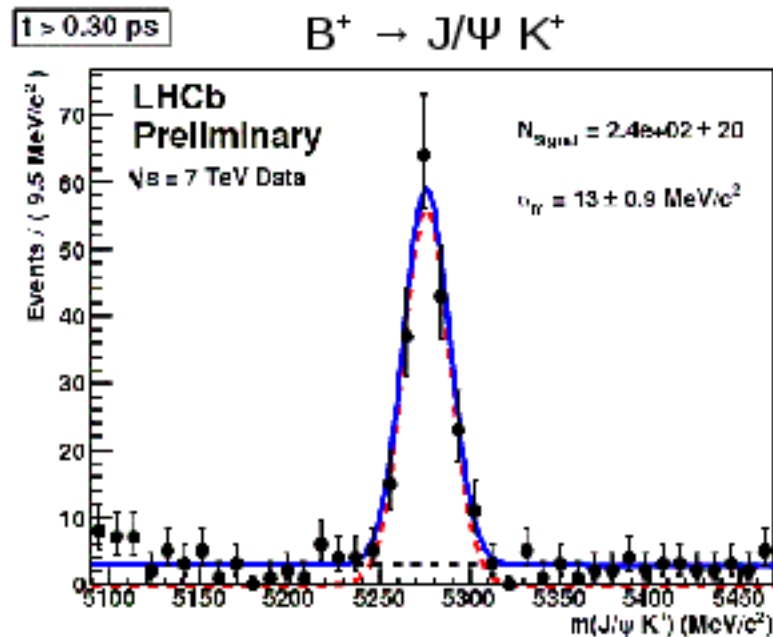


$$\Gamma = \hbar/\tau \quad \hbar = 6.58 \times 10^{-16} \text{ eV/s}$$

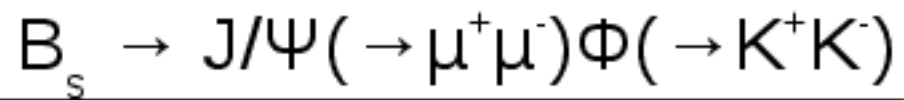
Mittlere Fluglänge im Laborsystem (für hochrelativistische Teilchen) :

$$\langle x \rangle = c \tau \gamma \quad \gamma^2 = 1 + p^2/(m_0^2 c^2) \quad (\text{hier angenommen } p = 50 \text{ GeV}/c)$$

Teilchen	τ	Γ	m	γ	$\langle x \rangle$
B hadron (B^0, B^+, B_s, \dots)	1.5 ps	$4.4 \times 10^{-4} \text{ eV}$	5 GeV/c	10	4.5 mm
K^* ($ \bar{s}d\rangle$)	$1.4 \times 10^{-22} \text{ s}$	47 MeV	892 MeV/c	56	$2 \times 10^{-12} \text{ m}$
Φ	$1.5 \times 10^{-21} \text{ s}$	4 MeV	1.02 GeV/c	50	$5.8 \times 10^{-12} \text{ m}$
J/ Ψ	$7 \times 10^{-21} \text{ s}$	93 keV	3.01 GeV/c	17	$3.6 \times 10^{-11} \text{ m}$



typische Detektorauflösungen: $\sigma(m) = 10\text{-}20 \text{ MeV}/c^2$, $\sigma(x) = 50 \mu\text{m}$



Fluglänge B_s meson: 20 mm

