

MOIN-MOIN / WELCOME!

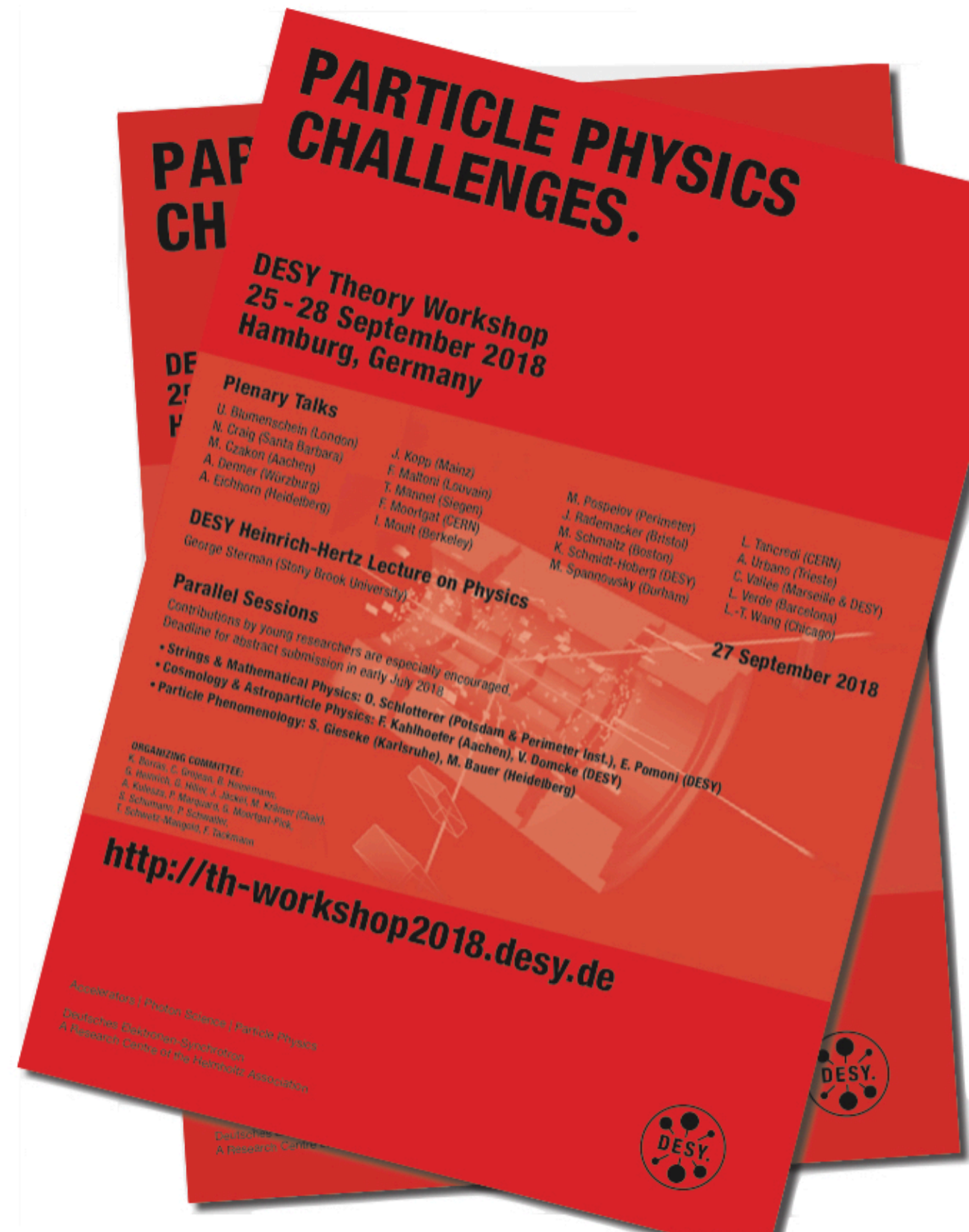
PARTICLE PHYSICS CHALLENGES.

DESY Theory Workshop

25 - 28 September 2018

<http://th-workshop2018.desy.de>

20 plenary talks, 88 parallel talks, 190 participants



To speakers:
Please upload your slides on Indico!

if you don't have a DESY indico account,
give your pdf file on USB stick to your convener before your session

Plenary sessions in Main Auditorium

Parallel sessions in 4 locations

Strings:

Bldg. 1, Seminar room 1

Cosmo:

Bldg. 1b, SR4a/4b

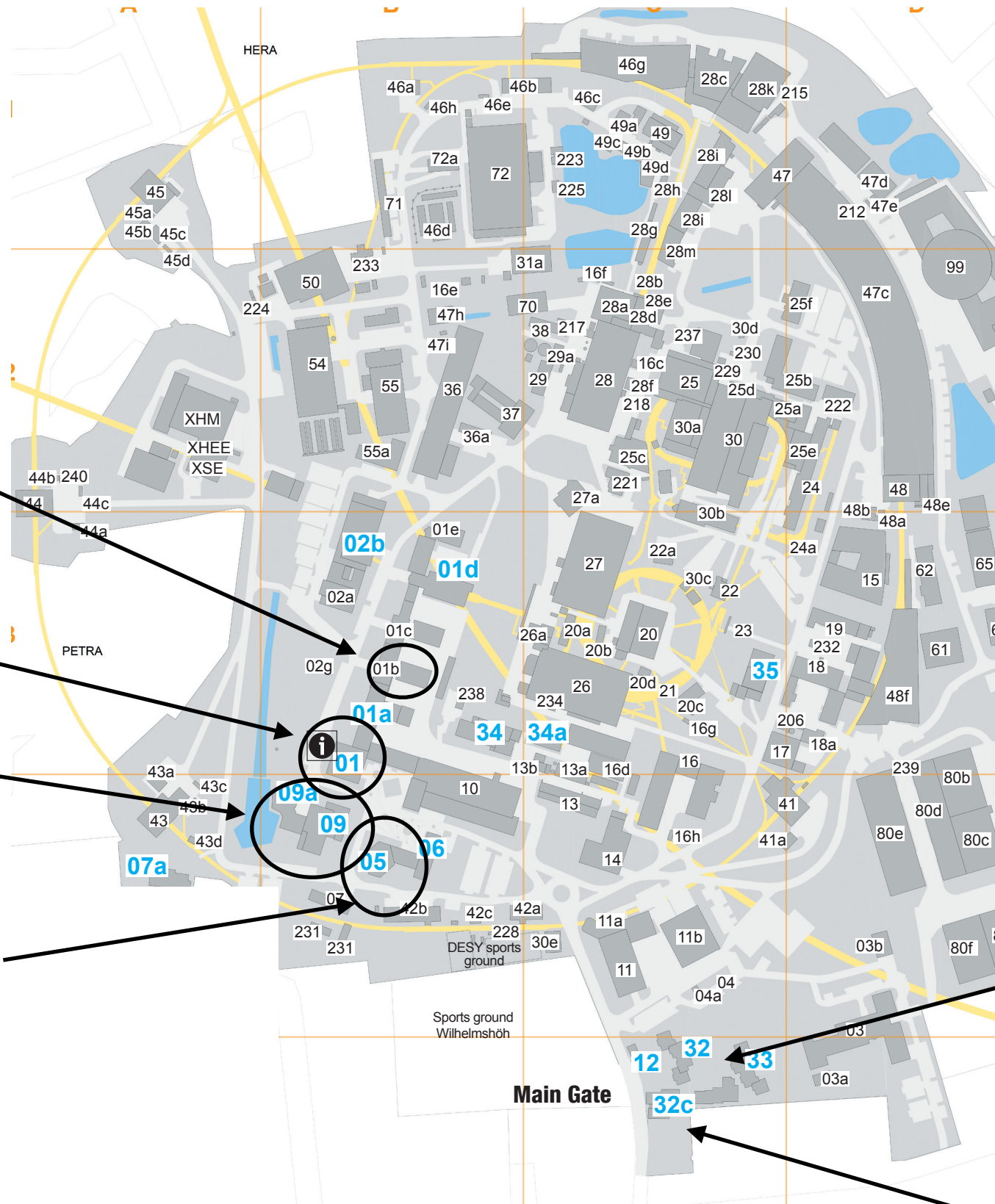
Main auditorium (Wednesday 4:30-7:00pm)

Pheno:

Main Auditorium

Bldg. 1b, SR4a/4b (Wednesday 4:30-7:00pm)

DESY Map



SR4a/4b
(first floor)

SR1
(ground floor)

Cafeteria

Main auditorium

Side entrance

DESY Hostel

Main entrance

Schedule Overview

Theory Workshop 2018: Schedule Overview				
	25/09/2018	26/09/2018	27/09/2018	28/09/2018
Plenary (DESY auditorium)	13:50 - 16:00	09:00 - 11:00	09:00 - 11:00	09:00 - 11:00
chair	M. Kraemer	A. Kulesza	G. Moorgat-Pick	J. Jaeckel
speakers	A. Urbano, L. Verde, A. Eichhorn	U. Blumenschein, A. Denner, M. Czakon	F. Moorgat, N. Craig, M. Schmaltz	J. Rademacker, T. Mannel, C. Vallée
	16:30 - 17:50	11:40 - 13:00	11:40 - 13:00	11:40 - 13:00
chair	C. Grojean	G. Heinrich	F. Tackmann	G. Weiglein
speakers	K. Schmidt-Hoberg, J. Kopp	F. Maltoni, M. Spannowsky	L. Tancredi, I. Mout	M. Pospelov, M. McCullough
Hertz Lecture (DESY auditorium)			18:00-19:00	
chair			M. Diehl	
Speaker			G. Sterman	
Parallel Cosmo		14:00-16:00	14:00-15:45	
		Cosmo 1 (SR4a)	Cosmo 2 (SR4b)	
			Cosmo 4 (SR4a)	
		16:30-19:00	16:15-17:40	
		Cosmo 3 (DESY auditorium)	Cosmo 5 (SR4a)	
Parallel Pheno		14:00-16:00	14:00-15:30	
		Pheno 1 (DESY auditorium)	Pheno 4 (DESY auditorium)	
		16:30-19:00	16:00-17:50	
		Pheno 2 (SR4a)	Pheno 3 (SR4b)	
			Pheno 5 (DESY auditorium)	
Parallel String		14:00-16:00	14:00-15:30	
		String1 (SR1)	String 3 (SR1)	
		16:30-19:00	16:00-17:20	
		String 2 (SR1)	String 4 (SR1)	
Social Activites	Welcome reception		Workshop dinner	
	18:30-21:30		19:20-22:20	
	DESY auditorium		DESY canteen	

On Thursday evening Hertz lecture & Workshop dinner

HERTZ LECTURE

DESY Lecture on Physics 2018

Imaging Fundamental Processes: Thought, experiment and the accessible universe

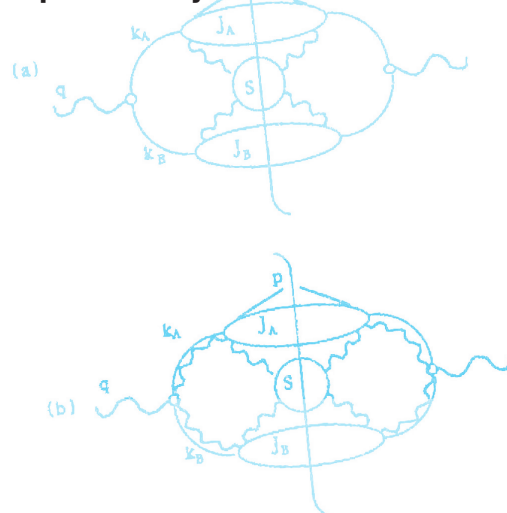
Prof. Dr. George Sterman
(Stony Brook University)

27 September 2018

18:00 h, DESY Auditorium

Notkestraße 85 | 22607 Hamburg | Germany

<http://www.desy.de/hertz>



Accelerators | Photon Science | Particle Physics

Deutsches Elektronen-Synchrotron
A Research Centre of the Helmholtz Association

Figure 21: Typical Feynman diagrams for annihilation processes. (a) covariant gauge. (b) covariant gauge. The most general leading region possibility of extra jets beyond the two shown here.

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PHYSICAL REVIEW LETTERS

5 DECEMBER 1977

Jets from Quantum Chromodynamics

George Sterman

Institute for Theoretical Physics, State University of New York at Stony Brook, Stony Brook, New York 11790

and

Steven Weinberg

Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138

(Received 26 July 1977)

The properties of hadronic jets in e^+e^- annihilation are examined in quantum chromodynamics, without using the assumptions of the parton model. We find that two-jet events dominate the cross section at high energy, and have the experimentally observed angular distribution. Estimates are given for the jet angular radius and its energy dependence. We argue that the detailed results of perturbation theory for production of arbitrary numbers of quarks and gluons can be reinterpreted in quantum chromodynamics as predictions for the production of jets.

The contemporary theory of fundamental forces can be pictured as just a handful of particle species, acting among themselves according to a few simple rules. This theory can in principle account for the richness of the visible universe. It results from a centuries-long process of speculation and investigation, culminating in the language of quantum field theory. Yet every successful theoretical framework defines its own limitations, and suggests new questions and criteria. Looking back and ahead, I'll give a perspective on our current theories and viewpoints, and on how future developments may be influenced by evolving ideas in theoretical physics, by high energy experiments at accelerators, and by exquisite observations of the faintest cosmic signals.

$$\begin{aligned}\sigma_a &= (d\sigma/d\Omega)_0 \Omega (g_E^2/3\pi^2) [-3 \ln(E\delta/\mu) - 2 \ln^2 2\epsilon - 4 \ln(E\delta/\mu) \ln(2\epsilon) + \frac{17}{4} - \pi^2/3], \\ \sigma_b &= (d\sigma/d\Omega)_0 \Omega (g_E^2/3\pi^2) [2 \ln^2(2\epsilon E/\mu) - \pi^2/6], \\ \sigma_c &= (d\sigma/d\Omega)_0 \Omega \{1 + (g_E^2/3\pi^2) [-2 \ln^2(E/\mu) + 3 \ln(E/\mu) - \frac{7}{4} + \pi^2/6]\},\end{aligned}$$

where $(d\sigma/d\Omega)_0$ is the cross section for $e^+e^- \rightarrow q\bar{q}$ in Born approximation:

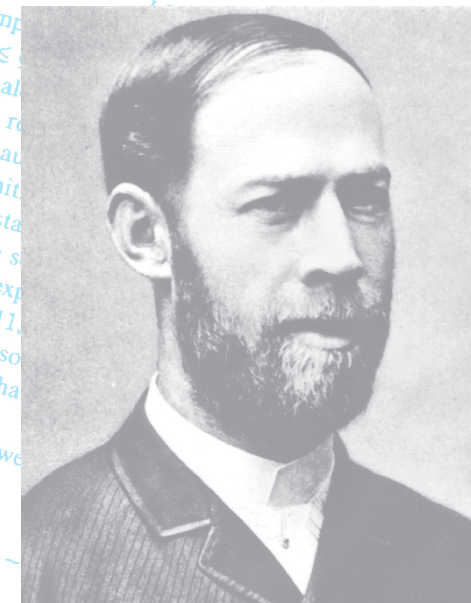
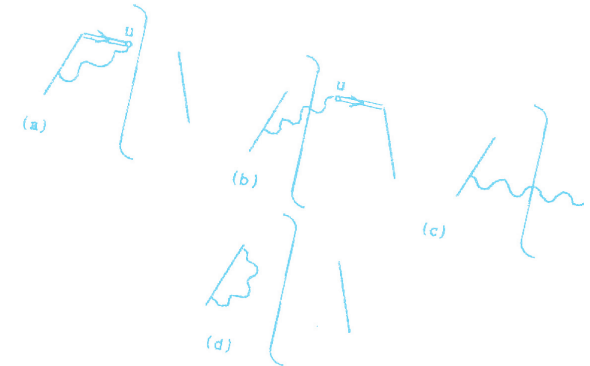
$$\left(\frac{d\sigma}{d\Omega}\right)_0 = \frac{\alpha^2}{4E^2} (1 + \cos^2\theta) \sum_{\text{flavors}} 3Q^2.$$

As expected, each separate contribution is singular for $\mu \rightarrow 0$, but cancellations occur in the sum, and the final result is free of mass singularities:

$$\sigma(E, \theta, \Omega, \epsilon, \delta) = (d\sigma/d\Omega)_0 \Omega [1 - (g_E^2/3\pi^2) (3 \ln \delta + 4 \ln \delta \ln 2\epsilon + \pi^2/3 - \frac{5}{2})].$$

This formula immediately demonstrates the dominance of two-jet final states at very high energy where $g_E^2/3\pi^2$ is small. By summing Eq. (6) over a set of cones of solid angle Ω that fill the 4π steradians around the e^+e^- collision, and comparing the result with the QCD expression $(1 + g_E^2/4\pi^2)\sigma_0$ for the total cross section, we see that the fraction of all events which have all but a fraction ϵ of their energy in some pair of opposite cones of half-angle δ is

ting $f=0.7$ and $\epsilon=0.2$ in Eq. (7), and using the asymptotic QCD formula⁹ $g_E^2 = 24\pi^2/25 \ln(E/\Lambda)$ with $\Lambda=500$ MeV, we find that $\delta(E)$ is about 13° at the energy $E=7.4$ GeV of current experiments,¹ and decreases as $E^{-0.25}$ at higher energies. In contrast, with a fixed transverse-momentum cut-off P_\perp , we would expect a jet angular radius $\varphi(E)$ which would decrease much faster, like $1/E$ or $(\ln E)/E$. At relatively low energy $\varphi(E)$ will be greater than $\delta(E)$, so that our calculation of the



Heinrich Hertz
1857 Hamburg-Karlsruhe-Bonn 1894

$$\begin{aligned}& \times \exp \left\{ - \int_{1/b^2}^{Q^2} \frac{d\bar{\mu}^2}{\bar{\mu}^2} \left[\ln \left(\frac{Q^2}{\bar{\mu}^2} \right) A(g(\bar{\mu})) + B(g(\bar{\mu})) \right] \right\} \\ & \times C_{ja} \left(\frac{x_A}{\xi_A}; g(1/b) \right) C_{jb} \left(\frac{x_B}{\xi_B}; g(1/b) \right) \\ & + \frac{4\pi^2\alpha^2}{9Q^2s} Y(Q_T; Q, x_A, x_B).\end{aligned}$$



SUMMATION OF LARGE CORRECTIONS

Restaurants near DESY

(for more info, see printed lists near registration desk)

No food
on campus
in the evenings

Name	Location	Cuisine	Information
Restaurants near DESY:			
Die Bäckerei	Osdorfer Landstr. 4	Italian	040-33 31 09 14
Restaurant Landhaus Flottbek	Baron-Voght-Str. 179	International	http://www.landhaus-flottbek.de
Restaurant Champus	Beselerstr. 35	German	040-89 06 53 50
Restaurant Mahlzeit	Albert-Einstein-Ring 8	Asian	040-80 03 03 08
Blockhouse	Waitzstr. 1	Steakhouse	http://www.block-house.de
Ristorante Panetteria	Osdorfer Landstr. 4	Italian	040-89 06 48 02
L'Incontro, il Bistro	Ebertallee 232	Italian	http://www.lincontro.info/bahrenfeld/index.php
Restaurant Quellental	Quellental 36 Near Klein Flottbek station	Mediterranean	www.quellental-restaurant.de
Don Quichotte	Osdorfer Landstr. 162	International	www.osdorfermuehle.de
Lühmann's Teestube	Blankeneser Landstr. 29	English, Vegetarian	www.luehmanns-teestube.de
Restaurant „Le Jardin“ im Hotel Merkure Am Volkspark	Albert-Einstein-Ring 2	Regional	040-89 95 20

WIFI

1) Network name: TH-Workshop-2018

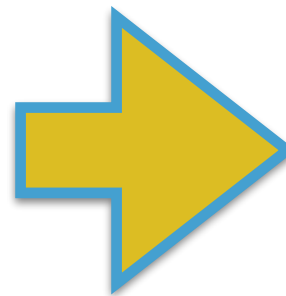
password (WPA/WPA2-PSK): ooteeP7quoom

2) Eduroam

3) DESY-guest (need to register)

See printed copies
near registration desk.

beware of road construction
around DESY



Information

WLAN	Conference WLAN Network name: TH-Workshop-2018 Password: ooteeP7quoom
Hostel	Check In Time: 2:00 pm Check Out Time: 10:30 am
Coffee breaks	<u>Plenary sessions</u> : bldg. 5, foyer of the auditorium <u>Parallel sessions</u> : bldg. 5, foyer of the auditorium + bldg. 1b, foyer in front of SR 4a/b
Cash machine	A cash machine is located in the foyer of canteen- building 9
Taxi to the airport	Please contact the registration desk
Public transport to airport	Take bus 1 from station DESY/Zum Hühnengrab (direction Altona) to S-Bahrenfeld, change at S-Bahrenfeld to S-Bahn S1 to airport (first three wagons). You only need to buy one ticket (3,30 €, the bus driver sells tickets).
Supermarkets	Lidl , from main entrance – Notkestraße – turn right and follow the street (~800 m). It will be clearly visible on the left of the street at the next junction.

The organising team

(to whom addresses questions/complaints...)

Secretaries: Cristina Guerrero, Inna Henning and Julia Herrmann



Chair: Michael Krämer (Aachen)



Local organisers: Christophe Grojean & Frank Tackmann

