

# Color meets Flavor



**Exciting times ahead:  
Will we officially become excellent?**



**Official announcement  
22.5.2025 17:00**



# Excellence strategy



To further strengthen the **international competitiveness of research** at **German** universities, the **federal and state governments** have established the **Excellence Strategy (ExStra)** as a permanent funding programme in 2017.

Researchers and universities enjoy a **completely free choice of research fields** and profile areas.

The **annual budget** for selected Clusters of Excellence and Universities of Excellence will be increased to **687 million € per year** from 2026 onwards.

The key objective of the Excellence Strategy is **to strengthen top-level research in areas that are internationally competitive**, to institutionally strengthen German universities, and to advance the development of the German higher education system.





# Excellence strategy



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at **German** universities, the **federal**  
**Excellence Strategy (ExStr)**

**Excellence of research**

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a  
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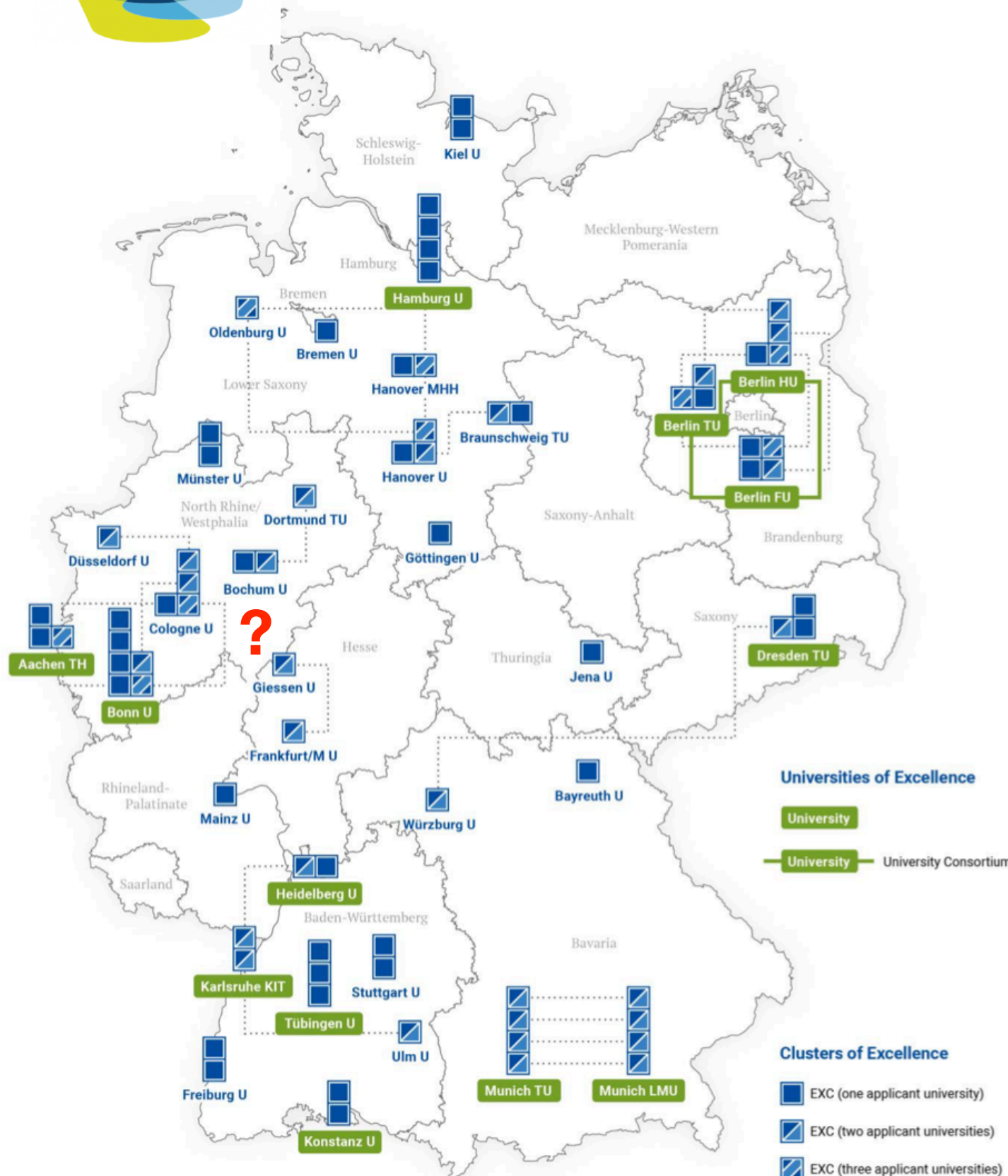
The key  
**to strengthen top-level**  
to inst  
and to advance the



ogy is  
**nationally competitive,**  
cities,  
education system.



# Excellence strategy



## First round of the Excellence Strategy

57 Cluster

### 6 Cluster from Bonn:

- Center for Dependency and Slavery Studies,
- Hausdorff Center for Mathematics,
- PhenoRob – Robotik und Phänotypisierung für Nachhaltige Nutzpflanzenproduktion,
- ECONtribute: Märkte & Public Policy,
- ImmunoSensation2 – the immune sensory system,
- Matter and light for quantum computing ML4Q

### Particle Physics related:

#### Munich:

- ORIGINS: Vom Ursprung des Universums bis zu den ersten Bausteinen des Lebens

#### Mainz:

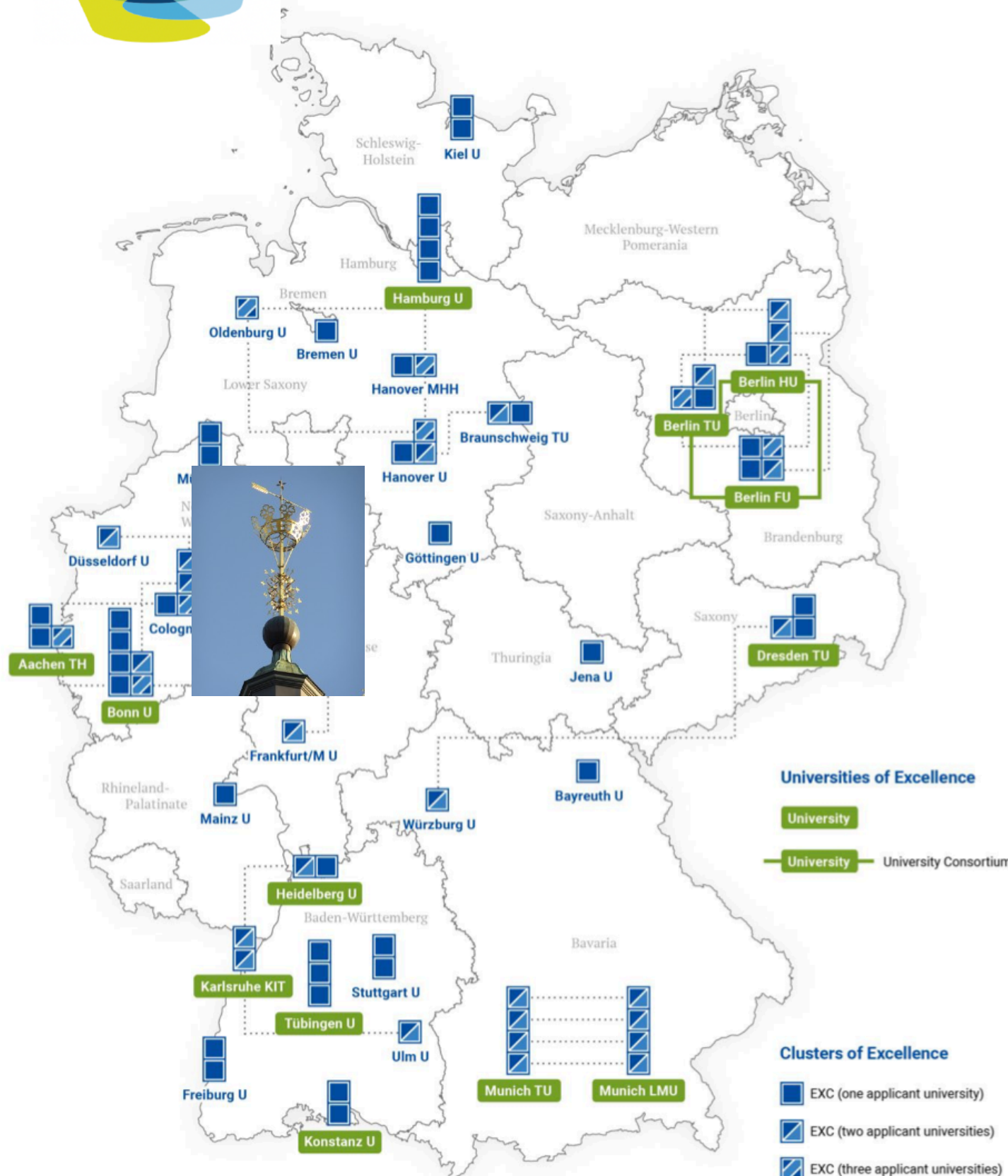
- Precision Physics, Fundamental Interactions and Structure of Matter (PRISMA+)

#### Hamburg: Quantum Universe





# Excellence strategy



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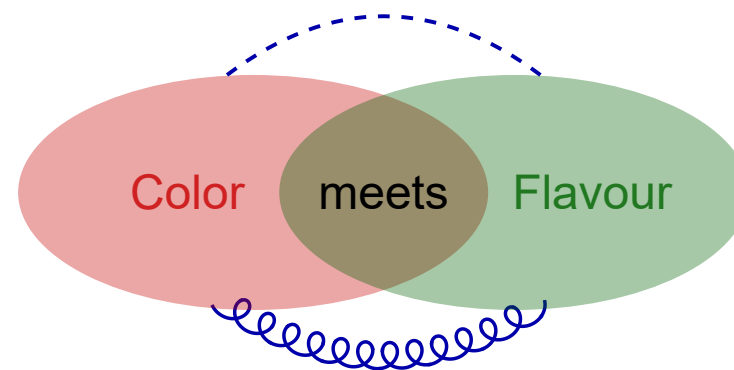
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Our project:

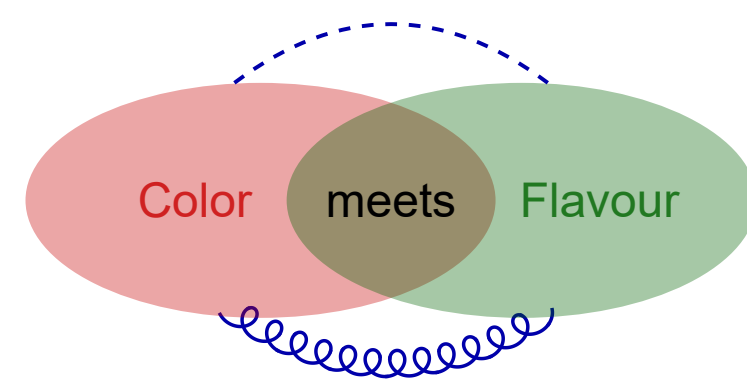
# Color meets Flavor





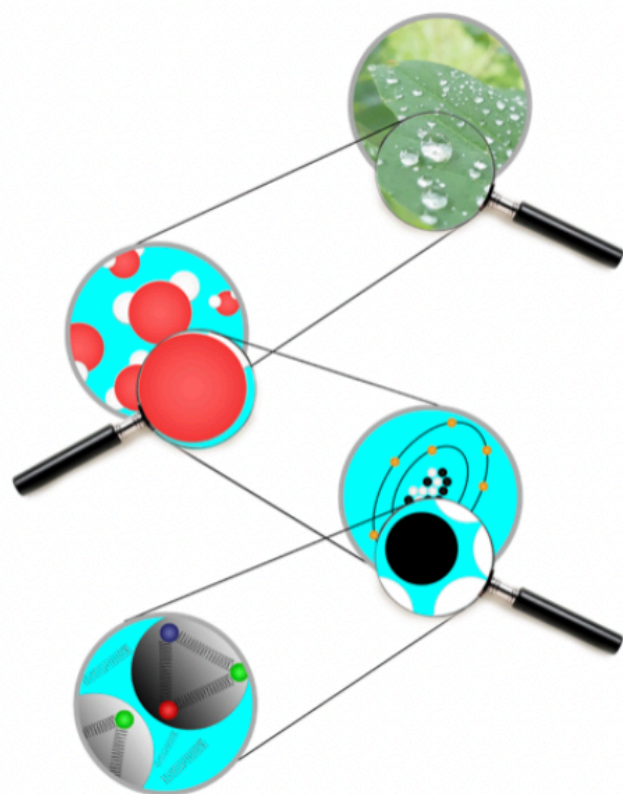
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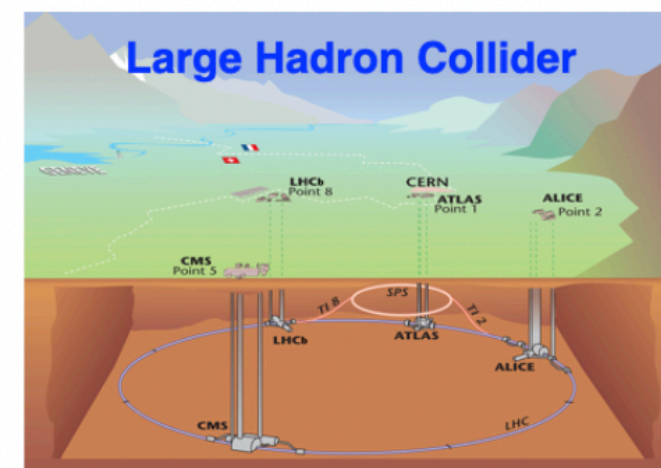


“Dass ich erkenne, was die Welt im Innersten zusammenhält”

## Particle Physics in 2025



	Drei Generationen der Materie (Fermionen)			Wechselwirkungen (Bosonen)	
	I	II	III		
Masse	$\approx 2.2 \text{ MeV}/c^2$	$\approx 1.28 \text{ GeV}/c^2$	$\approx 173.1 \text{ GeV}/c^2$	0	$\approx 124.97 \text{ GeV}/c^2$
Ladung	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	0	0
Spin	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	0
	<b>u</b> Up	<b>c</b> Charm	<b>t</b> Top	<b>g</b> Gluon	<b>H</b> Higgs
	<b>d</b> Down	<b>s</b> Strange	<b>b</b> Bottom	<b><math>\gamma</math></b> Photon	
	<b>e</b> Elektron	<b><math>\mu</math></b> Muon	<b><math>\tau</math></b> Tau	<b>Z</b> Z-Boson	
	<b><math>\nu_e</math></b> Elektron-Neutrino	<b><math>\nu_\mu</math></b> Muon-Neutrino	<b><math>\nu_\tau</math></b> Tau-Neutrino	<b>W</b> W-Boson	



Standardmodel(s)



Elektromagnetic interaction (IA), strong IA, weak IA, (Gravitation)

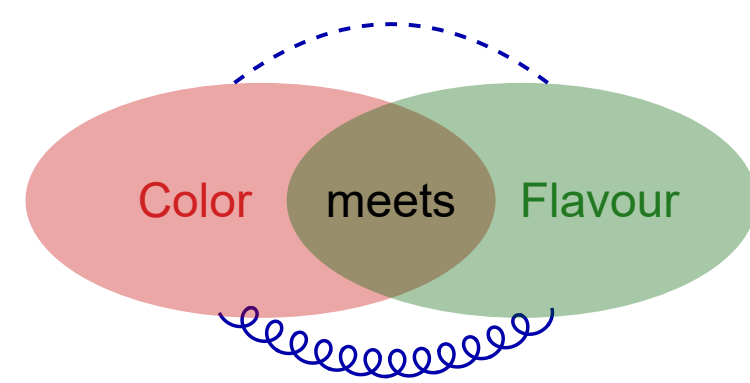
Color: binds quarks into proton

Flavor: radioactive decay of a neutron to a proton

SM describes thousands of measurement with a very high precision!

Our project:

# Color meets Flavor



Aim to answer 3 fundamental questions:

1. How does matter emerge from the fundamental building blocks of nature

2. Are there additional particles or interactions?

3. What is the origin of the matter anti-matter asymmetry in the Universe

## BARYONS

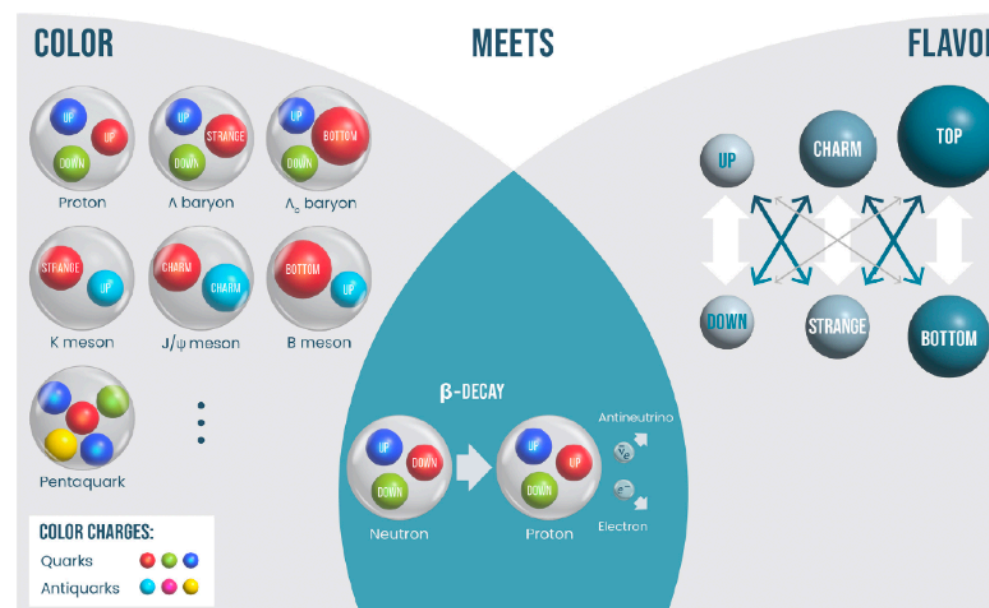
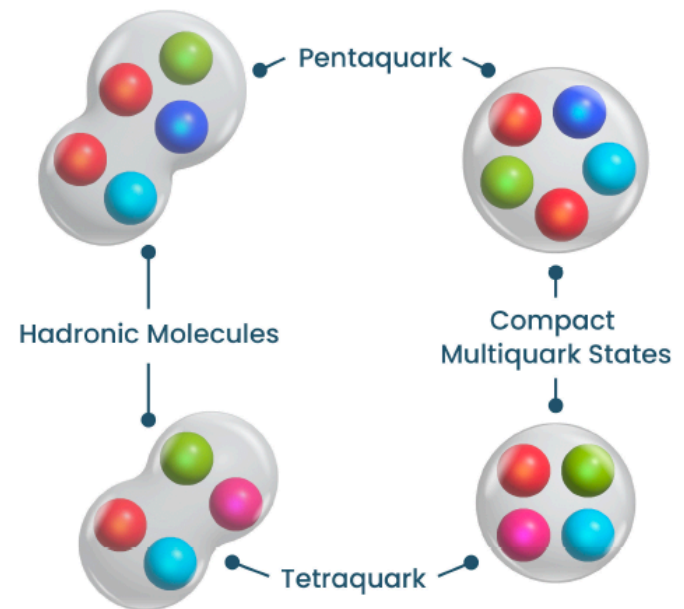


Proton

## MESONS



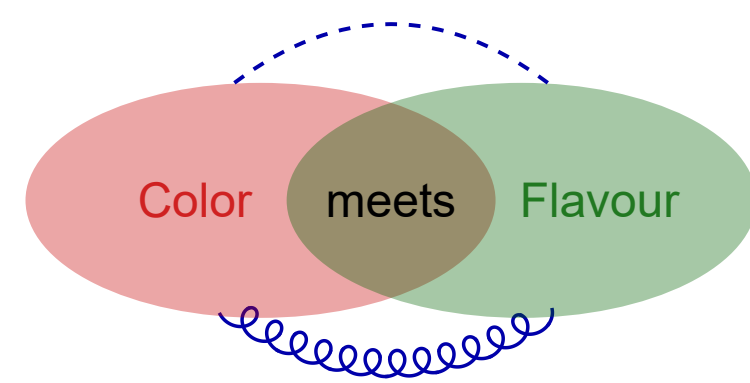
Pion





Our project:

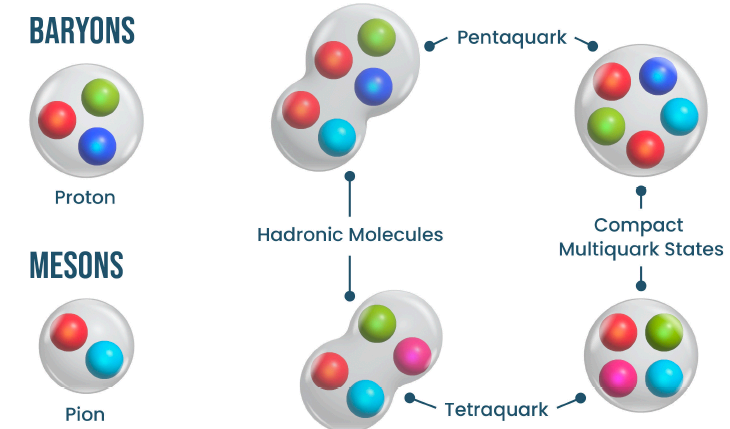
# Color meets Flavor



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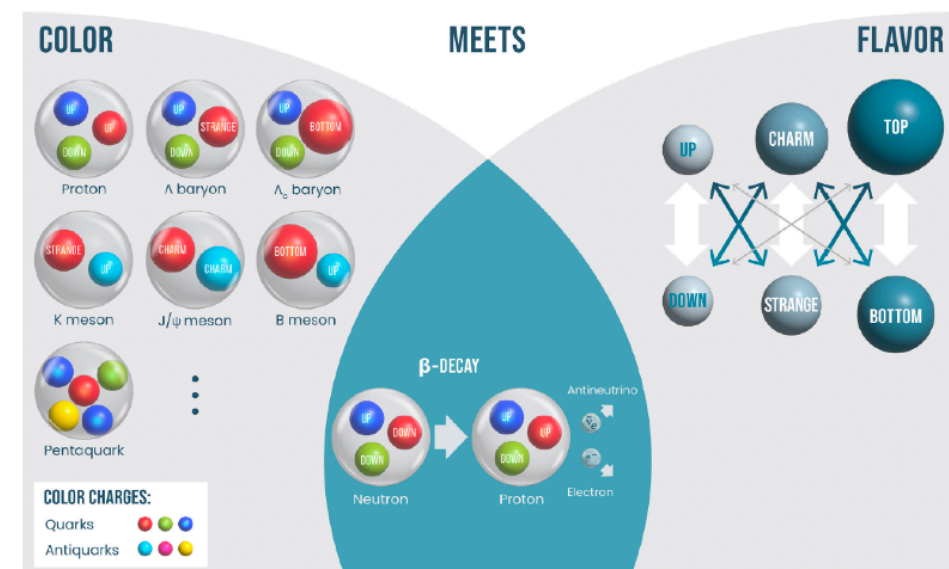
1. How does matter emerge from the fundamental building blocks of nature

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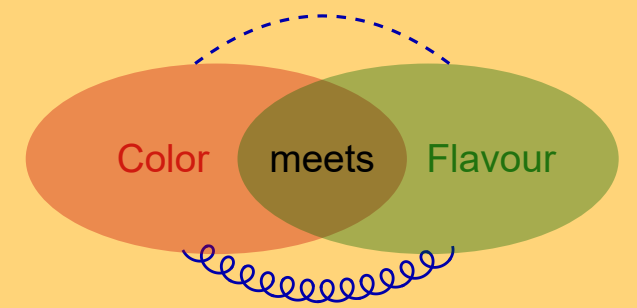


3. What is the origin of the matter anti-matter asymmetry in the Universe

If you do not care about physics  
Total budget:  
close to 60 000 000 €



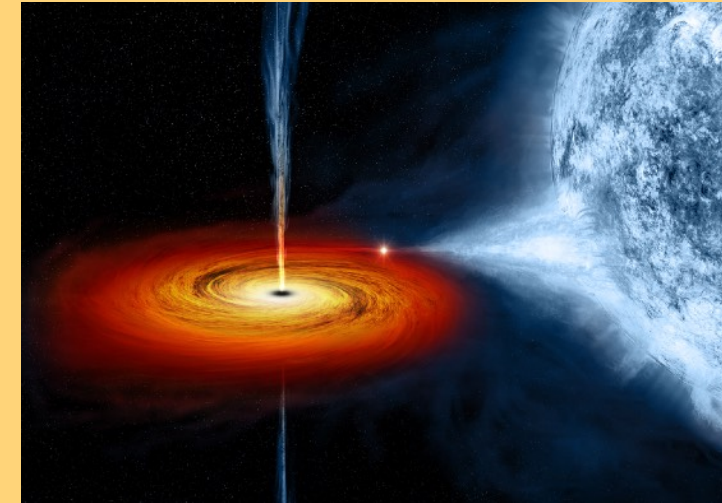
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## Fundamental vs. applied research

### Fundamental research:

- increase human knowledge - unexpected findings
- economic application is **not** the main aim

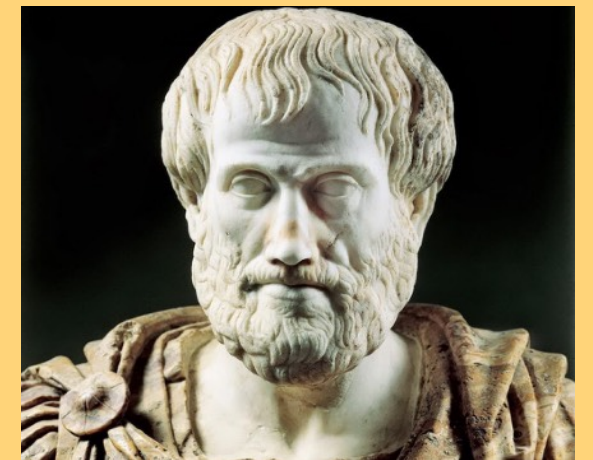


### Applied research:

- improve technology - expected/hoped for findings
- economic application is an important aim

As usual:

**too little and too much are not good**



**Fair balance:** if our ancestors did only do applied research we would have the most sophisticated torches, but we never had invented the LED



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## Fundamental research: Spin-offs

- Quantum mechanics

eleQtron

- General Theory of Relativity

- Particle Physics

- General education

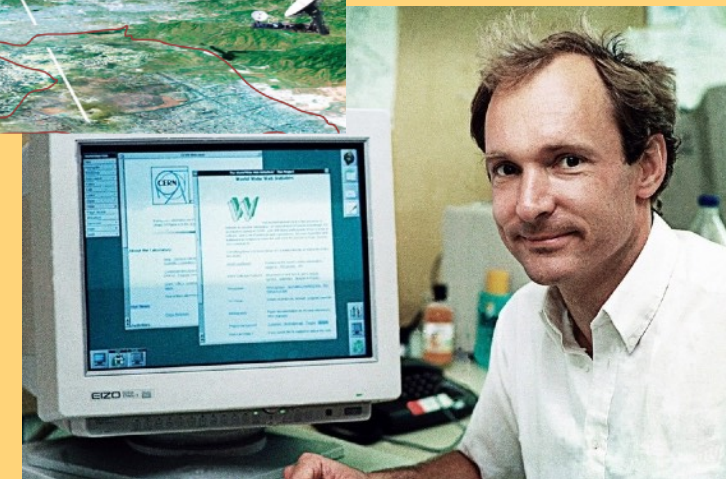
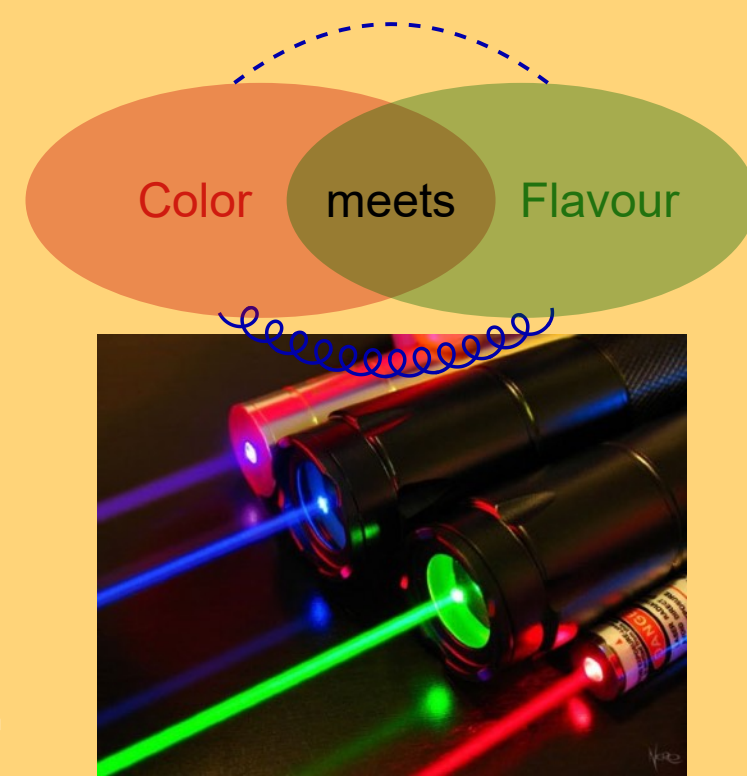
- Contribution to culture, internationalisation,...

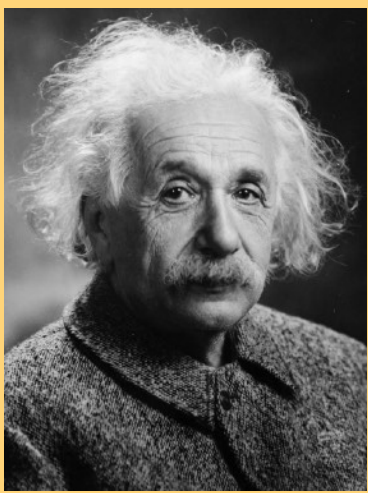
- ★ Laser
- ★ computer
- ★ semi-conductor
- ★ Quantum Computer

- ★ GPS

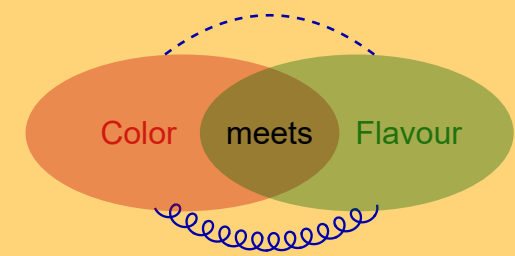
- ★ WWW
- ★ radiation therapy

- ★ mechanics @ formula 1 team
- ★ most of our post-docs not in academia





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## Numbers are also relative

### Other big numbers

- 849.8 billion US\$ US military budget 2025
- 27 billion £ Buyout Northern Bank
- 500 million £ Blue passport

### Actual LHC contribution

2024: Germany  $\approx 267$  million € per year  
equivalent to **3.2€ per inhabitant**

**1 pint per year!**

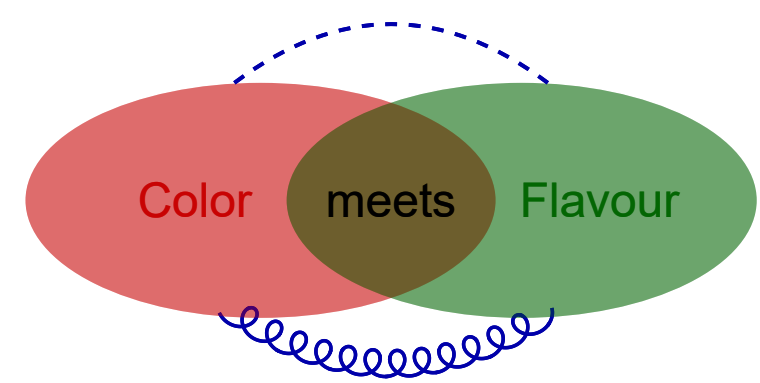
**This is THE pint of science!**





Our team in Siegen:

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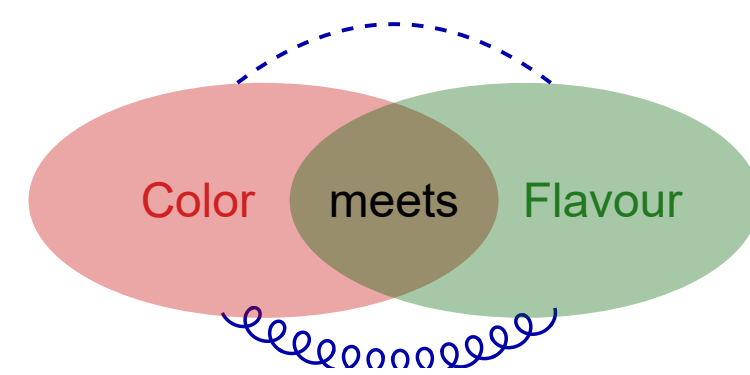


**CPPS** Center for Particle  
Physics Siegen

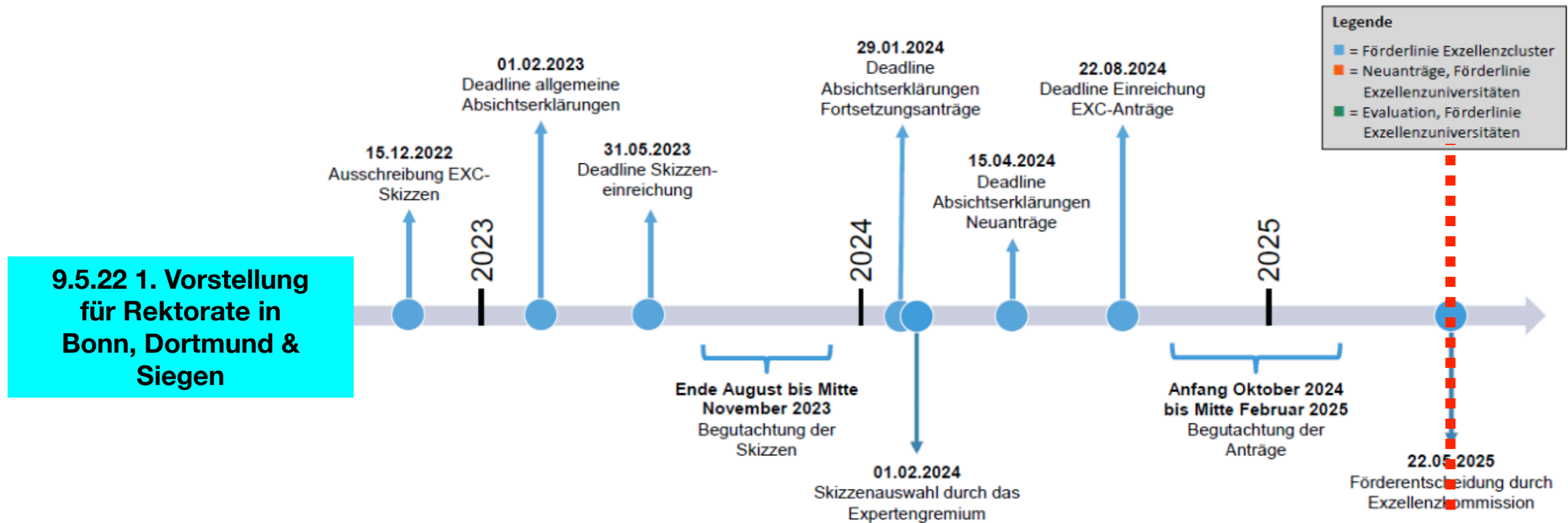


Time line:

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## Förderlinie Exzellenzcluster



### Ancient History:

Color meets Flavor: Name 2011 Symposium Alex K. @60

Siegen - Dortmund Theory: QFET 2013- 2019

Siegen - Dortmund Experiment: Lecture flavor physics in experiment and theory since 2018

Siegen - Bonn: 2016 semi-leptonic decays

Netzwerk NRW-Antrag 2019: Albrecht, Dingfelder, Mannel

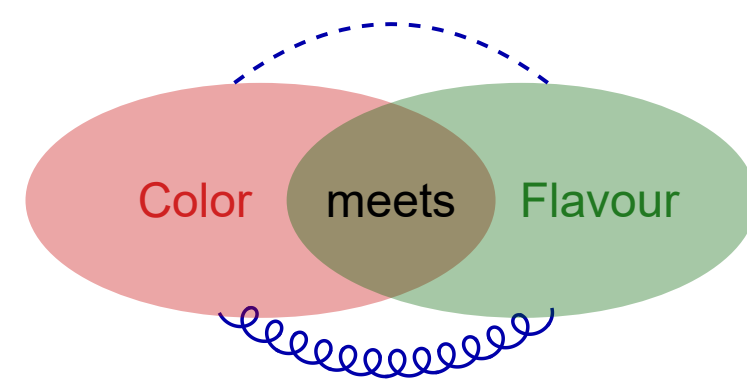
29.1.2021 Email: Mannel to Albrecht, Dingfelder, Lenz, Spaan†'23



### Erster Schritt zur Exzellenz

Uni Siegen punktet in der Exzellenzstrategie: Antragsskizze aus der Physik schafft es im wichtigsten deutschen Forschungswettbewerb in die Vorauswahl.

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**Funding starts 1st January 2026**

**Up to 70 Clusters (each 3 - 10 M € per year)**

**2018: 57 projects accepted from 34 universities: 65% (29%)**

**41 successful draft application**

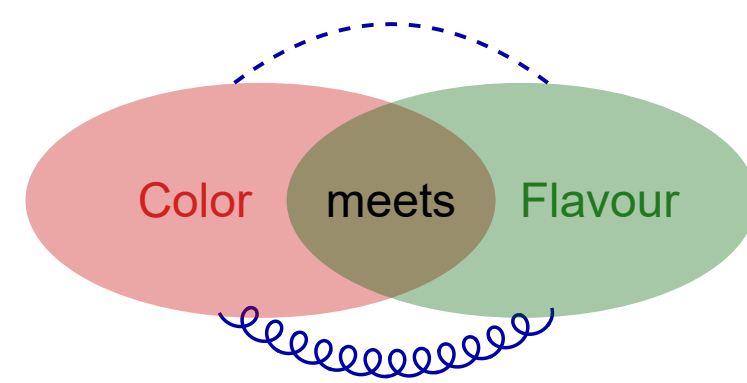
**All proposals equal probable  $\frac{70}{41 + 57} \approx 71 \%$**

**or all prolongations will be accepted  $\frac{13}{41} \approx 32 \%$**

**But there will be an irrational element in the decision**



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A comparative assessment provides the basis for the decisions made by the **Committee of (39) Experts** in February 2024

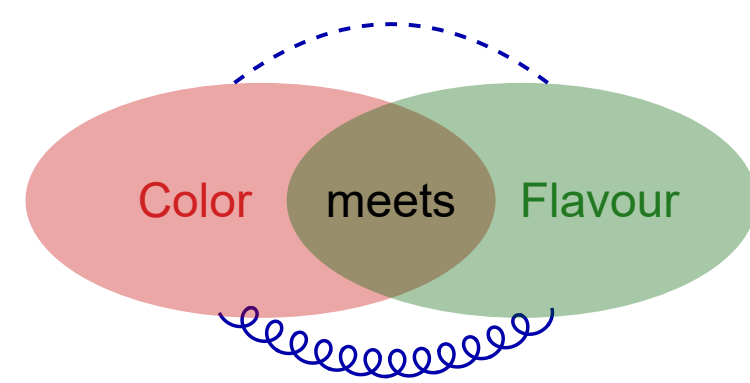


Experts in particle physics

19.-21.5.2025 A comparative assessment provides the basis for the recommendations put forward by the **Committee of Experts**



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The **Many-Worlds Interpretation (MWI)** of quantum mechanics suggests that every quantum measurement results in the universe splitting into multiple parallel universes, each representing a different possible outcome.

Instead of a single reality, MWI posits that all possible realities exist simultaneously, each evolving independently.

## Relative state formulation of quantum mechanics

Hugh Everett (Princeton U.) (1957)

Published in: *Rev.Mod.Phys.* 29 (1957) 454-462

[DOI](#) [cite](#) [claim](#) [reference search](#) [985 citations](#)

## The Theory of the Universal Wave Function

Hugh Everett, III (Princeton U.) (1956)

[pdf](#) [links](#) [cite](#) [claim](#) [reference search](#) [0 citations](#)

## The Many-Worlds Interpretation of Quantum Mechanics

## THE THEORY OF THE UNIVERSAL WAVE FUNCTION

Hugh Everett, III

### I. INTRODUCTION

We begin, as a way of entering our subject, by characterizing a particular interpretation of quantum theory which, although not representative of the more careful formulations of some writers, is the most common form encountered in textbooks and university lectures on the subject.

A physical system is described completely by a state function  $\psi$ , which is an element of a Hilbert space, and which furthermore gives information only concerning the probabilities of the results of various observations which can be made on the system. The state function  $\psi$  is thought of as objectively characterizing the physical system, i.e., at all times an isolated system is thought of as possessing a state function, independently of our state of knowledge of it. On the other hand,  $\psi$  changes in a causal manner so long as the system remains isolated, obeying a differential equation. Thus there are two fundamentally different ways in which the state function can change:<sup>1</sup>

*Process 1:* The discontinuous change brought about by the observation of a quantity with eigenstates  $\phi_1, \phi_2, \dots$ , in which the state  $\psi$  will be changed to the state  $\phi_j$  with probability  $|\langle\psi, \phi_j\rangle|^2$ .

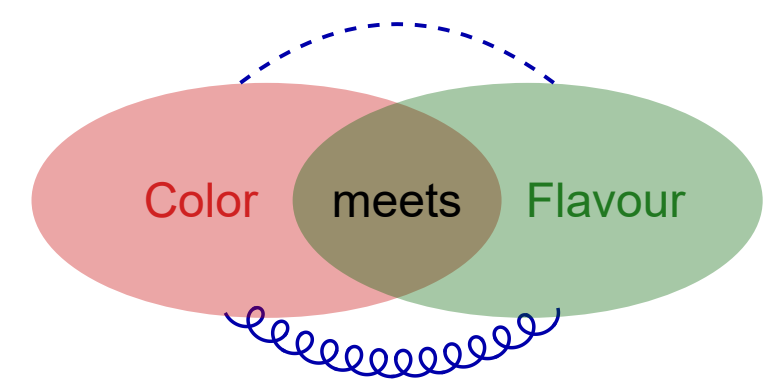
*Process 2:* The continuous, deterministic change of state of the (isolated) system with time according to a wave equation  $\frac{\partial\psi}{\partial t} = U\psi$ , where  $U$  is a linear operator.

<sup>1</sup> We use here the terminology of von Neumann [17].



Interpretation of QM

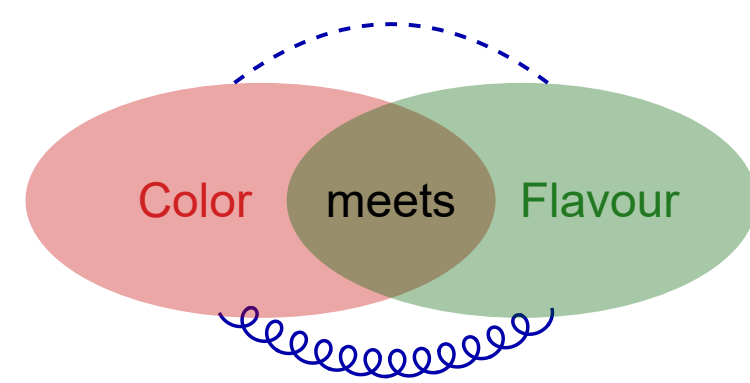
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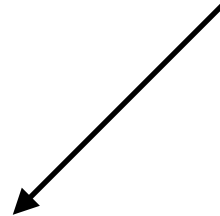
At 17:00 our Universe will split into 2 parallel universes

Interpretation of QM

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At 17:00 our Universe will split into 2 parallel universes



University of Siegen receives its long-deserved first excellence cluster in physics. Experts all over the world unanimously claim that this decision was long overdue.

The leadership of Siegen University announced to put in a further, substantial increase in the funding of its physics Department, however it is not decided yet, whether the salaries of the participating researchers will be tripled or quadrupled.



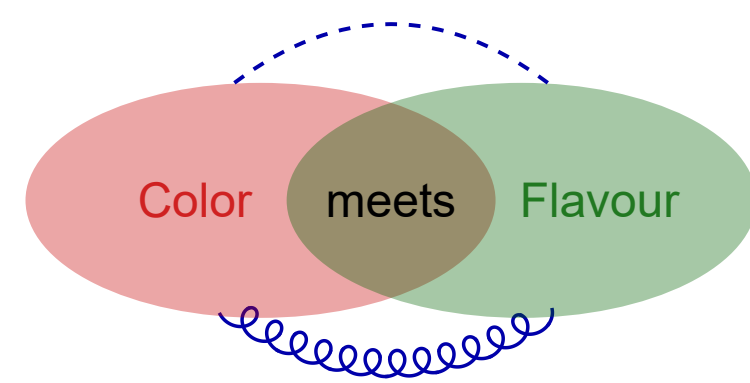
Black market prices for the “Siegen” Panini sticker collection book are skyrocketing. In particular picture 173 was breaking the 1000\$ barrier.



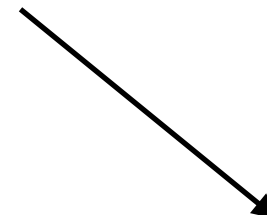
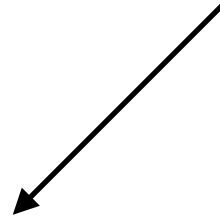


Interpretation of QM

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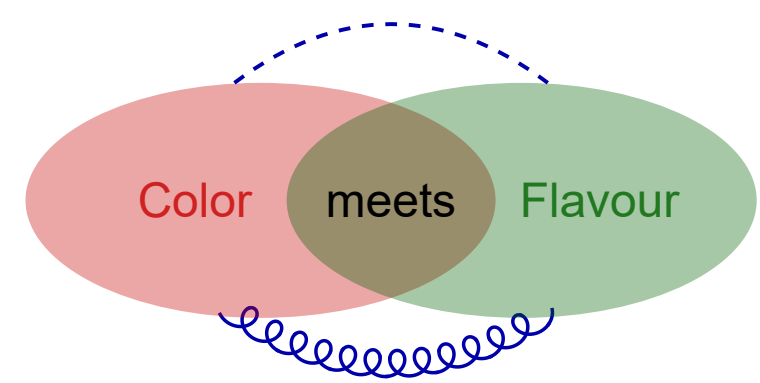


Forscher der Universität Siegen waren wieder mal nicht fähig Fördermittel zu generieren. Auch in der diesjährigen Runde der Exzellenz Strategie gingen die “Experten” vom Emmy Noether Campus leer aus. Rektorin Reese erwägt nun die Schliessung dieses notorisch erfolglosen Bereiches, sowie eine Umschulung des verbeamteten Personales und gleichzeitig eine Wiedereröffnung des Biergartens am Oberen Schloss.



Black market prices for the “Siegen” Panini sticker collection book are skyrocketing. In particular picture 173 was breaking the 1000\$ barrier.

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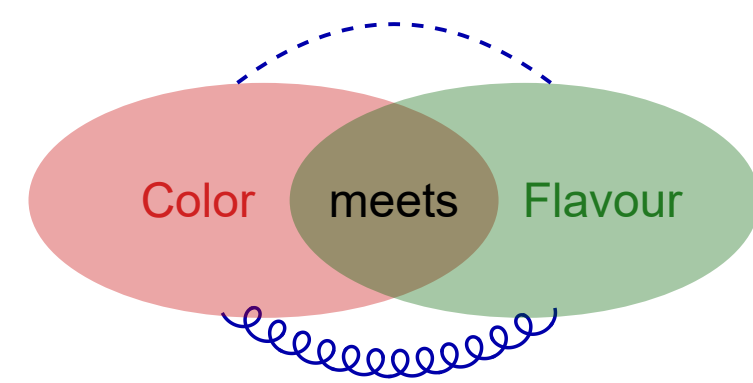
In both Universes: many thanks to

- Alle Mitstreiter in Siegen, Bonn, Dortmund and Jülich
- Our families and friends
- Everybody in the administration, who was living the **Ermöglichungskultur**
- The old and new University leadership

Let's think also about our copies in the other universe....



# Color meets Flavor



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There are still things to do:

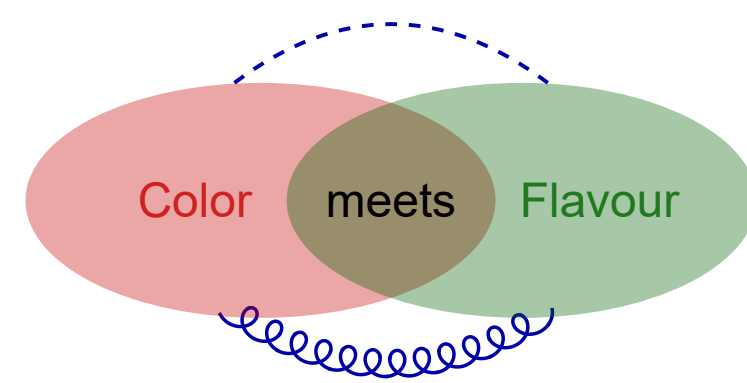
Example: the observatory



We will need also  
future support!  
In both Universes

Let's think also about our copies in the other universe....

# Color meets Flavor



In both Universes:

**Mint Challenge**  Offene Uni 2025  
Naturwissenschaftlich-Technische Fakultät  
Entdecken - Knobeln - Gewinnen

**Wann & Wo?**  
 24. Mai 2025, 10 - 16 Uhr  
Tag der offenen Uni  
Schlossplatz, Unteres Schloss

**Was?**  
Besucht die Pavillons der Departments von Fakultät IV und löst knifflige Aufgaben!


**Gewinnt tolle Preise!**  
Hauptpreise:

- Eintägiger Besuch des Hockenheimrings mit S3 Team
- Wisentforschung und Führung mit Biologin Klaudia Witte
- DIY Elektronenmikroskopbild auf Tasse oder T-Shirt
- Exklusivführung im Spitzenforschungszentrum INCYTE (Weitere attraktive Sachpreise)


**Erfahrt alles über Studium und Forschung aus erster Hand!**  
Gespräche mit ForscherInnen  
Ready-to-Study Vorträge



**Discover the scientist in YOU**

 Universität Siegen /  Naturwissenschaftlich-Technische Fakultät



**PHYSIK IM APOLLO**  Universität Siegen

**QUANTENCOMPUTING TRIFFT AKROBATIK**

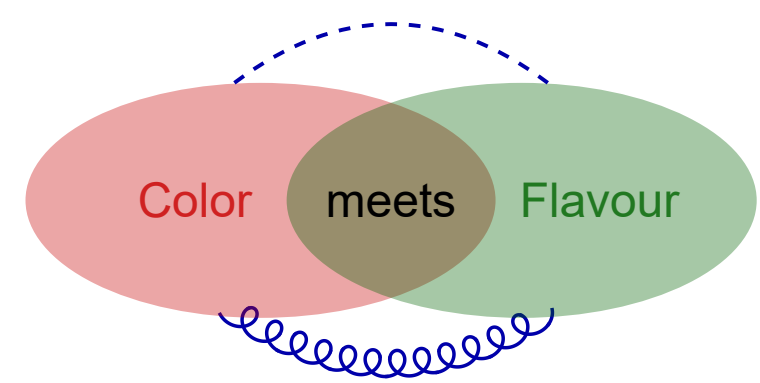


**23.11.25 18:00**  
**24.11.25 10:00**  
**25.11.25 19:30**

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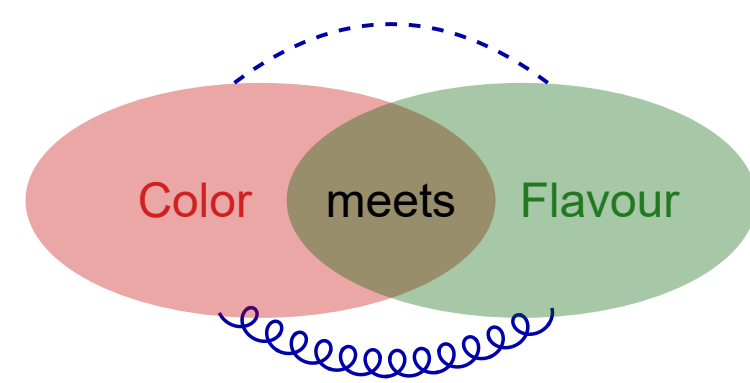


Not only physics - but also cross-sectional topics are crucial in the application

like “Transfer” and a connection to the  
local and national industry

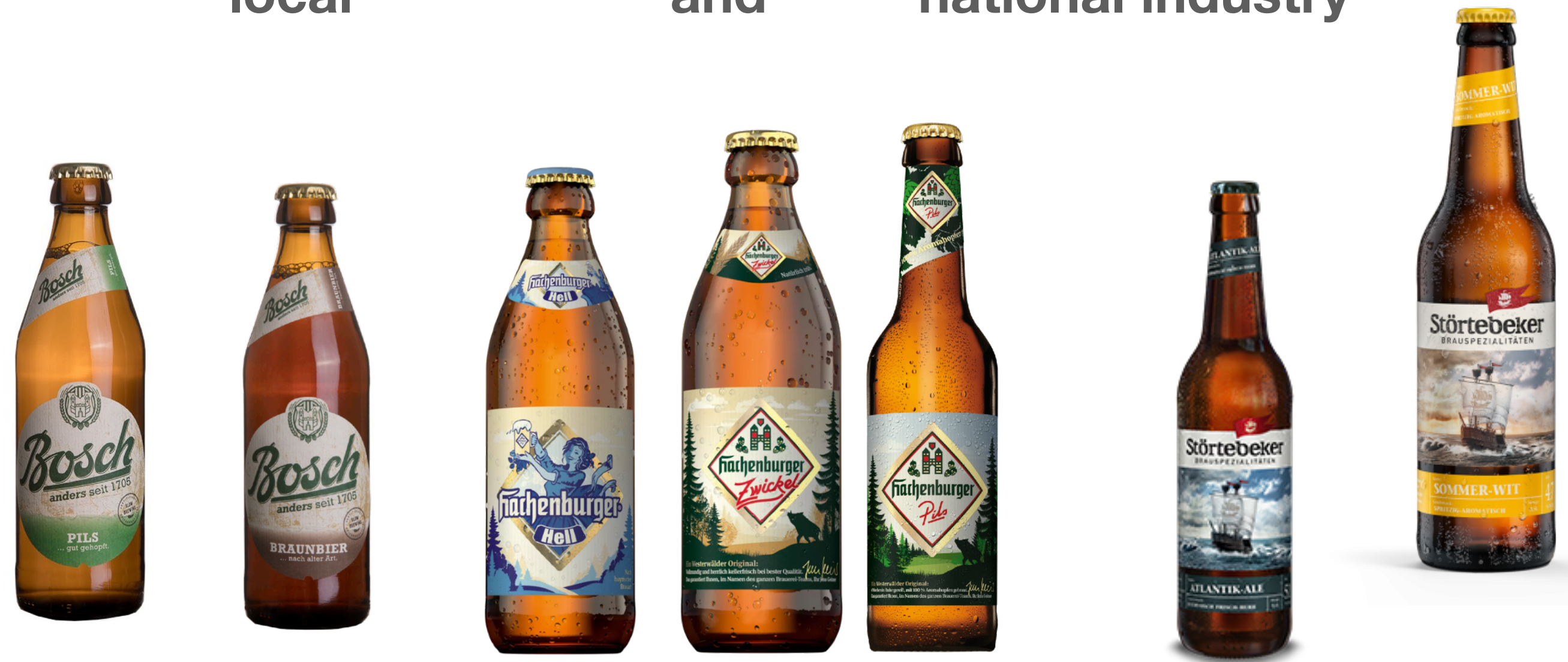


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