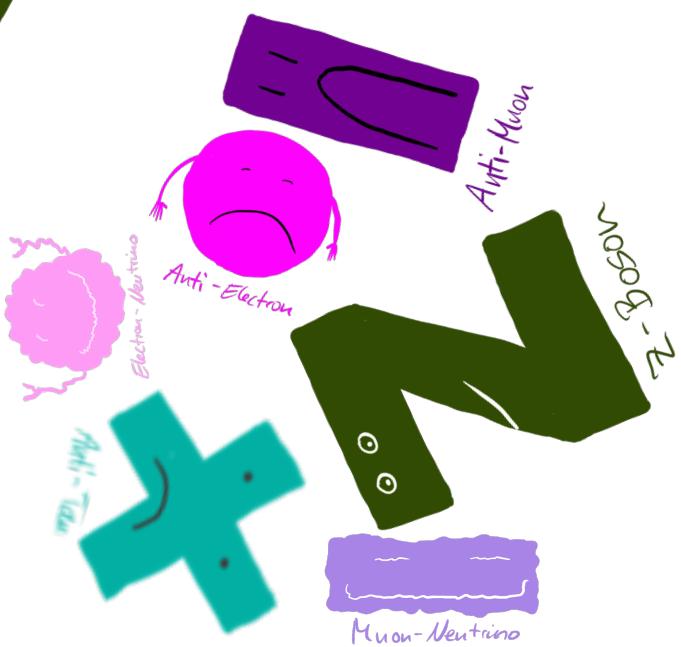
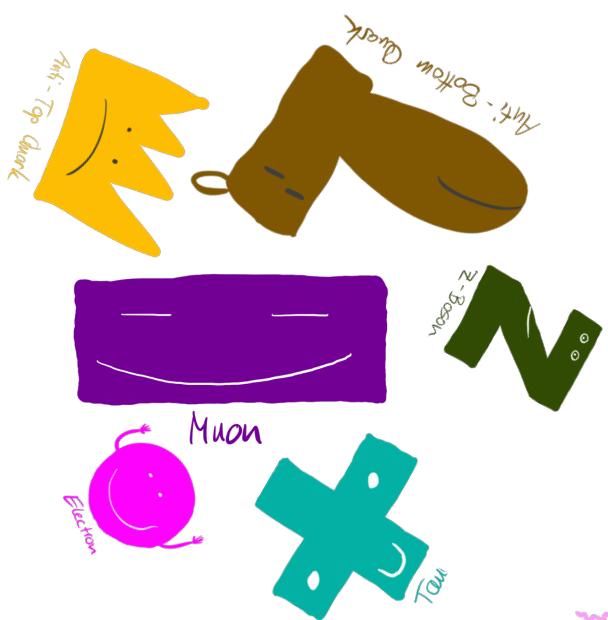


Particle Double



Particle
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Particle Double



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Particle
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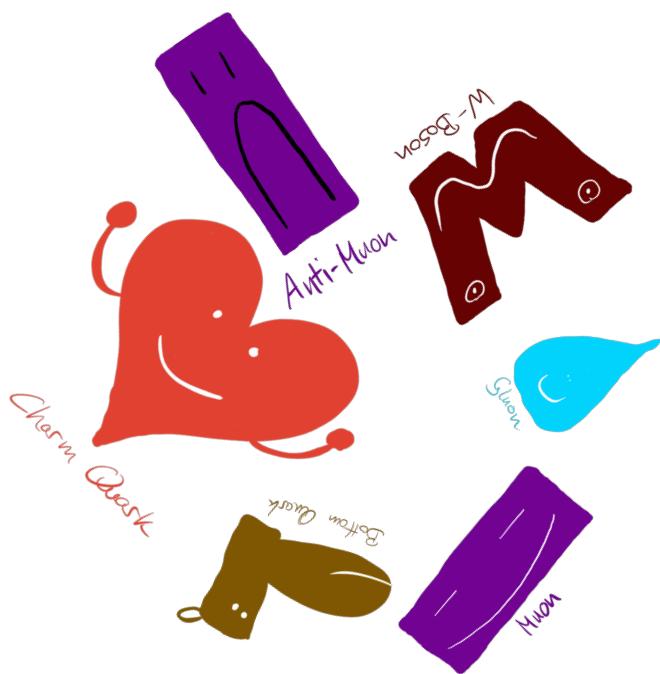
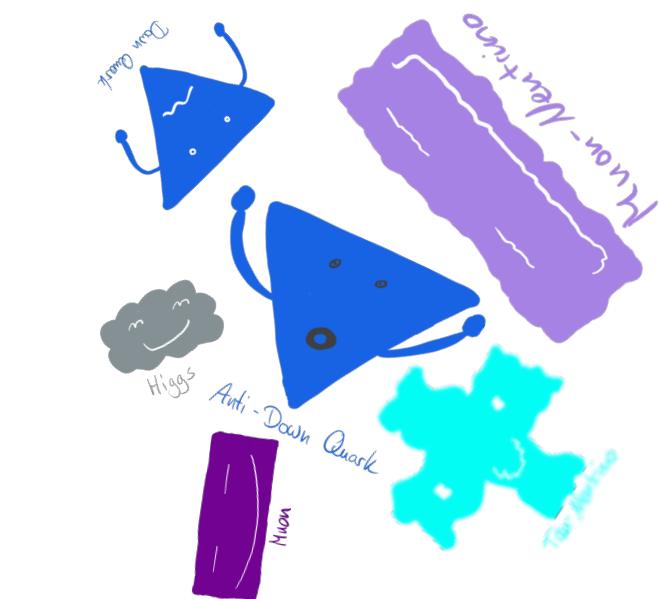
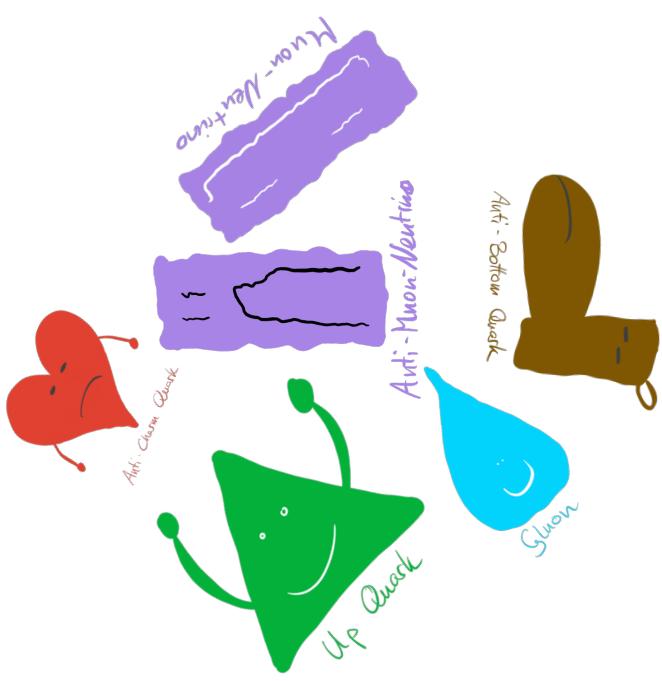
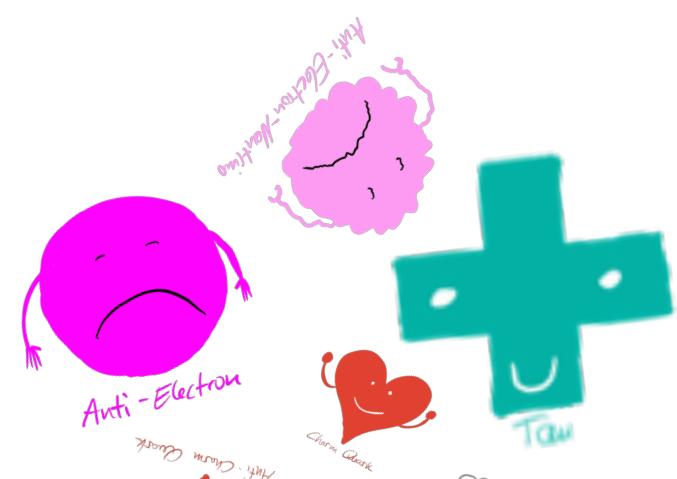
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Particle Double



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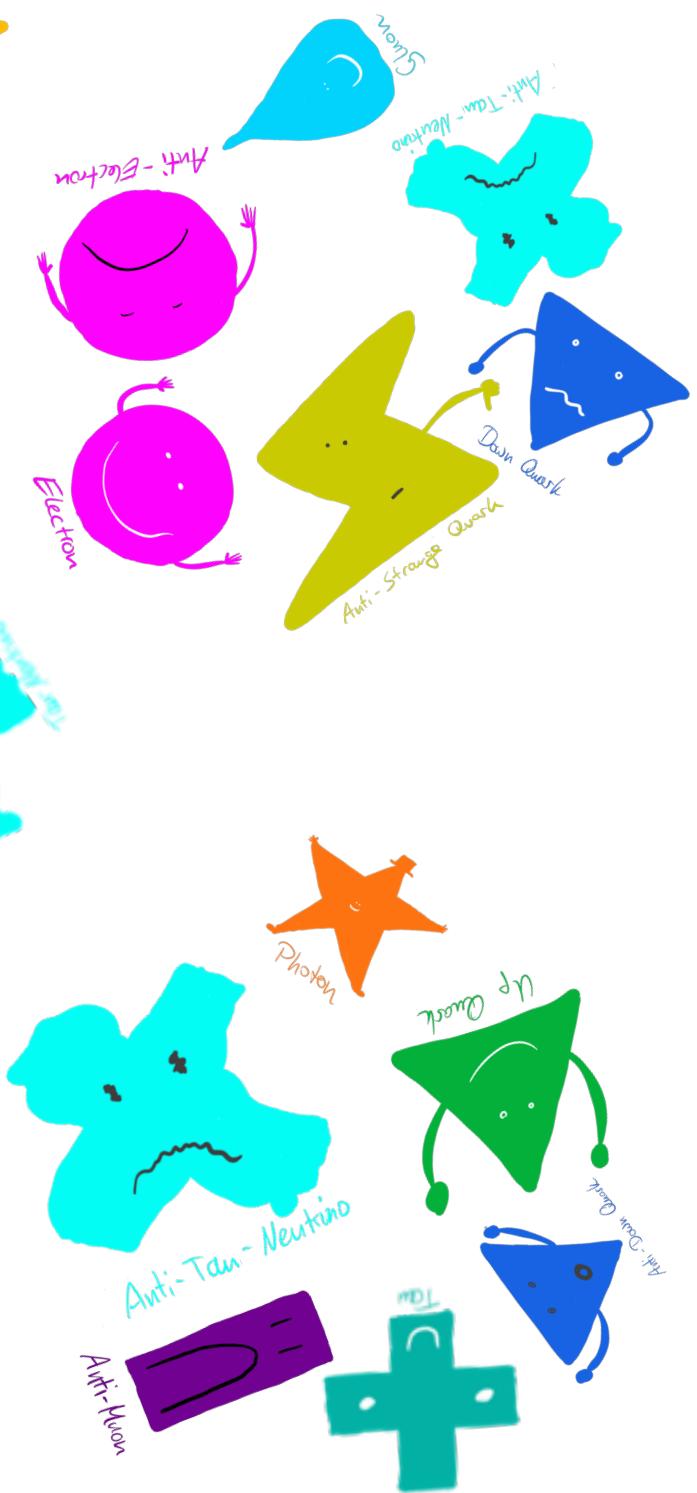
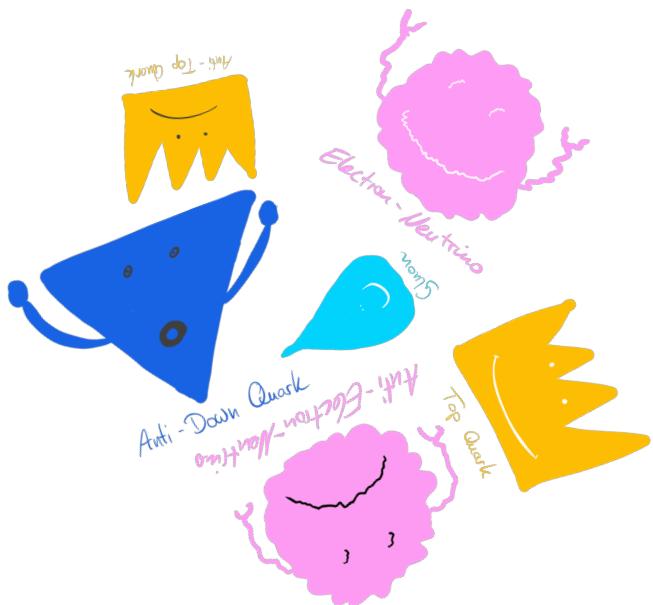
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Particle Double



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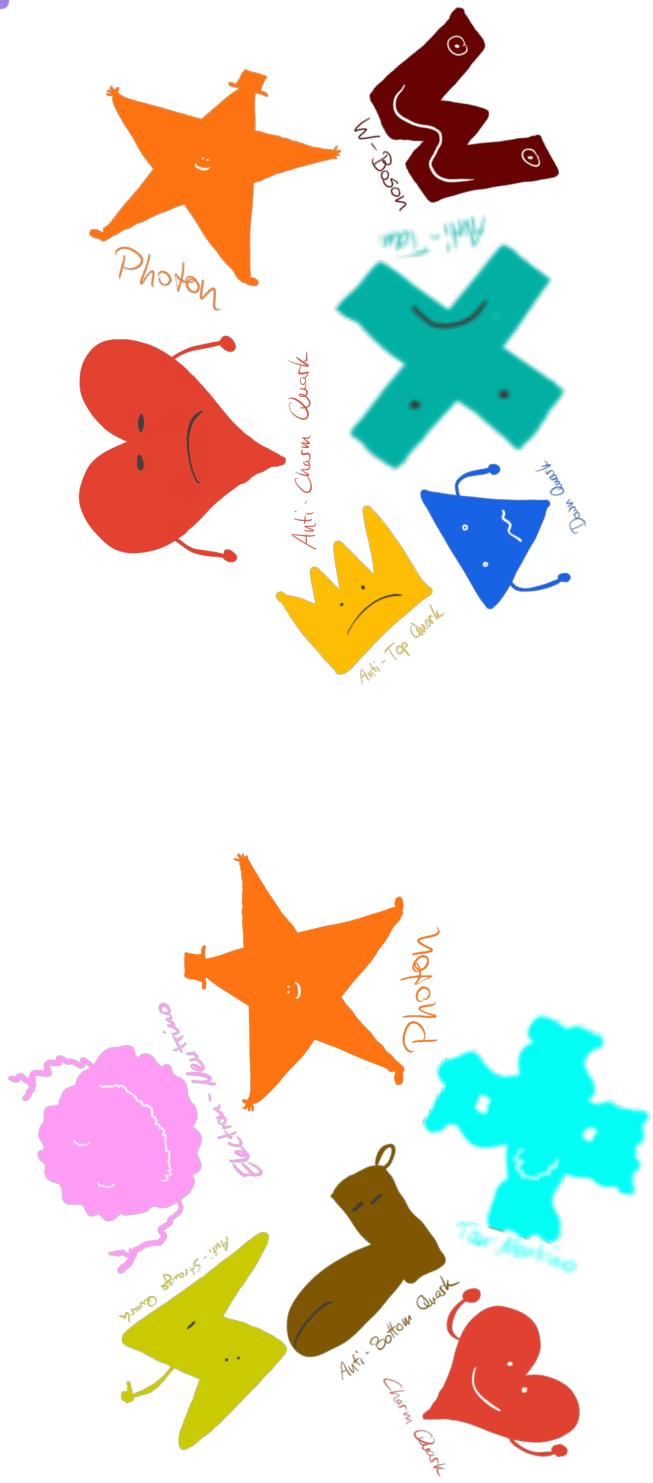
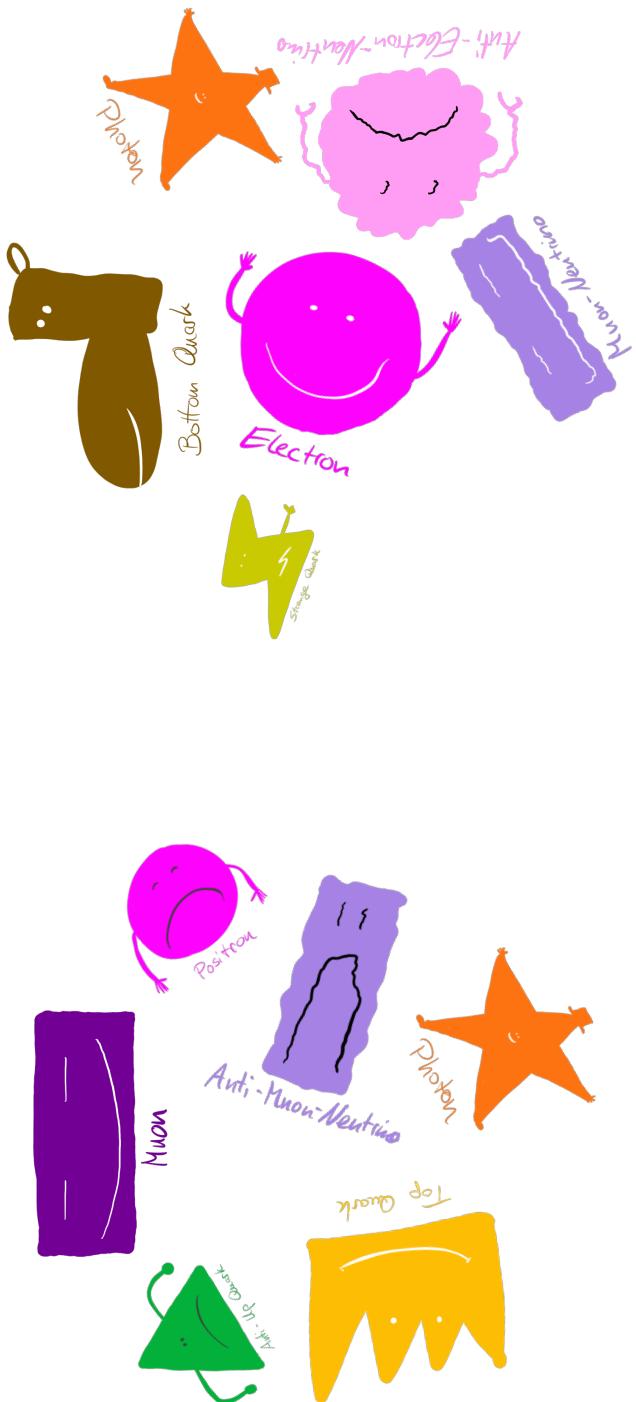
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Particle Double



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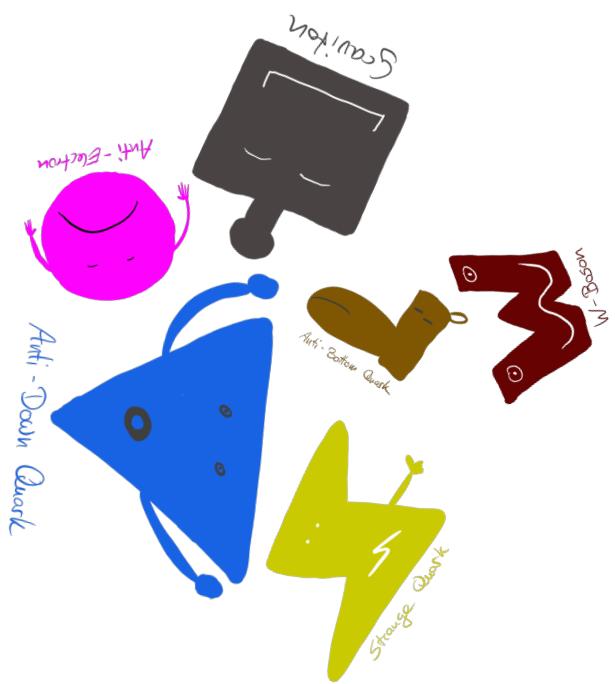
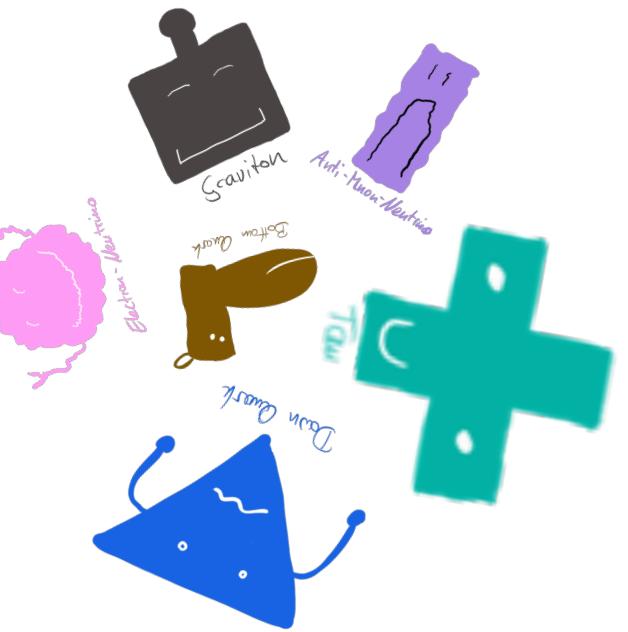
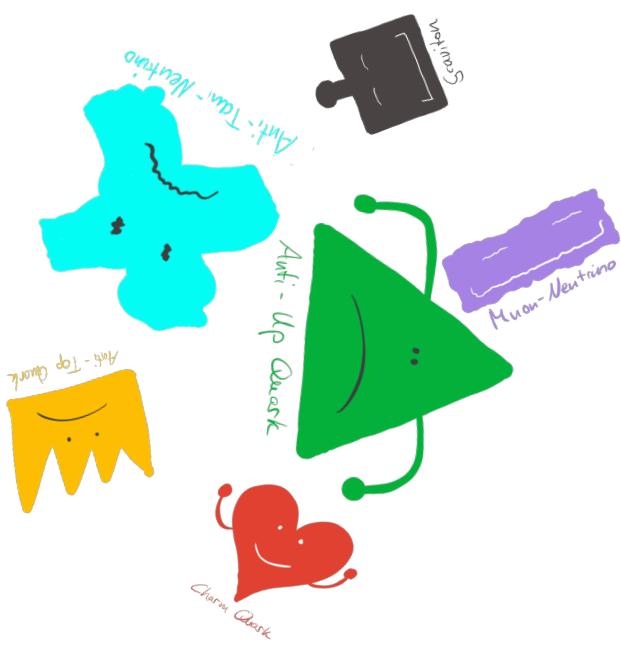
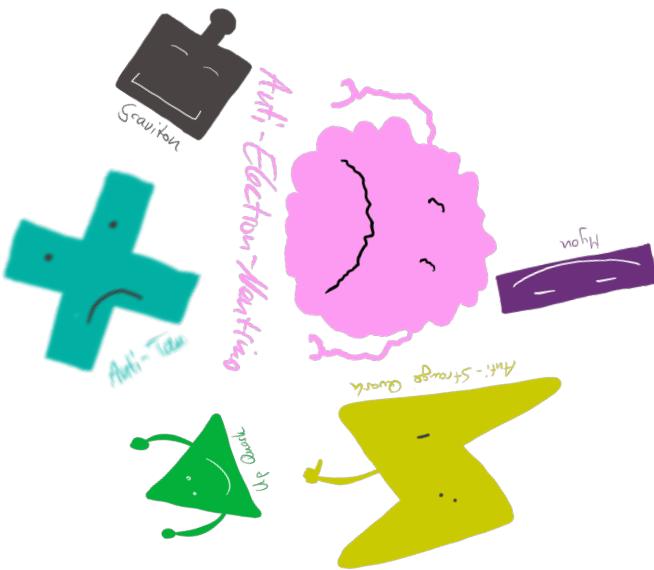
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Particle Double



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Particle
Double

Particle Doppelganger



Particle
Double

Particle
Double

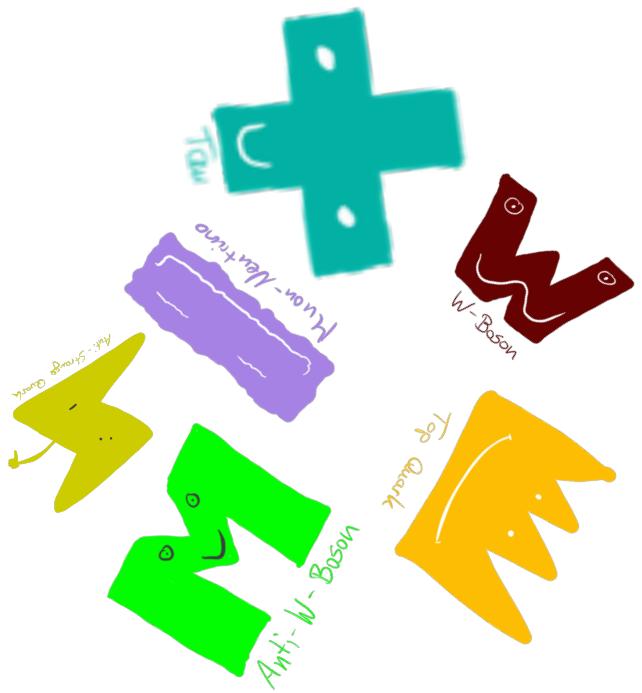
Particle
Double

Particle
Double

Particle
Double

Particle
Double

Particle Doppel



To Do:

1. Print on 300g DIN A4 two-sided
2. Use a circular cutter and cut cards with a diameter of 10 cm

Particle
Double

Particle
Double

Particle
Double

Particle
Double

Particle
Double

Particle
Double

Double
Particle

Dark
Matter

Dark
Energy

Particle
Double

Particle
Double

Particle
Double

Particle
Double

Particle
Double

Particle
Double

Particle Doppelgäbe

Game Idea

- Lay out the cards according to the game variant.
- Identify matching elementary particles and lay out, pass, or pick up cards.
- Check each other for assigning the correct symbol to the correct elementary particle and if there is a match.
 - Help: Dark matter or dark energy?!
Quickly close your eyes
and shout "Help!"
Then put the card away.

Variation 2 – Sandwich

- Hand out the cards to all players.
- Place the last card face down in the middle.
 1. Flip the middle card.
- 2. Try to get rid of the cards in your own pile by identifying matches.
- The first player to get rid of all their cards wins the round.

Particle Doppelgäbe

Variation 4 – Greed

- Each player receives a face-down card.
- Place a face-up card in the middle.
 1. Reveal your cards.
- 2. Find matches between any of the revealed cards and the card in the middle.
- 3. Name the particle and take the card as your new card.

The card in the middle stays where it is!

- The player who ends up with the most cards wins the round.

Particle Doppelgäbe

Particle Dobble

Variation 1 - Trip to Hell

- Each person receives a face-down card.
- The remaining cards form a face-up pile in the middle.
 1. Flip the face-down cards.
 2. Name the particle shared by the middle card and your hand card, and take the card from the middle as your new hand card.
 - Whoever has the most cards at the end wins the round.

Particle Dobble

Variation 3 - Hot potato

- Each person receives one face-down card.
 1. Everyone turns over their hand card.
 2. Try to find a match with another card.
- 3. Name the particle and place your card on top of the other one. This card now applies to the other player.
 - The last person remaining is the loser.

Variation 5 - Poisoned gift

- Place a face-up pile in the middle.
 - Each player receives a face-down card.
1. Place your cards face up in front of you.
 2. Find matches and place the middle card on another player's pile.
- The player with the smallest pile wins the round.

Particle Dobble

Particle Doppelgäbe

Standardmodell

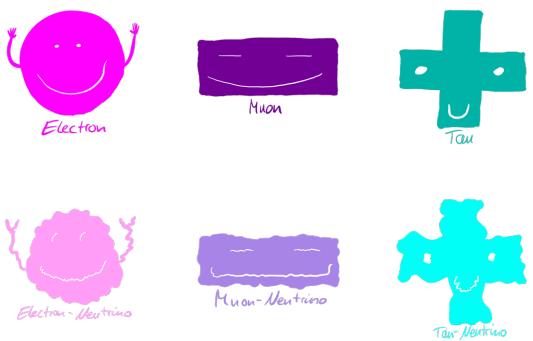
The Standard Model of particle physics describes the smallest building blocks of matter (quarks, leptons) and their interactions (electromagnetic, weak, strong) via exchange particles (bosons). It also explains the origin of mass through the Higgs boson. Gravitation is not included.

Quarks



Particle Doppelgäbe

Leptons



Particle Doppelgäbe

Physical Quantities

Important particle properties are:

- Mass: e.g., electron $\approx 0.511 \text{ eV}$
- Charge: 0, ± 1 , $\pm 2/3$, $\pm 1/3$ (in e)
- Spin: $\pm 1/2$ (fermions), 0 or 1 (bosons)
- Color charge: red, green, blue
(only quarks, gluons)
- Lepton/baryon number: ± 1 or 0
- Isospin: e.g., proton $+1/2$, neutron $-1/2$

These properties determine behavior and interactions.

Particle Double

Particle Double

Vektor Bosons



Crazies



Dark Energy Dark Matter

Particle Double