

Particle Physics Mafia

CASUS Get-together

09.04.2025 // MLMD Group



```
mirror object to mirror
mirror_mod.mirror_object
operation == "MIRROR_X":
    mirror_mod.use_x = True
    mirror_mod.use_y = False
    mirror_mod.use_z = False
operation == "MIRROR_Y"
    mirror_mod.use_x = False
    mirror_mod.use_y = True
    mirror_mod.use_z = False
operation == "MIRROR_Z"
    mirror_mod.use_x = False
    mirror_mod.use_y = False
    mirror_mod.use_z = True
```



Background and motivation

What is this game?

- A social deduction game themed around particle physics.
- Players are particles on either the Matter or Antimatter team.
- Goal:
 - **Matter:** Eliminate all Antimatter particles.
 - **Antimatter:** Outnumber Matter to destabilize the universe.

Phases of the Game

- The game alternates between the cycles of a particle collider:
 - **Unobserved Phase (Night)** — Particles act in secret.
 - **Observed Phase (Day)** — Discussion and voting who to put in the collider.
- Up to one particle is sent to the **collider** (lynched) each cycle.

Observation (Investigation)

- **Electron(s)** can observe one particle per unobserved phase.
- You only learn the particle's **charge**: + or - or 0.
- **Important:**
 - Most Matter = + or 0, Most Antimatter = -
 - But there are **exceptions!**

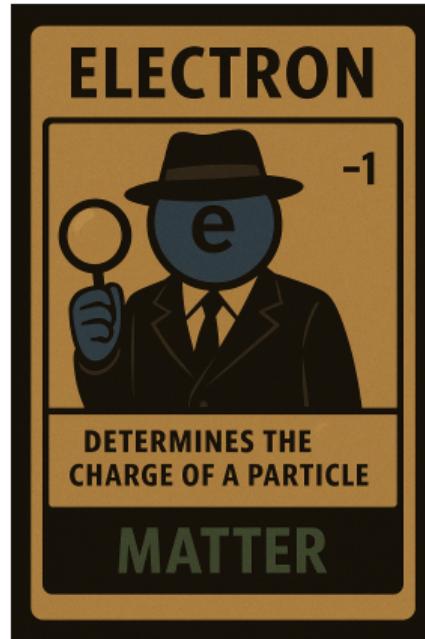
Charge Alignment Examples

Particle	Charge	Alignment
Up / Charm Quark	+	Matter
Down Quark	-	Matter (Looks Antimatter)
Anti-down Quark	+	Antimatter (Looks Matter)
Anti-up Quark	-	Antimatter
Tau	-	Matter (Looks Antimatter)
Muon	-	Matter (Looks Antimatter)

- **Gluon's one-time ability:**

- Sees a group of 3 particles that forms a Hadron, guided by the moderator.
- If one is put in the collider, all decay.

Electron (Detective)



Determines the charge (+ or -) of one particle each unobserved phase.
May misidentify alignment due to deceptive charges.

Photon (Watcher)



Selects a particle each unobserved phase and sees everyone who interacted with that particle during the night.

Up Quark (Citizen)



Has no active power. Binds with other matter quarks to form a hadron.

Charm Quark (Citizen)



Has no active power. Binds with other matter quarks to form a hadron.

Down Quark (Outsider)



Has negative charge — appears as Antimatter if investigated. Binds with other matter quarks to form a hadron.

Electron Neutrino (Little Girl)



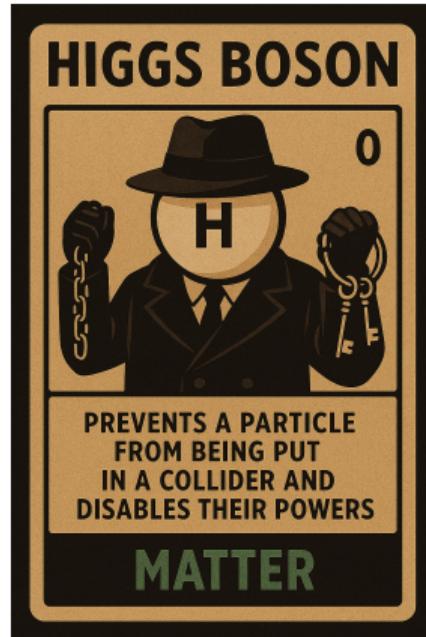
May peek during the Antimatter phase. If caught peeking by the Antimatter team, is scattered immediately.

W Boson (Doctor)



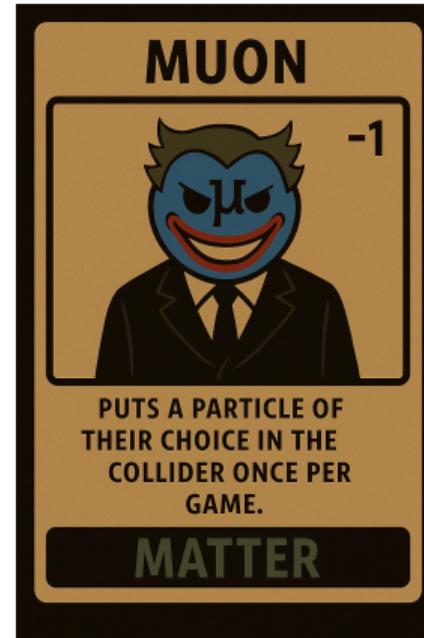
Protects one particle each night from being sent to the collider. Cannot protect the same target two nights in a row.

Higgs Boson (Jailer)



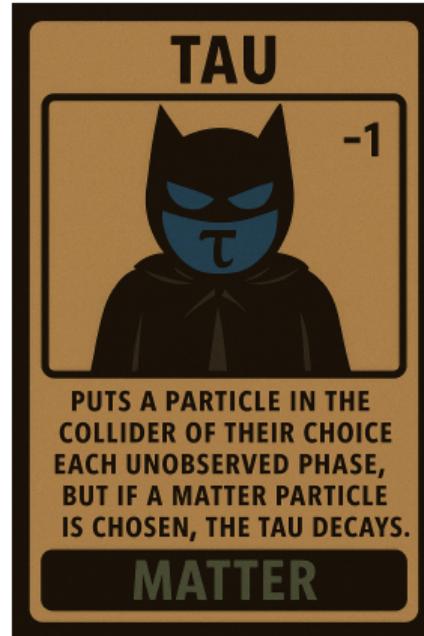
Prevents one particle from being targeted or using abilities for the night.
Can't choose the same target consecutively.

Muon (Insane)



May send one particle of their choice to the collider, one time during the game. Powerful but limited.

Tau (Vigilante)



Can send a particle to the collider each unobserved phase. If a Matter particle is chosen, Tau self-destructs.

Gluon (Cupid)



During the first unobserved phase, sees a group of 3 quarks that forms a Hadron.

Anti-up Quark (Mafia)



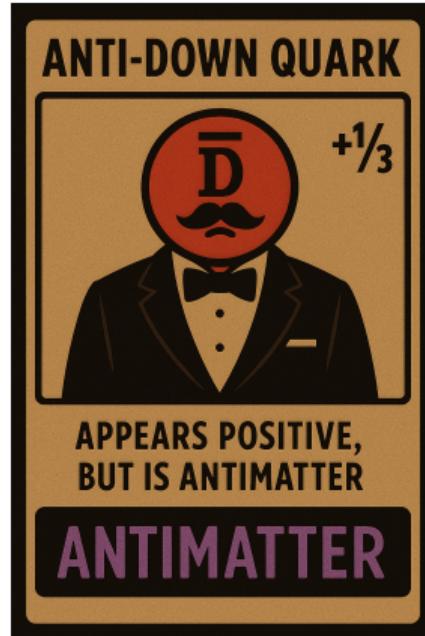
Standard Antimatter member. Collaborates with other antimatter to eliminate Matter each night.

Anti-top Quark (Boss)



Mafia boss. Makes the final decision on which particle the Antimatter team sends to the collider.

Anti-down Quark (Godfather)



Antimatter-aligned but has a positive charge — appears as Matter when investigated.

All roles

	POSITIVE	NEUTRAL	NEGATIVE			
MATTER	CHARM QUARK  <p>C +2/3 BINDS WITH OTHER QUARKS TO FORM A HADRON MATTER</p>	UP QUARK  <p>U +2/3 BINDS WITH OTHER QUARKS TO FORM A HADRON MATTER</p>	NEUTRINO  <p>V 0 PEEK'S ANTIMATTER WHILE IN THE UNOBSERVED STATE MATTER</p>	PHOTON  <p>γ 0 SEES ALL THE PARTICLES THAT COLLIDE WITH A CHOSEN PARTICLE DURING THE UNOBSERVED PHAS MATTER</p>	ELECTRON  <p>e -1 DETERMINES THE CHARGE OF A PARTICLE MATTER</p>	DOWN QUARK  <p>d -1/3 HE'S A MATTER PARTICLE, BUT HAS NEGATIVE CHARGE MATTER</p>
ANTIMATTER	W BOSON  <p>W +1 PROTECTS A PARTICLE FROM BEING PUT IN A COLLIDER MATTER</p>	HIGGS BOSON  <p>H 0 PREVENTS A PARTICLE FROM BEING PUT IN A COLLIDER AND DISABLES THEIR POWERS MATTER</p>	GLUON  <p>G 0 BINDS THREE MATTER QUARKS TO FORM A HADRON MATTER</p>	TAU  <p>Τ -1 PUTS A PARTICLE IN THE COLLIDER OF THEIR CHOICE EACH UNOBSERVED PHASE, BUT IF A MATTER PARTICLE IS CHOSEN, THE TAU DECAYS. MATTER</p>	MUON  <p>μ -1 PUTS A PARTICLE OF THEIR CHOICE IN THE COLLIDER ONCE PER GAME. MATTER</p>	
ANTIMATTER	ANTI-DOWN QUARK  <p>D̄ +1/3 APPEARS POSITIVE, BUT IS ANTIMATTER ANTIMATTER</p>			ANTI-UP QUARK  <p>Ū -2/3 REGULAR ANTIMATTER THUG ANTIMATTER</p>	ANTI-TOP QUARK  <p>T̄ -2/3 HAS FINAL SAY IN COLLIDING ANTIMATTER</p>	



CASUS
CENTER FOR ADVANCED
SYSTEMS UNDERSTANDING

www.casus.science

