Quark Clash
a computer game based on particle physics

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On behalf of the design & development team

How this project started?

- Quark poker board game
  - IPPOG DB
  - (old) Slides from CERN IPPOG meeting 2011

  → Teach elementary particle properties while having fun playing known card games

- Semi-dormant project in the past years due to lack of time to develop it more

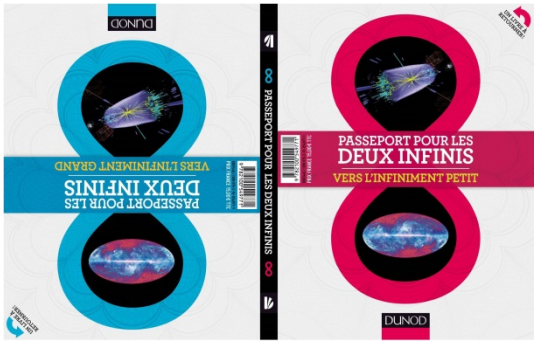
- Feedback received: paperboard cards are « old-fashioned » in the digital area

→ Obvious continuation of the project: a computer game

- But how to proceed?
  - No experience in computer game
  - No expert in our labs

  → Graphic designer, computer professionals, engineers and physicists but no game designer/programmer, etc.

Well, we got lucky…



- Fall 2014: contacted by a teacher of « ENJMIN » interested in the « Passeport pour les deux infinis » book
  - IPPOG DB

→ What is « ENJMIN »?
  - « École Nationale du Jeu et des Médias Interactifs Numériques »
    → « National School of game and interactive digital media »
  - English website
  - Master degree diploma

- First contacts by e-mail
  - Making the card game digital is a good topic for a few month-long internship

- January 2015: presentation of the project in the school premises
  - Each team of students chooses a project they like

- Spring 2015: the internship is taking shape
  - 2 months project (July & September) for a group of 4 students
    → Game design, programming, art & graphics, sound
  - Light (2.0!?) supervision: e-mail & videoconference only!

Internship

- At first a cultural clash!
  - Generation gap
  - Research / Art worlds
  - Digital gaming part of the student DNA / we know it through our children (at best)

→ We had to know / understand each other first…

- Students were « different » from those we usually have for « regular » internships
  - They take over the internship topic and create something out of it

- Goal: to have a final (playable) product at the end of the internship
  - Two months is a short period

    → Focus on three particle interactions:

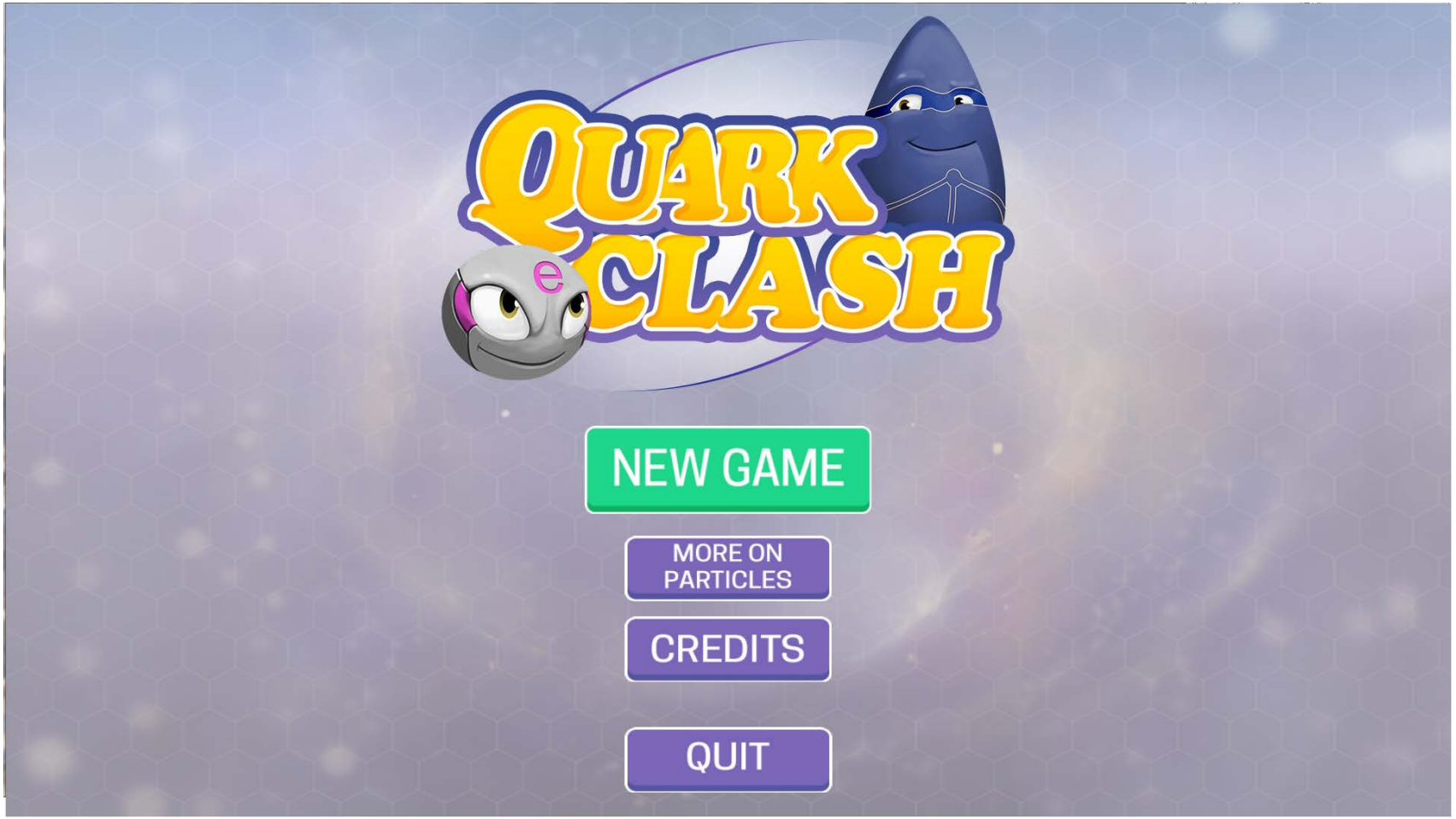
    an elementary particle is transformed into another one via a force carrier

- Players have cards symbolising particles and forces
- Goal is to make physically-valid interactions using cards in hand and a common deck
- (Automated) combat phase ending each turn – to attract regular digital game players
  - Cards have additional (non-physical) properties!

  → Lengthy discussions: not mandatory but gets player's attention

The game: Quark Clash

- Three supported platforms: Windows, Mac and web
- In English
- Two play modes: single player (against the machine) or 2 players



The game: Quark Clash

Style inspired by
« The Particle Zoo »

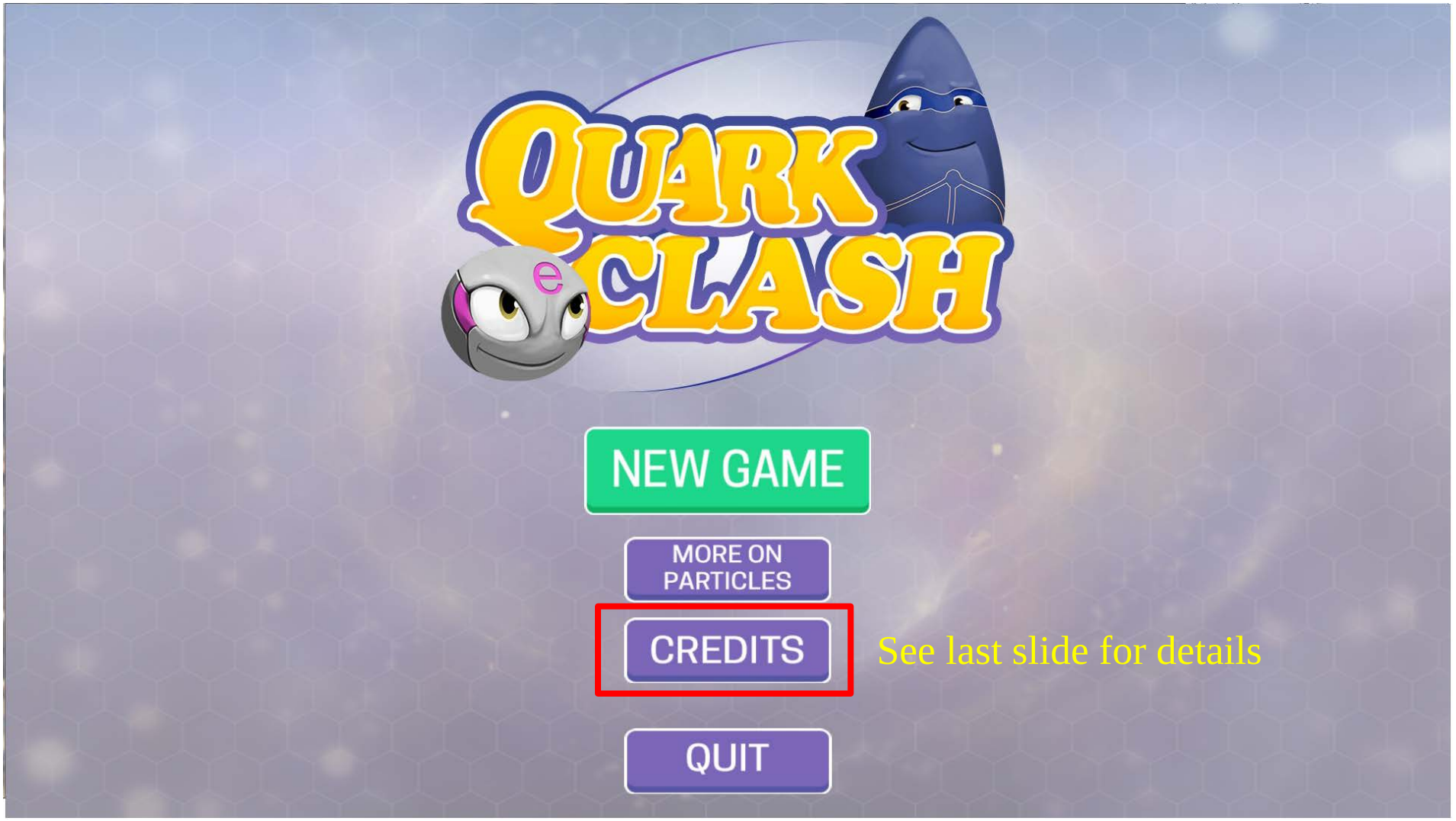
NEW GAME

MORE ON PARTICLES

CREDITS

QUIT

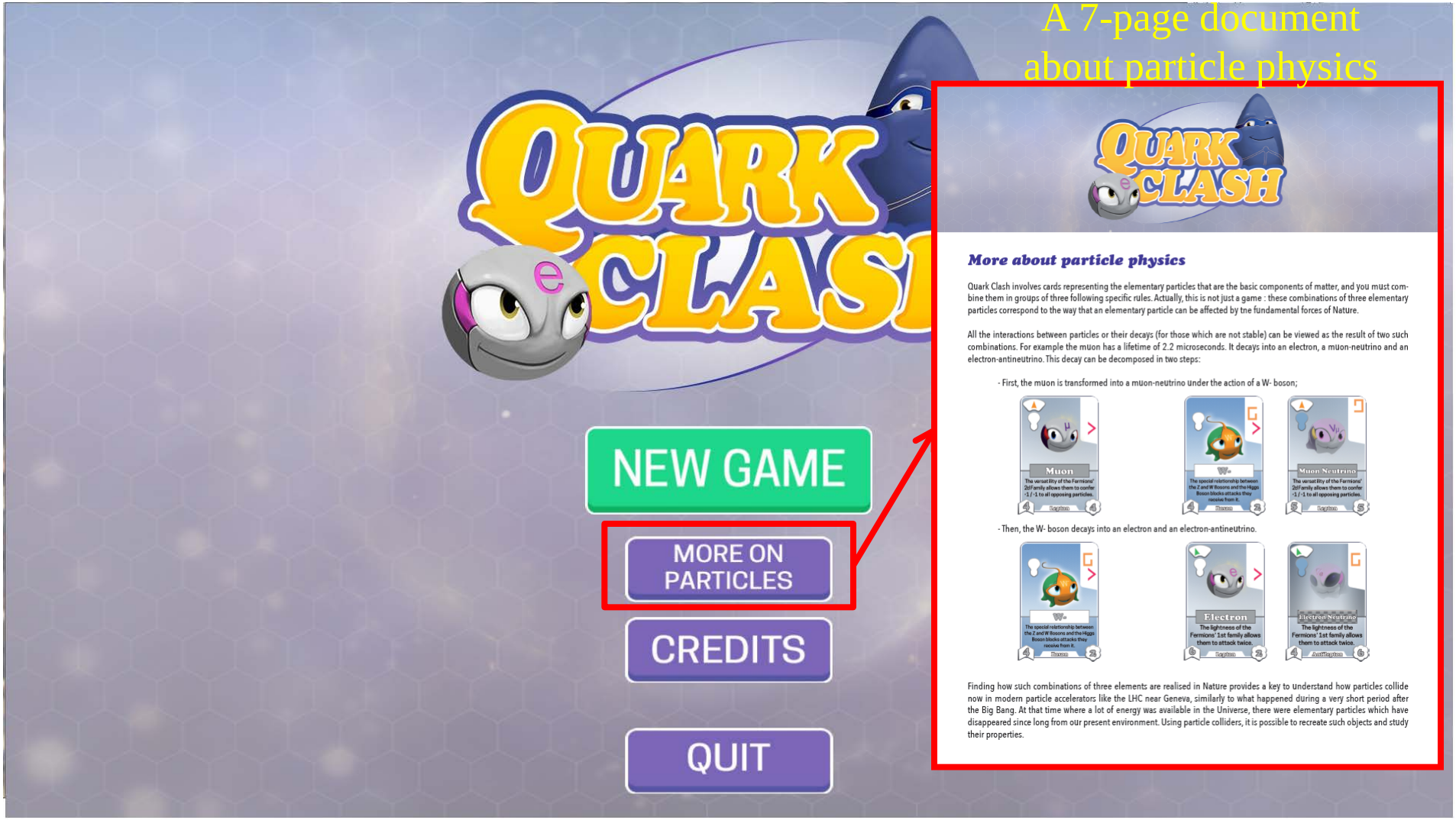
The game: Quark Clash



See last slide for details

The game: Quark Clash

A 7-page document about particle physics



QUARK CLASH

More about particle physics

Quark Clash involves cards representing the elementary particles that are the basic components of matter, and you must combine them in groups of three following specific rules. Actually, this is not just a game : these combinations of three elementary particles correspond to the way that an elementary particle can be affected by tne fundamental forces of Nature.

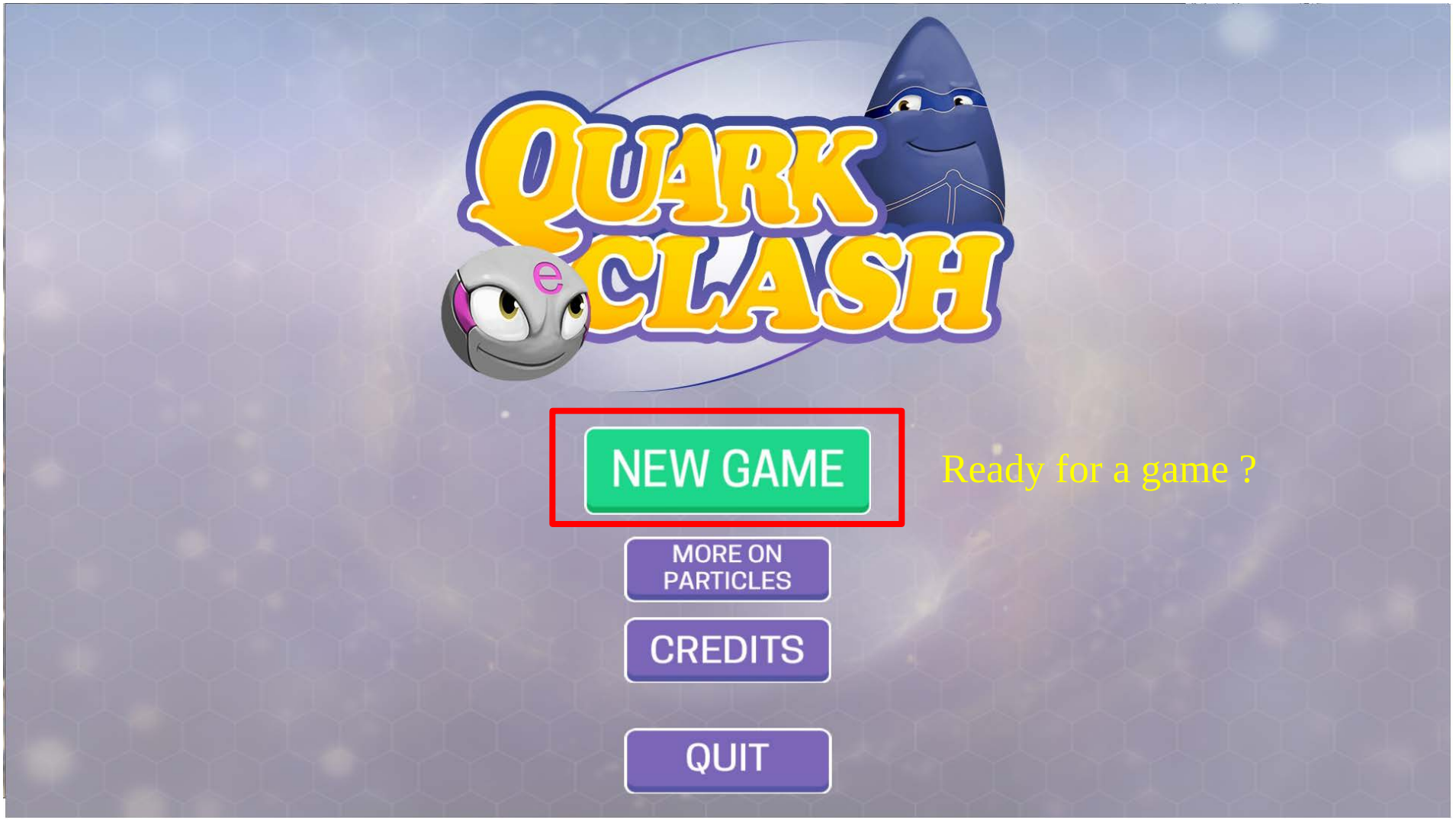
All the interactions between particles or their decays (for those which are not stable) can be viewed as the result of two such combinations. For example the muon has a lifetime of 2.2 microseconds. It decays into an electron, a muon-neutrino and an electron-antineutrino. This decay can be decomposed in two steps:

- First, the muon is transformed into a muon-neutrino under the action of a W- boson;

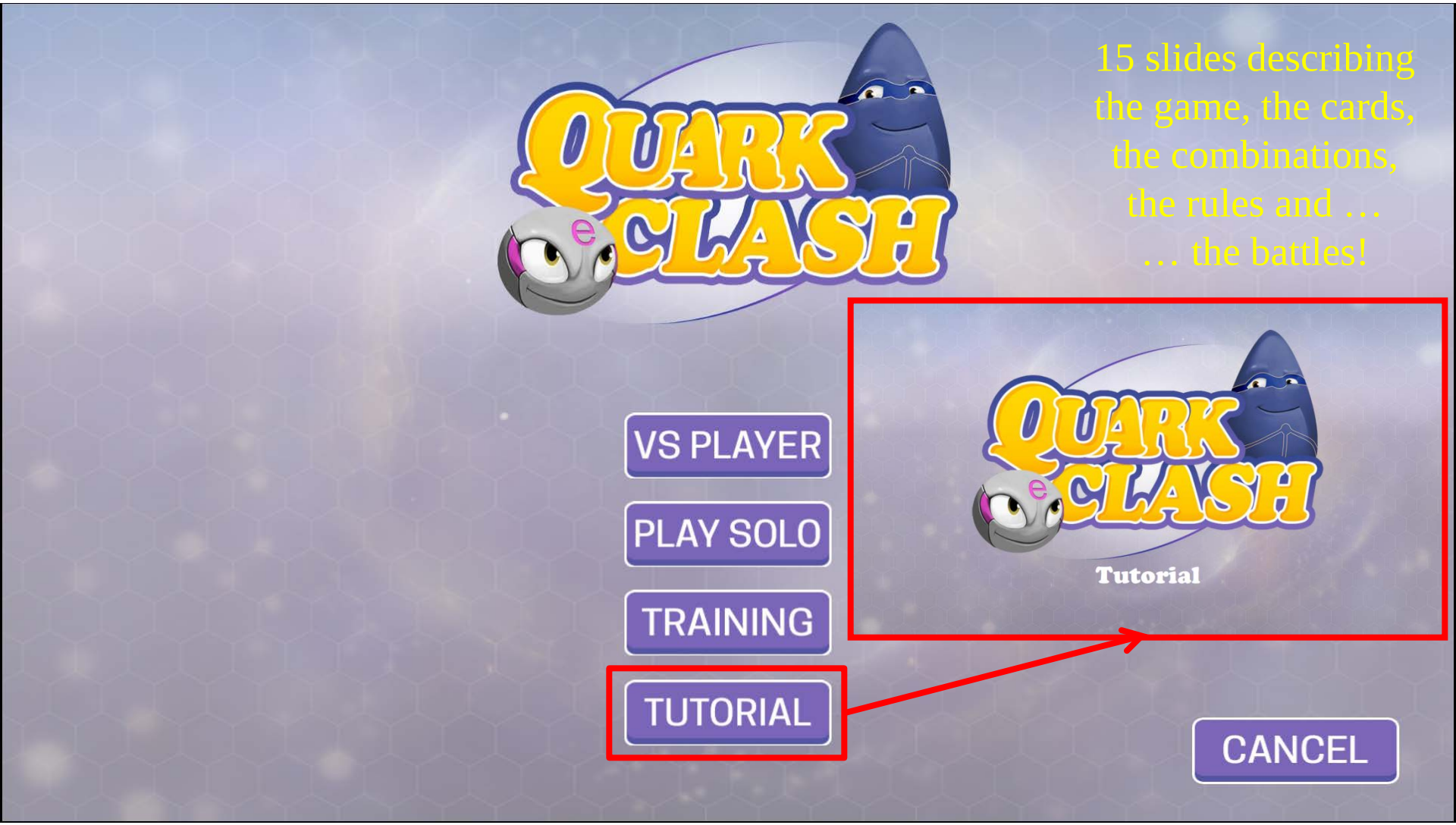
- Then, the W- boson decays into an electron and an electron-antineutrino.

Finding how such combinations of three elements are realised in Nature provides a key to understand how particles collide now in modern particle accelerators like the LHC near Geneva, similarly to what happened during a very short period after the Big Bang. At that time where a lot of energy was available in the Universe, there were elementary particles which have disappeared since long from our present environment. Using particle colliders, it is possible to recreate such objects and study their properties.

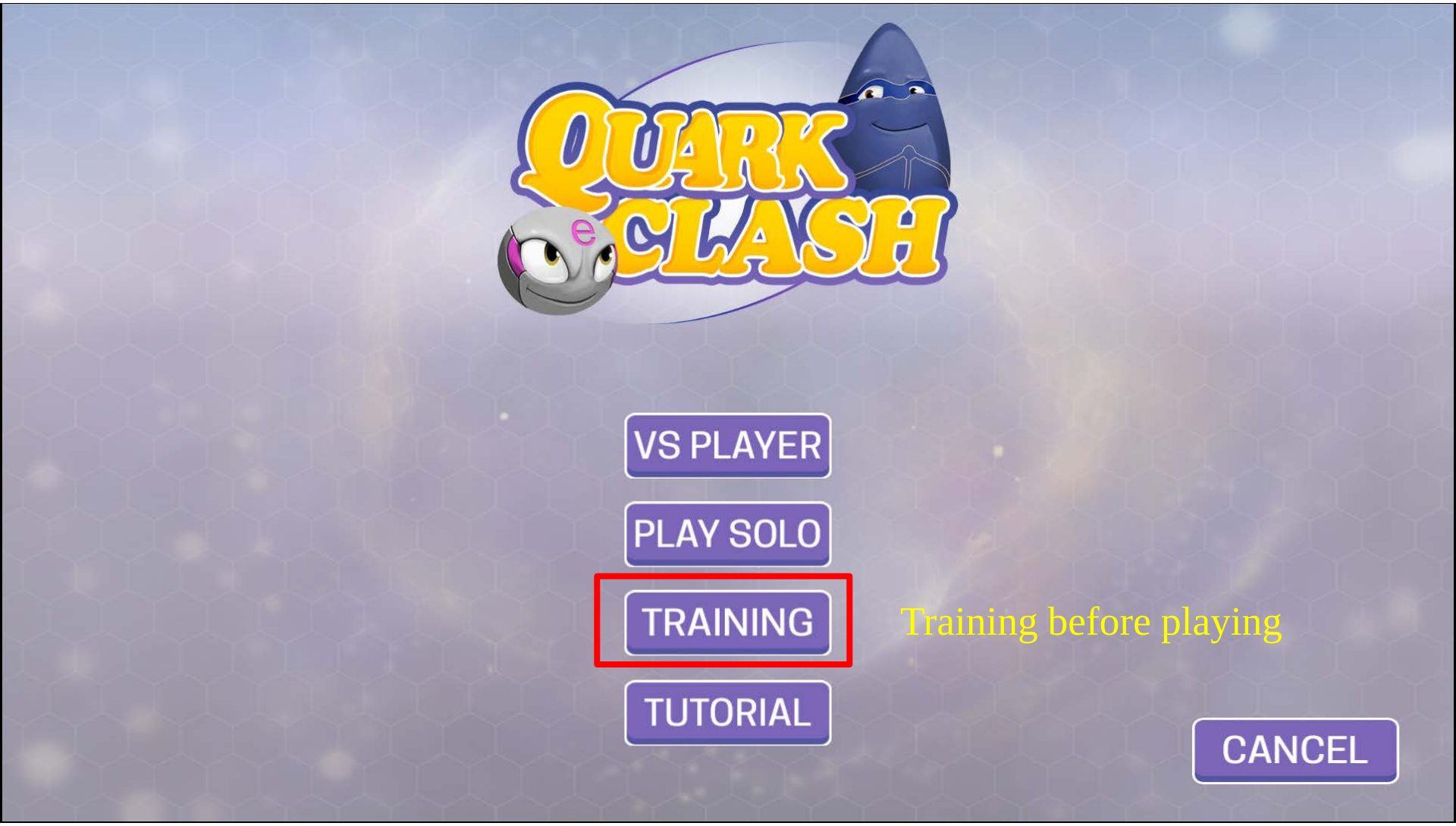
The game: Quark Clash



New game menu

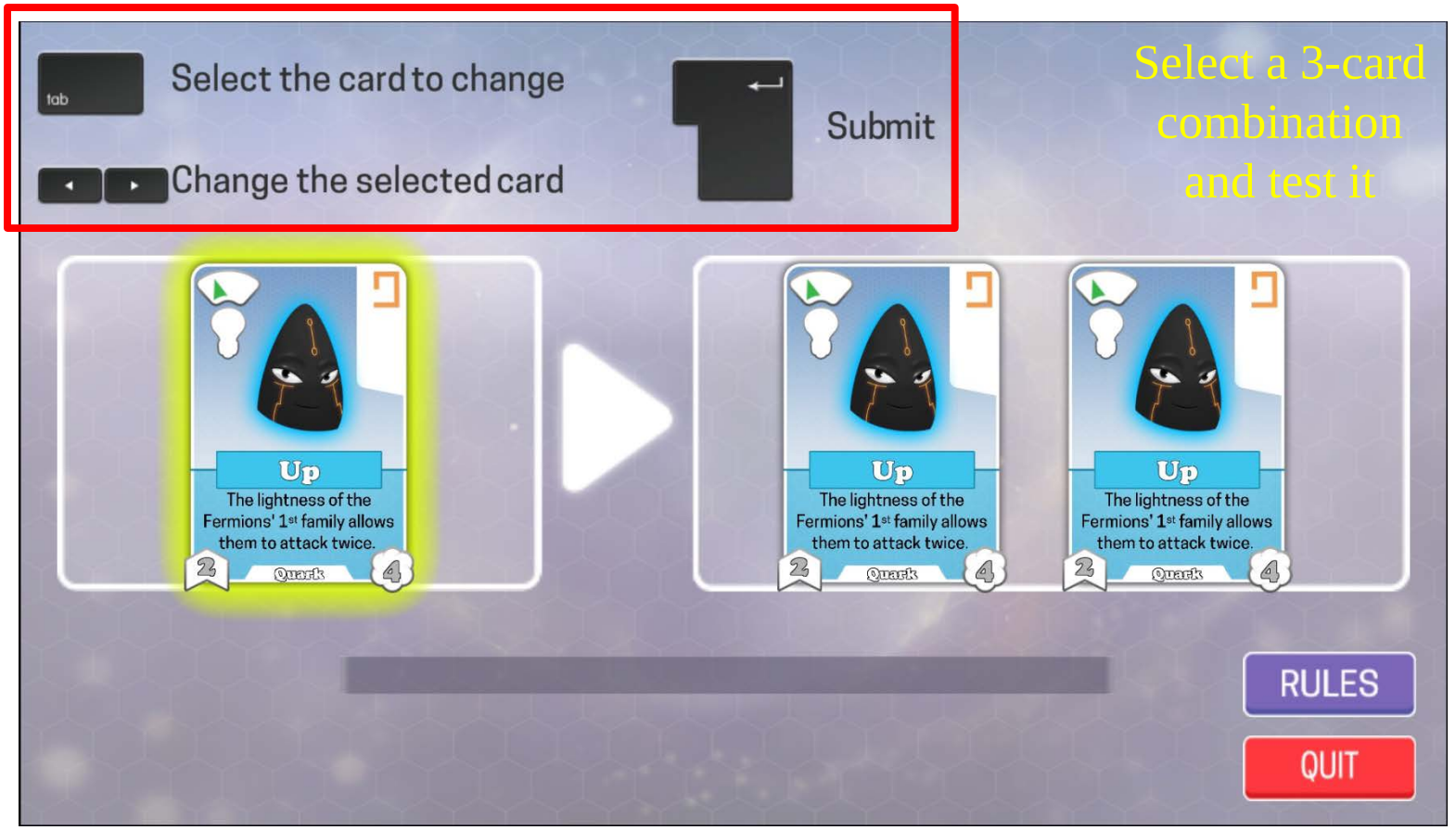


New game menu



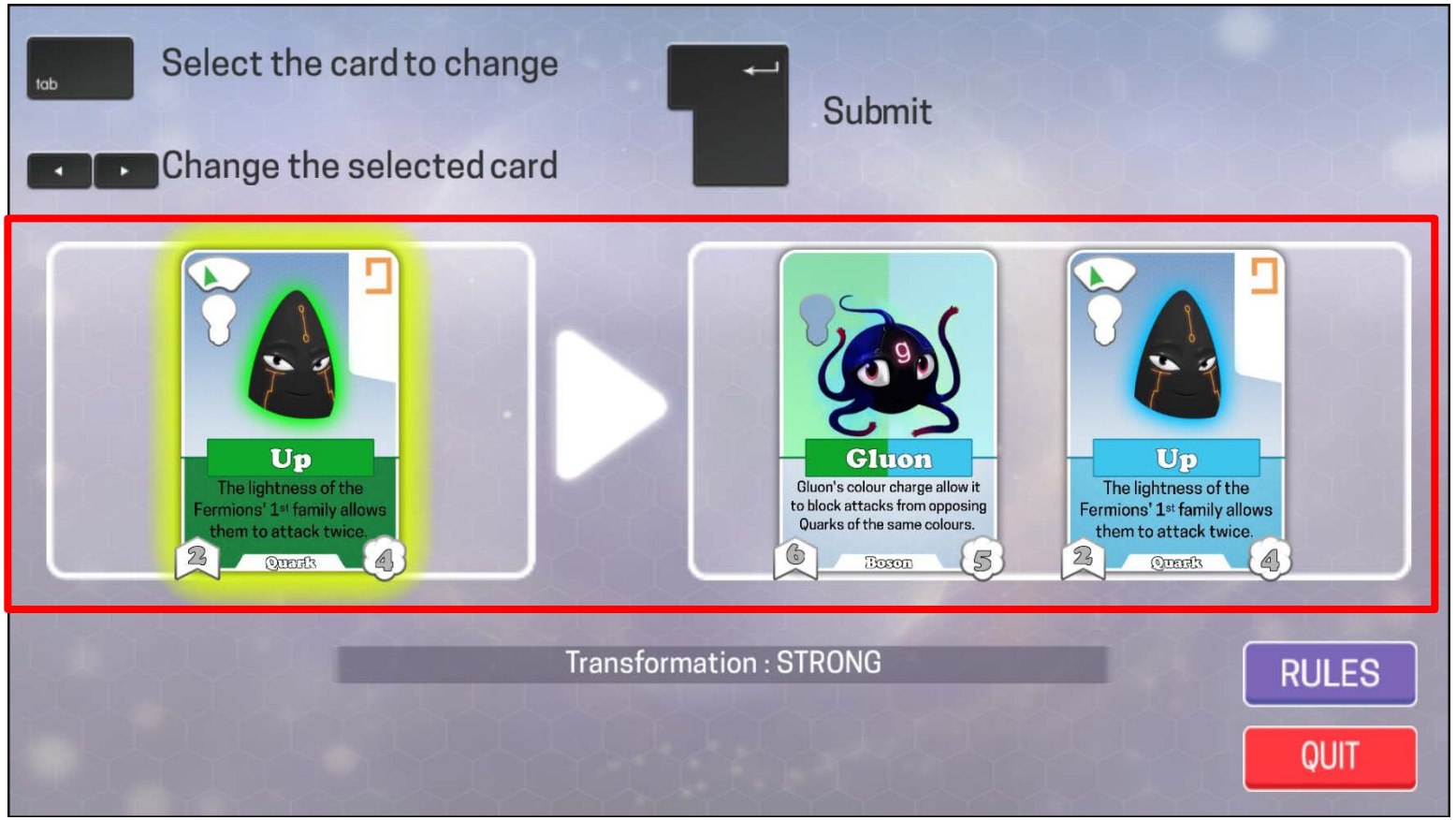
Training

- Tool initially developed to test/debug the (in)valid combinations of cards
  - Found useful enough to be added to the game package



Training

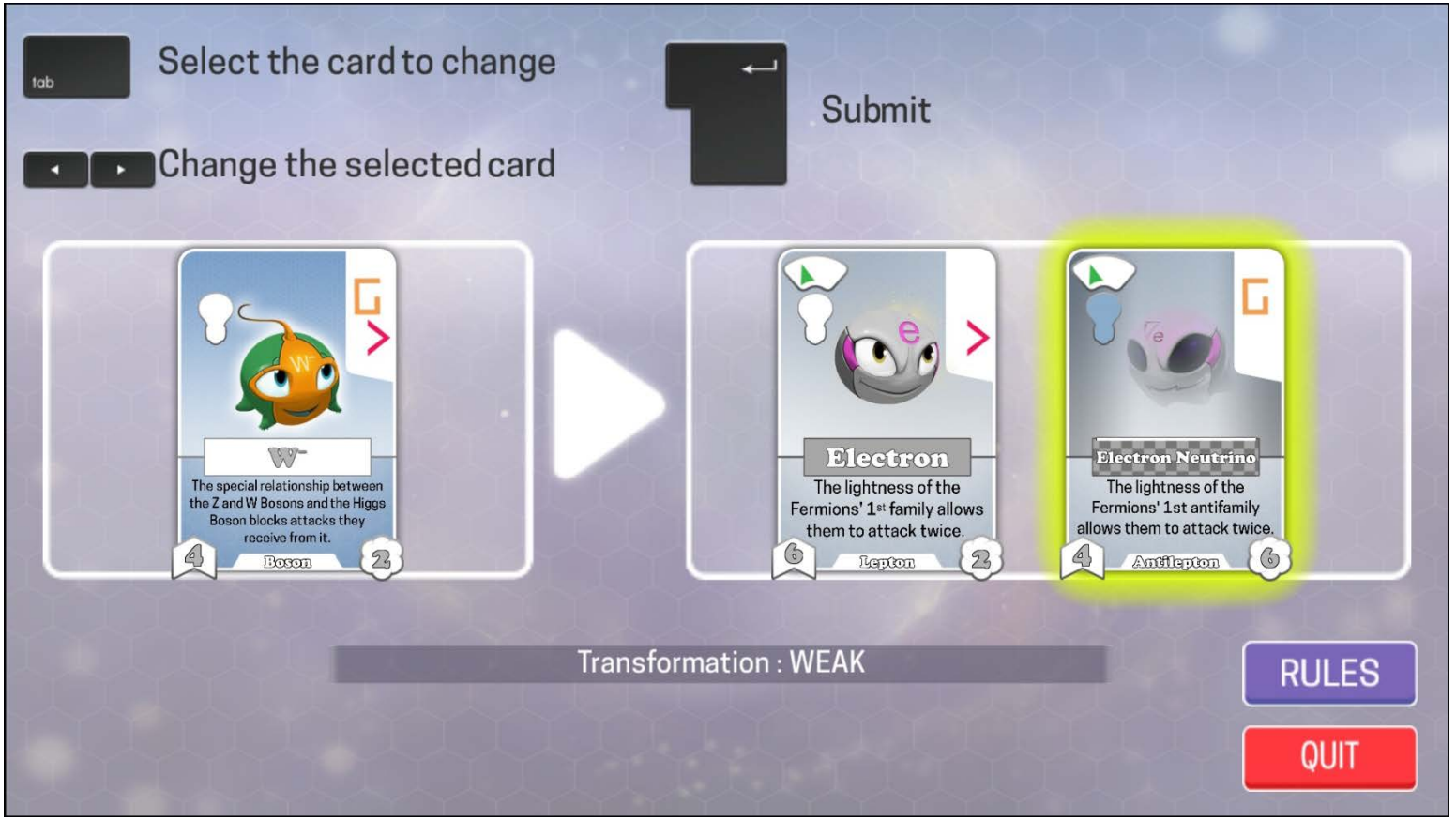
- Some examples



Symbols and colors help

Training

- Some examples



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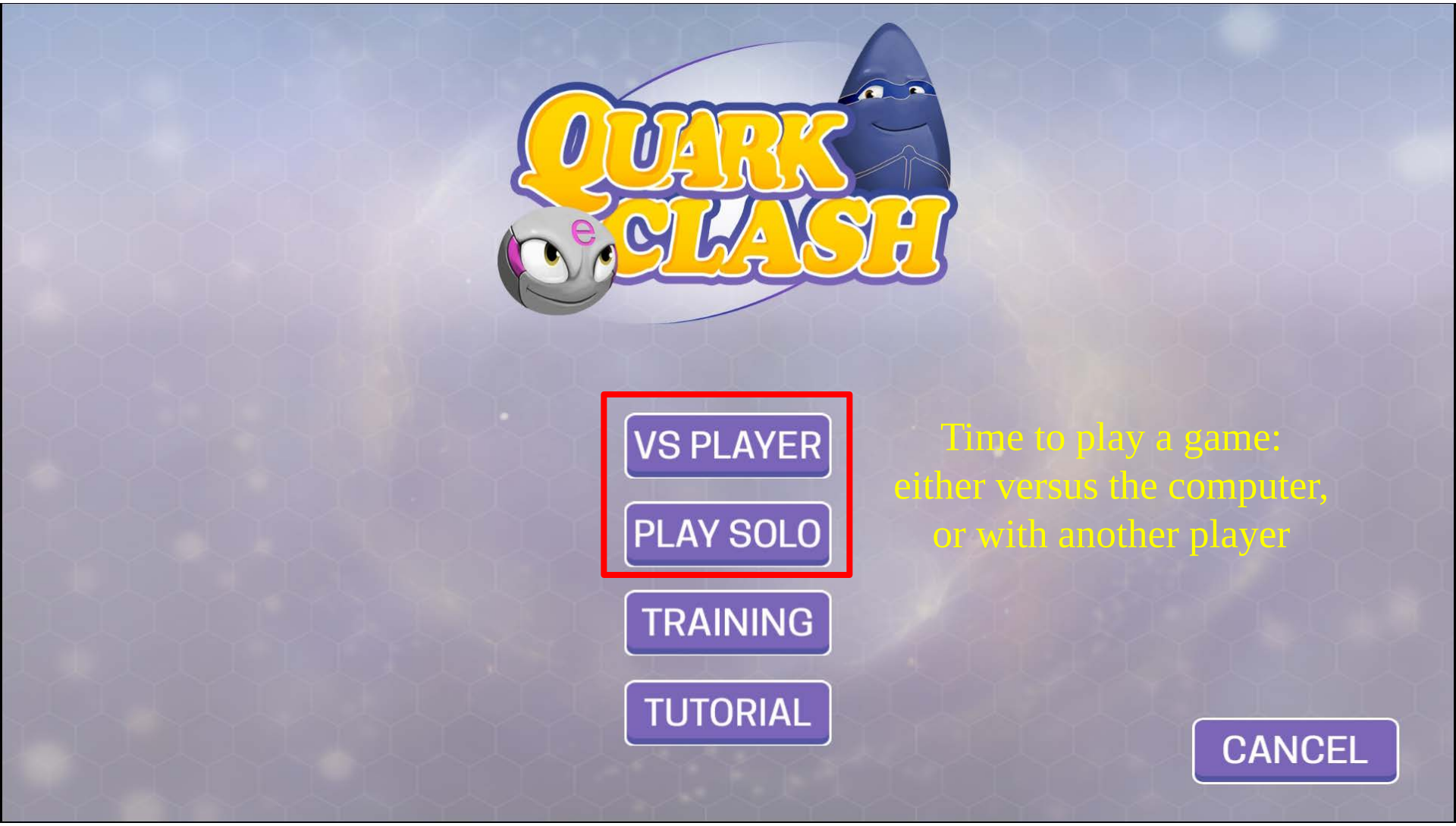


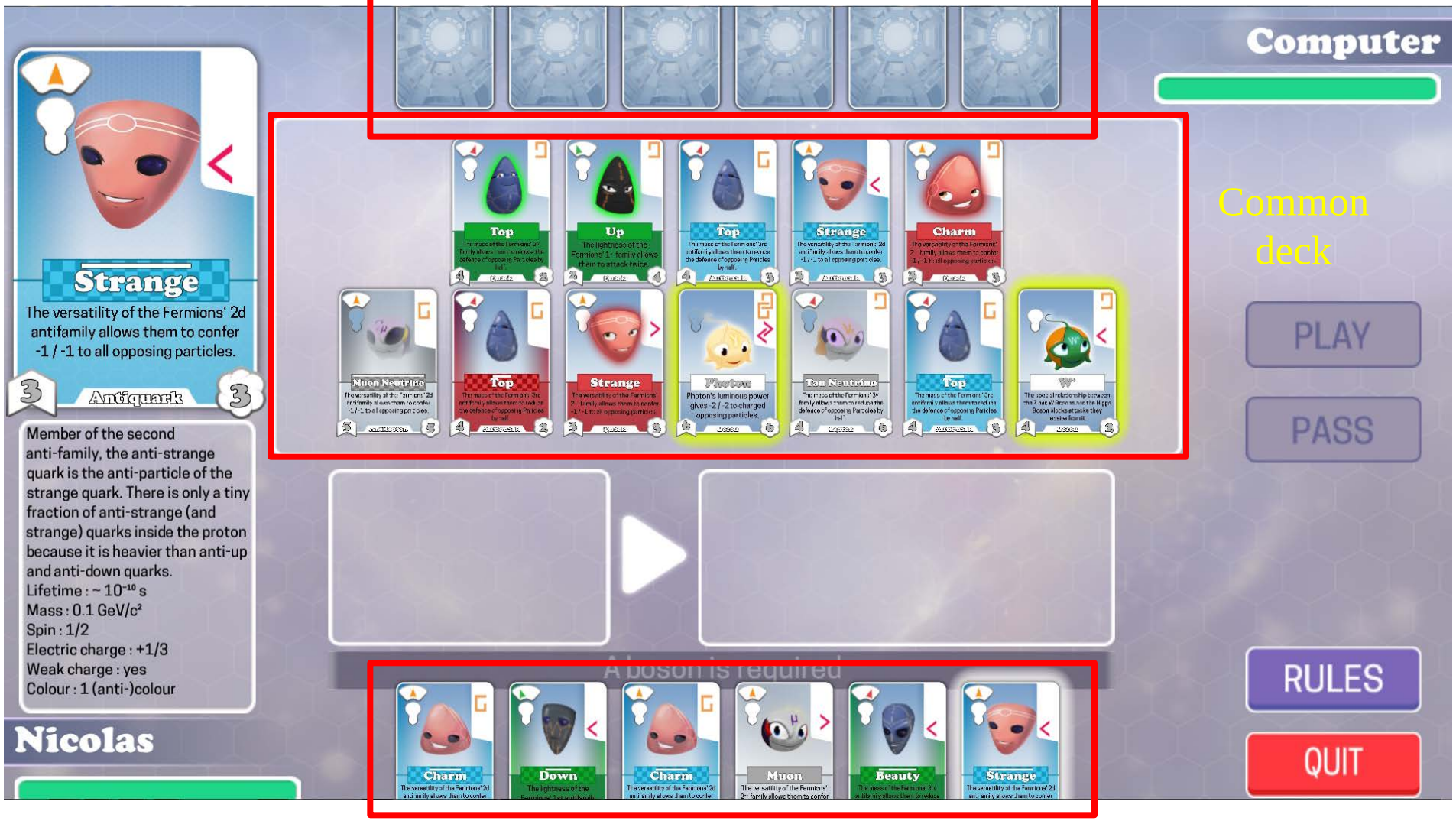
The « board » game

The « board » game

The two players with their « life bars »

The « board » game

Computer's deck is hidden

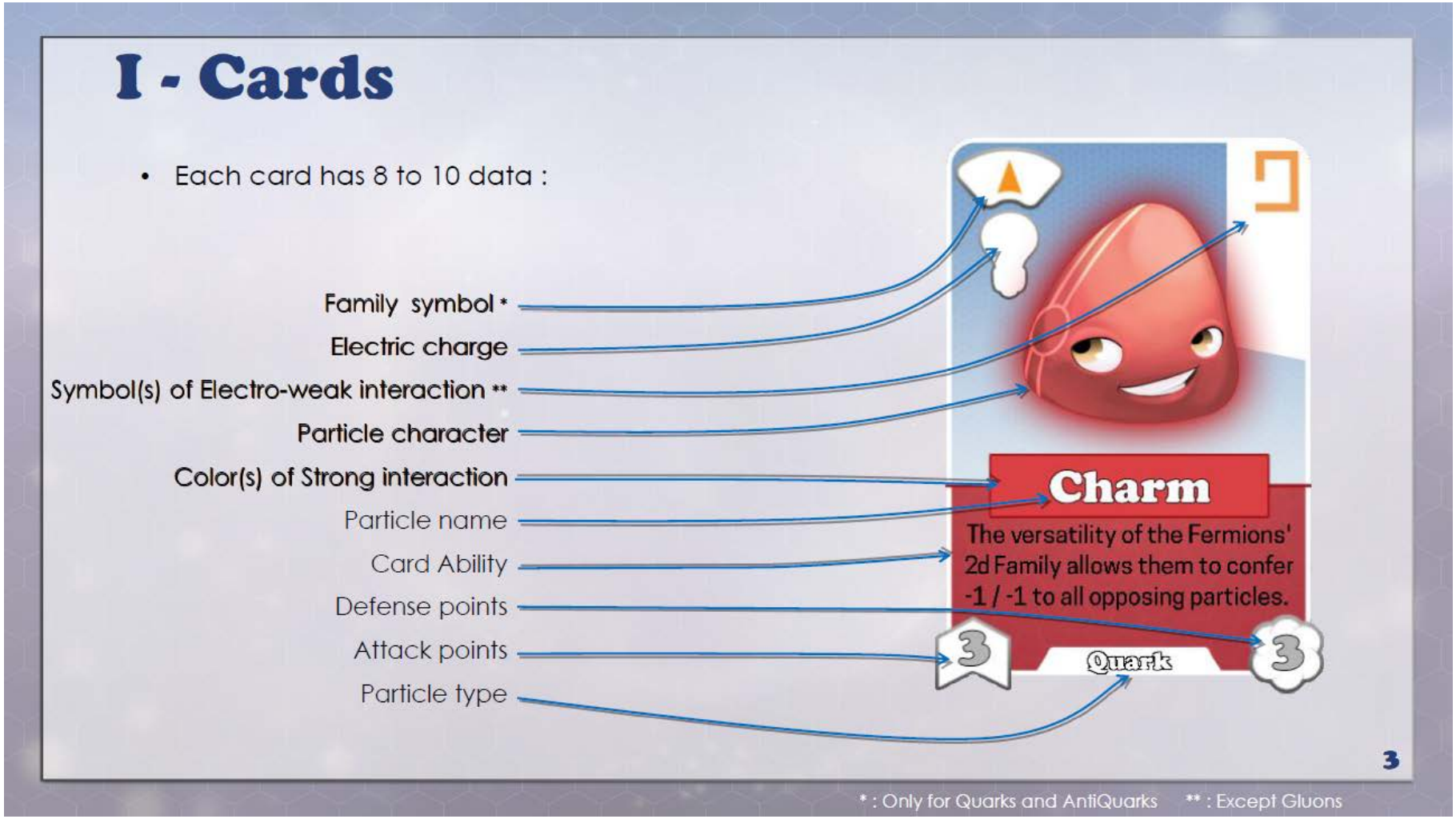


Your deck

The « board » game

Card contents

- Slide taken from the tutorial



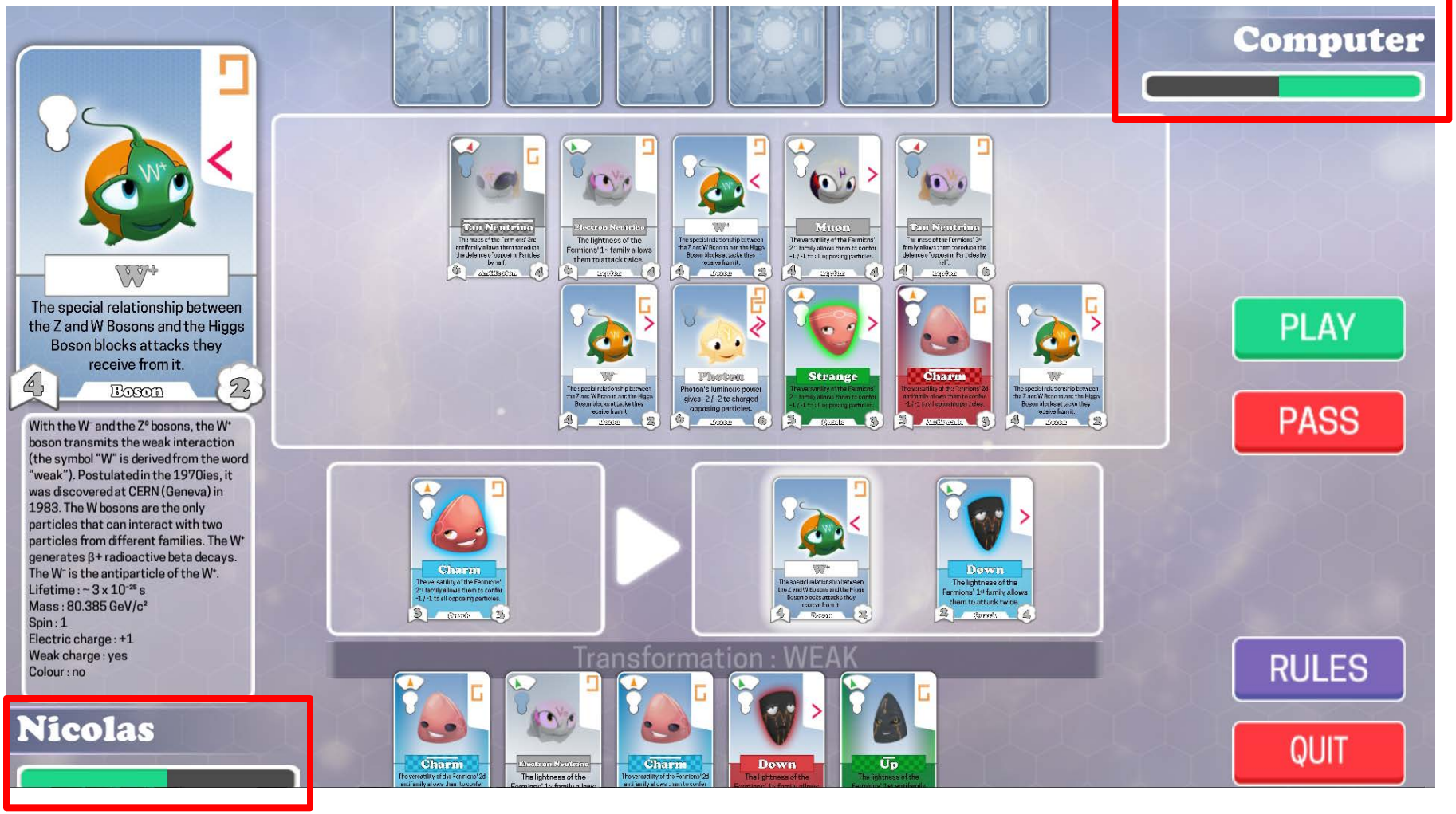
Let’s play!

- Strange quark radiating a photon

Let’s play!

- Quark flavour changing transformation

Result of past fights



‘Live’ combat


Top
Charm
Beauty
Charm
W
Top
Muon Neutrino
Muon Neutrino
Tau
Up
Down
Higgs
Down
Transformation : WEAK
Beauty
Charm
Electron Neutrino
Up
Top
Nicolas
PLAY
PASS
RULES
QUIT

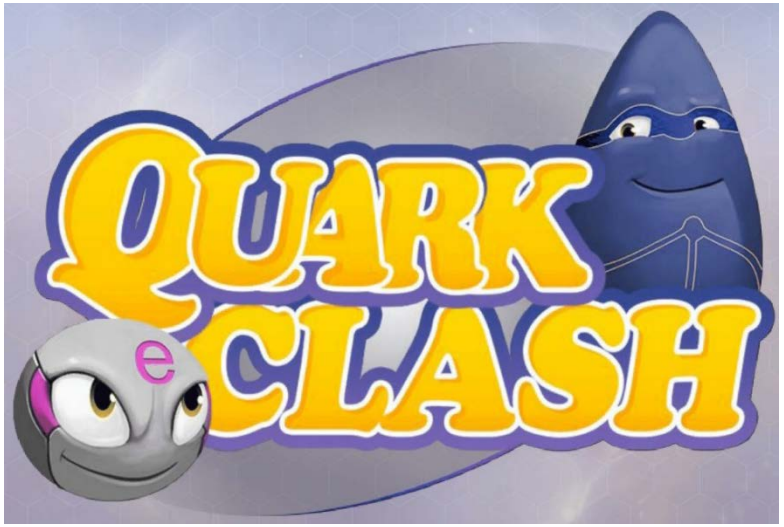
Next steps

- Add the game to the IPPOG database
  - Last version (with a few bug fixes) available early this week
    → Tests are underway

- Get feedback from you and other players

- Debriefing meeting at LAL Orsay next week
  - How to use the Quark Clash game?
  - Do we want to have a similar internship next Summer?
  - If yes, what should be modified/improved?
    → Scope, organization, support

- To contact us:
  elementaire@lal.in2p3.fr



Credits

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Battles

- Each card has three properties: attack, defense and a special ability
  - Common to many recent card games, digital or not (Pokemon, Magic)

    → Concepts familiar to (experienced) players – unlike particle physics

- The longer the particle lifetime the more defense points it owns
- Heavier particles have more attack points
- Particle and antiparticles have the same properties

→ The most experimental part of the current game