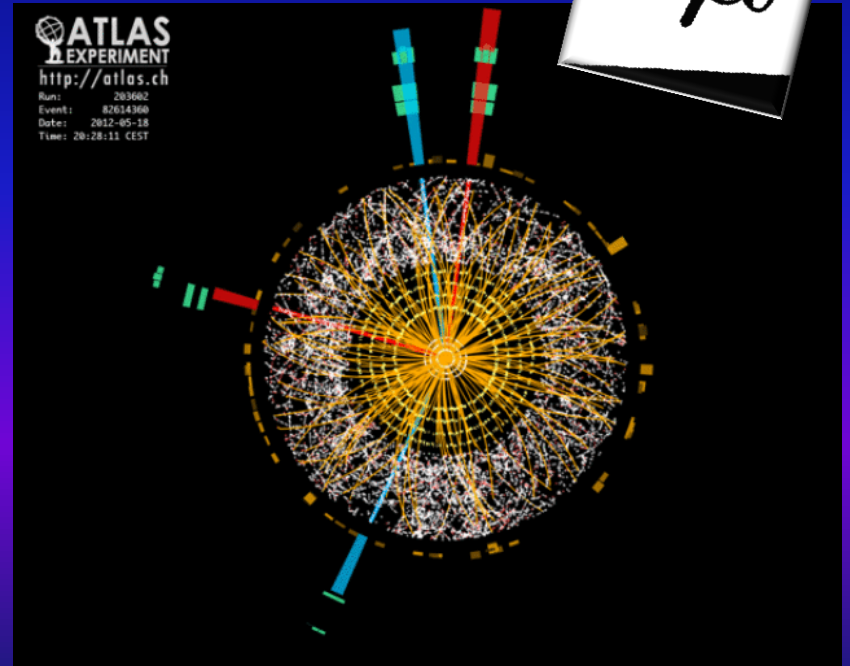
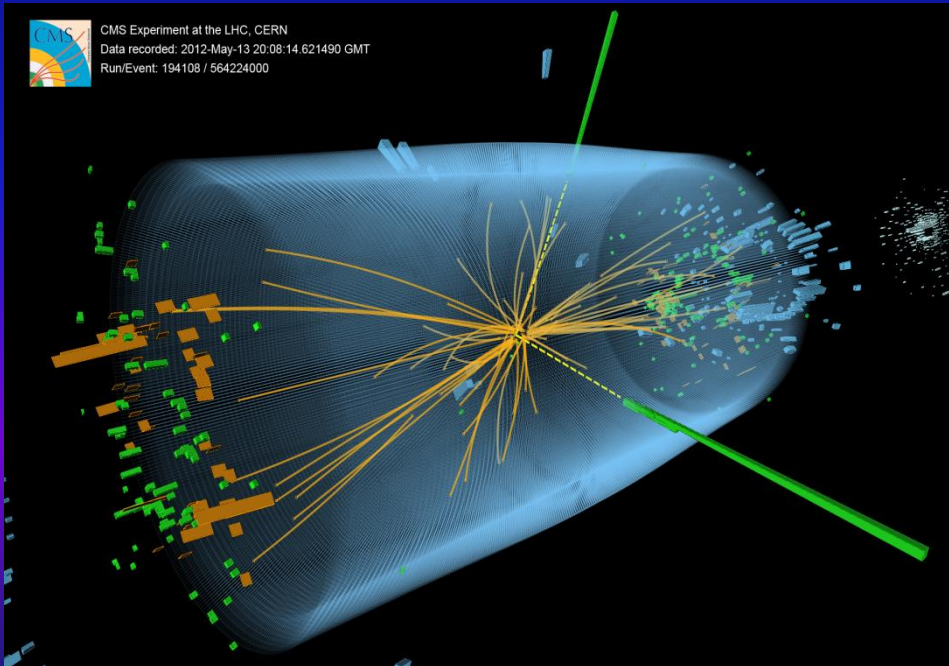
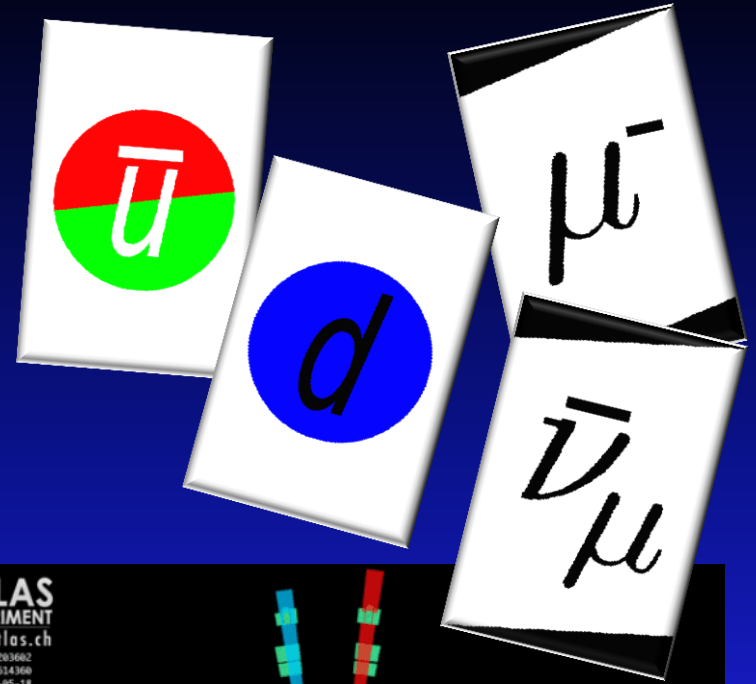


# HOGYAN CSINÁLJUNK KÁRTYÁBÓL HIGGS BOZONT?

Csörgő Tamás

MTA Wigner Fizikai Kutatóközpont

csorgo.tamas @ wigner.mta.hu



# ELEMI RÉSZECSKÉK

# - JÁTÉKOSAN

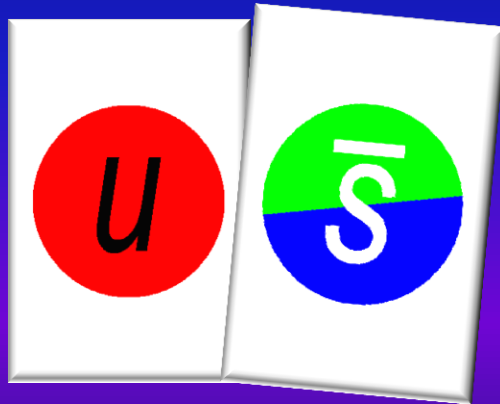
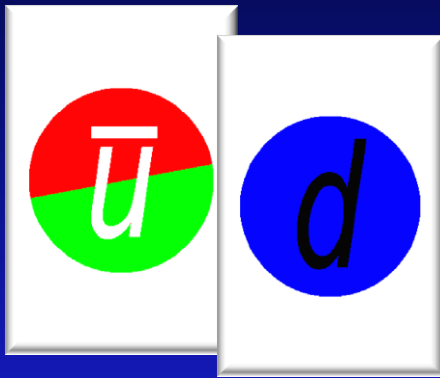
Fermions

Quarks				
Leptons				
				Bosons (Forces)

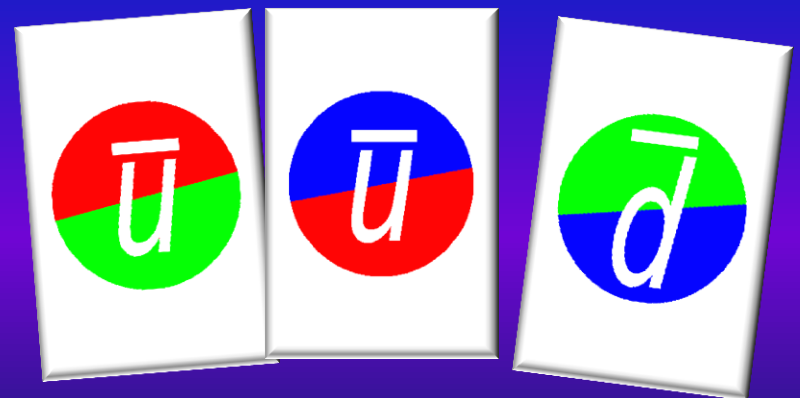
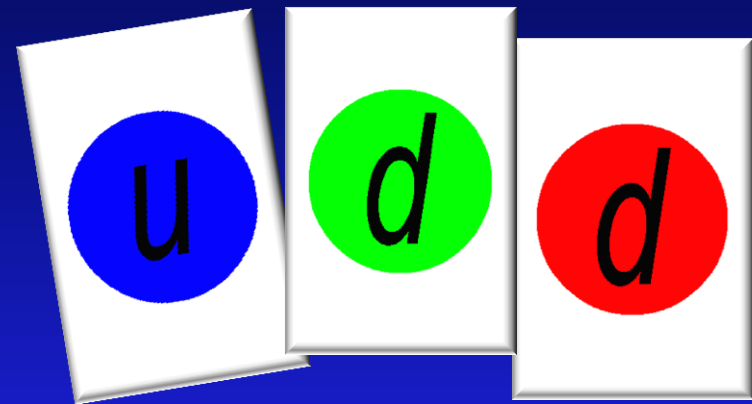


# SU(3) SZÍN ÉS OPTIKAI SZÍN

Mezonok



(Anti)Barionok



# RÉSZECSKÉS KÁRTYAJÁTÉK

## 66 kártyalap, 4 játék:

- ANTI
- Detektáljunk!
- Kvarkanyag
- Kozmikus záporok

e-könyvként megjelent

<http://www.lulu.com/>

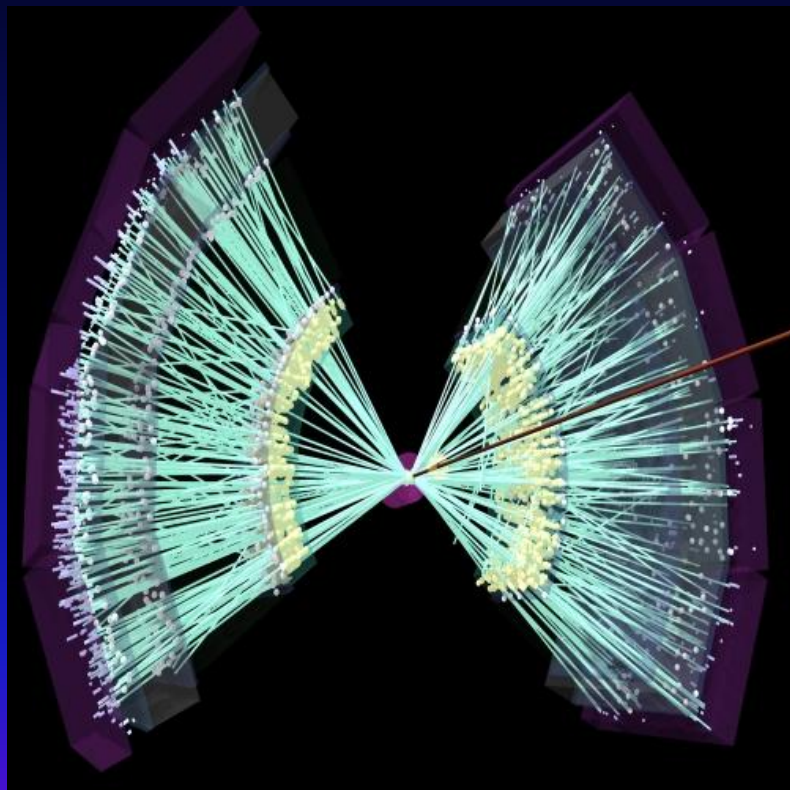
„Meet the Scientist”

[nyitóelőadás és bemutató](#)

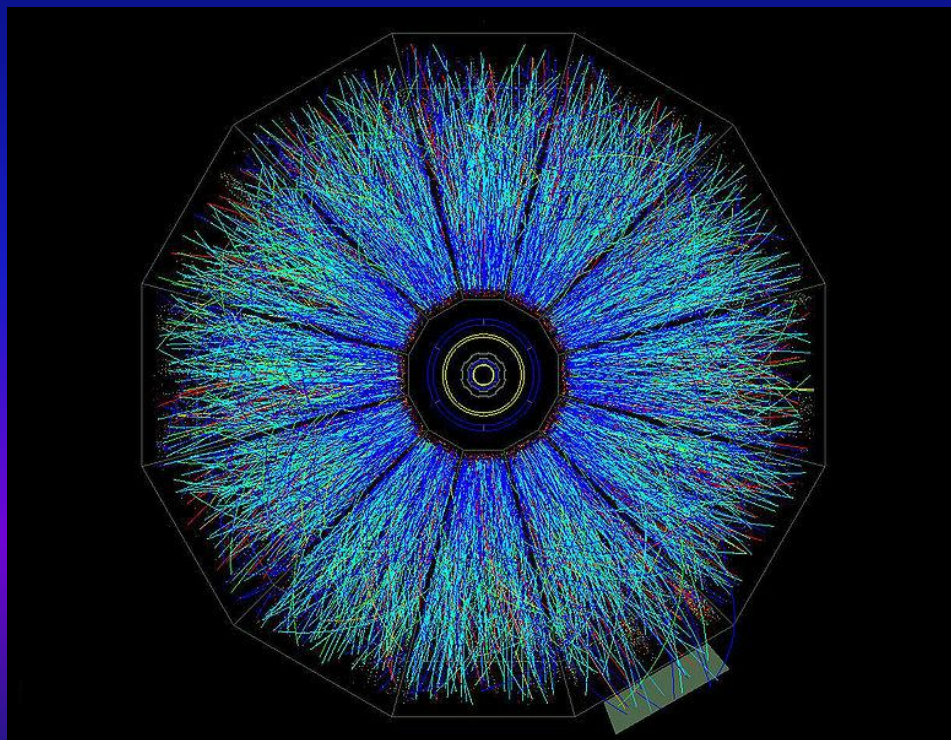


# KVARKANYAG - KÍSÉRLETILEG

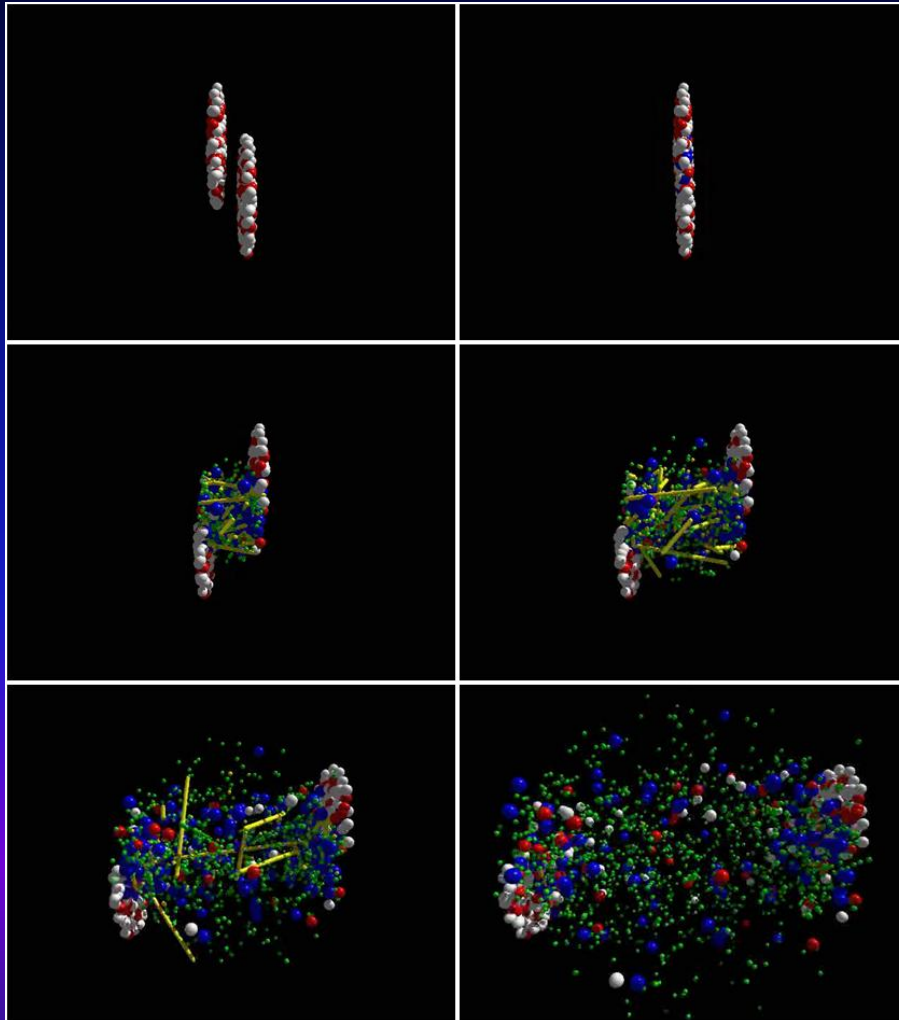
A kvarkok tökéletes folyadékát, angol rövidítésével az sQGP-t az USA Brookhaveni Nemzeti Laboratóriumában a PHENIX és a STAR kísérletben fedezték fel a RHIC (Relativistic Heavy Ion Collider) gyorsítóban.



A tökéletes kvarkfolyadék, az sQGP tulajdonságait megerősítette és további részletekkel gazdagította a CERH LHC ALICE, ALTAS és CMS kísérlete.

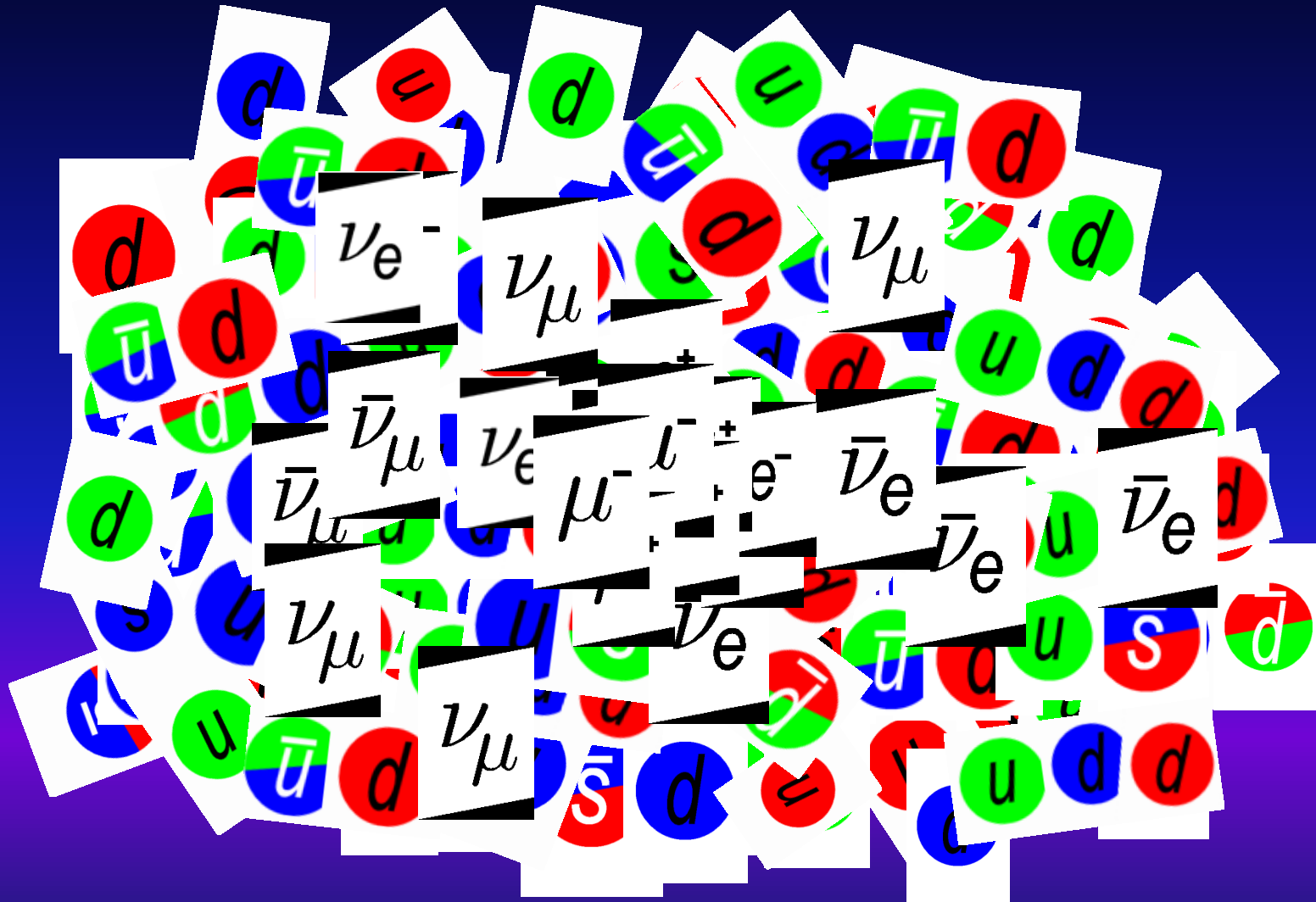


# KVARKANYAG - ELMÉLETILEG



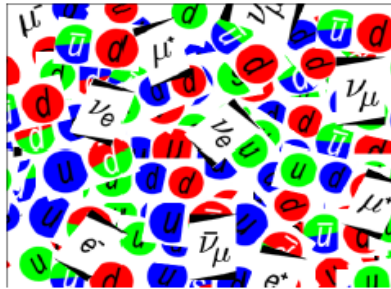
A RHIC Au+Au ütközéseinek elméleti leírása. Nagy energiás nehézion-ütközésekben erősen kölcsönható **kvark-gluon plazma** jön létre, meglepő tulajdonságokkal: a kvarkok tökéletes folyadékának tulajdonságait az USA Relativisztikus Nehézion Ütköztető (RHIC) gyorsítójának kísérletei tárták fel a Brookhaveni Nemzeti Laboratóriumban. Az eredményeket megerősítették, és további részletekkel gazdagították a CERN LHC ALICE, ATLAS és CMS kísérletei.

# KVARKANYAG - JÁTÉKOSAN



# RÉSZECSKÉS KÁRTYAJÁTÉK

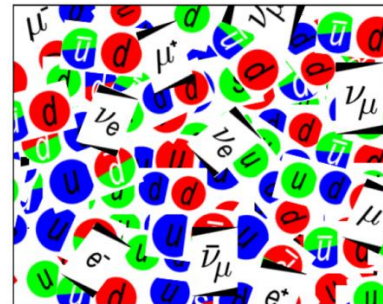
ELEMI RÉSZECSKÉK JÁTÉKOSAN



Csörgő Judit  
Török Csaba  
Csörgő Tamás

# QUARK MATTER CARD GAME

ELEMENTARY PARTICLES ON YOUR OWN



Judit Csörgő  
Csaba Török  
Tamás Csörgő



# NEMZETKÖZI FIGYELEM, NÉHÁNY PÉLDA

## SUBATOMIC SHUFFLE

Prefer particle physics to poker? Pick up a deck of the Quark Matter Card both. Instead of kings and queens, the cards feature quarks (up, down, and trons, and their neutrinos; and antiparticles for all.

Hungarian high school students Csaba Török and Judit Csörgő invent father, Tamás, a physicist at the KFKI Research Institute for Particle Budapest. The simplest game is "Anti," in which players quickly identify combinations, bearing in mind a quantum-mechanical property called color of the card. It's an abstract concept, but "even children who cannot Tamás says. For adult players, he recommends "Quark Matter," which piled to represent the quark-gluon plasmas physicists cook up at Brookha



Relativistic  
(RHIC), and  
PHENIX  
cards are

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ncemag.org **SCIENCE** VOL 331 14 JANUARY 2011  
Published by AAAS

2011.01.04.

Quark Matter at RHIC: It's in the Cards

## @brookhavenToday Story Archives

### Quark Matter at RHIC: It's in the Cards

#### Students and RHIC physicist develop quark-gluon plasma card game

By Karen McNulty Walsh | January 4, 2011

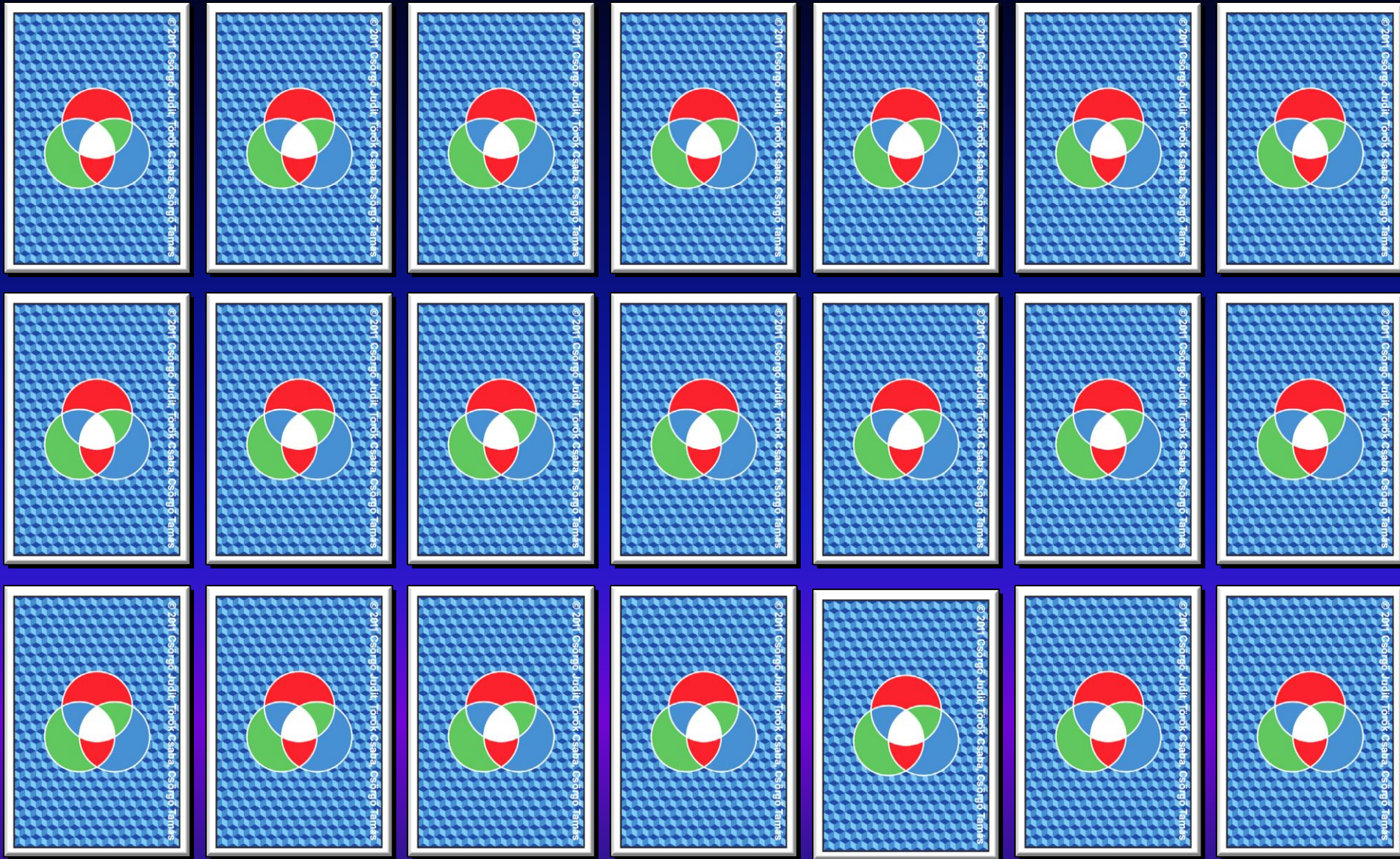
Happy New Year! Like the sprays of confetti and streamers exploding in Times Square at midnight on December 31, millions of subatomic particles will soon be streaming from heavy ion collisions at RHIC, Brookhaven Lab's Relativistic Heavy Ion Collider.

Linking subatomic particles with New Year's Eve celebrations may not be so strange: Two years ago, a group of Hungarian secondary school students rang in the New Year while playing with particles, literally. The group, which included Judit Csörgő, daughter of RHIC/PHENIX collaborator Tamás Csörgő, and her friend Csaba Török, were at a New Year's celebration, playing with the first edition of a set of cards invented by Csaba as an entertaining way to learn about subatomic particles and their interactions. The game, more formally developed and tested by the students with mentoring help from Tamás, won an honorable mention in a 2010 Hungarian competition for junior innovators. It is now available for purchase as an e-book, with cards included, on Lulu, currently with Hungarian directions. An English version is in the works.

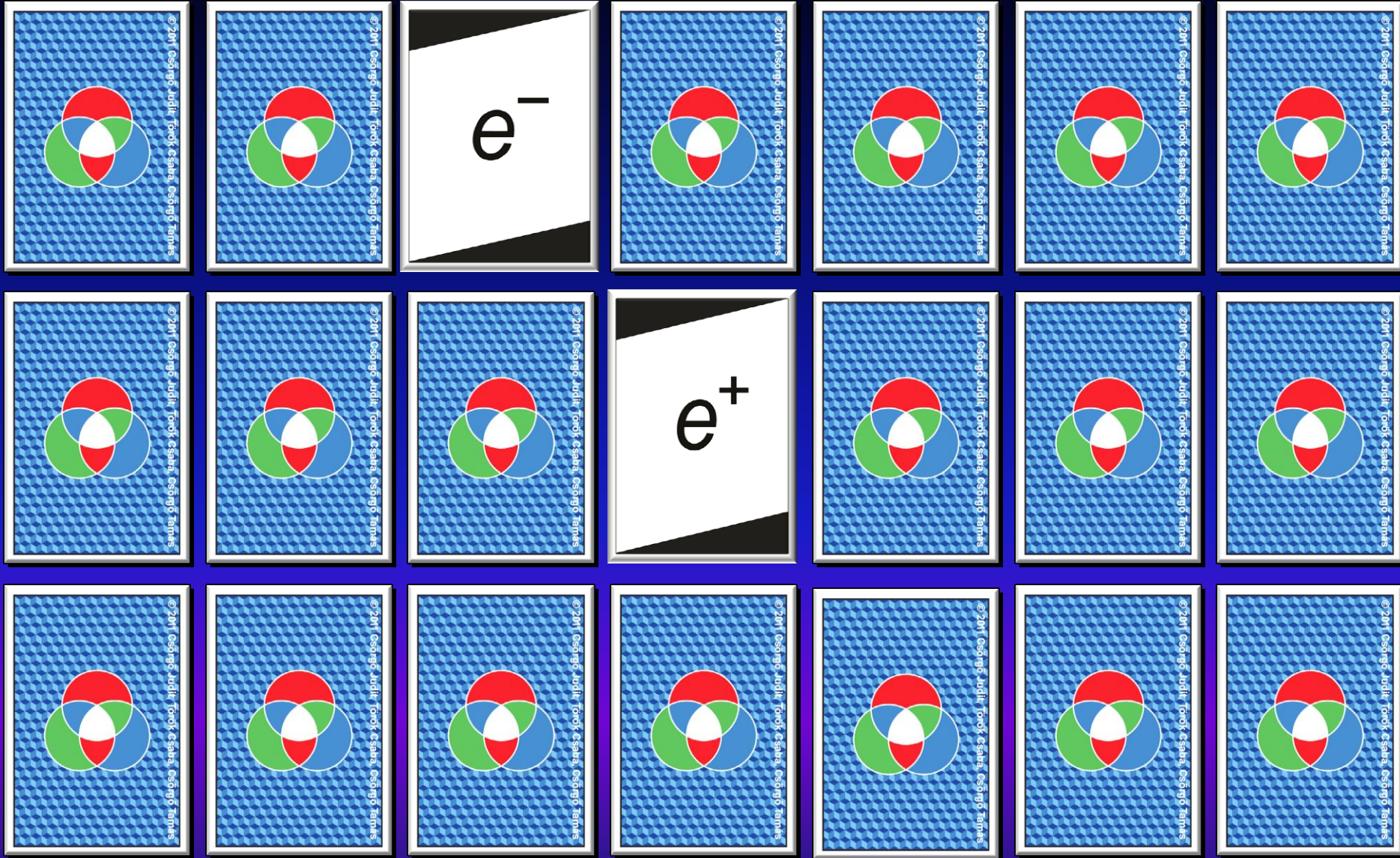


RHIC/PHENIX collaborator Tamás Csörgő, Csaba Török and Judit Csörgő with their card game at the exhibition in the "Palace of Wonders" after the ceremony of the 19th Hungarian National Contest for Junior Innovators and Scientist (Budapest, Hungary, June 10, 2010).

# A KVARKANYAG MEMÓRIÁJA

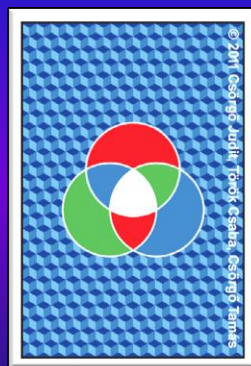
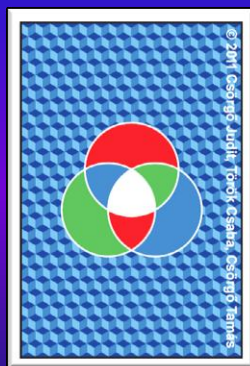
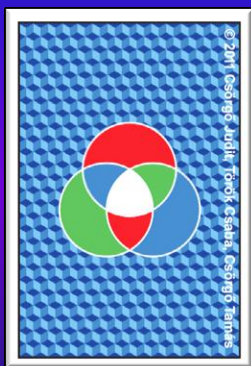
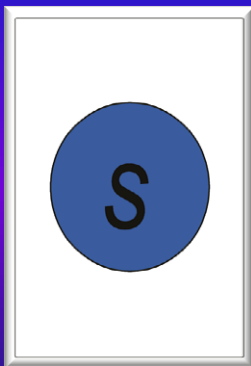
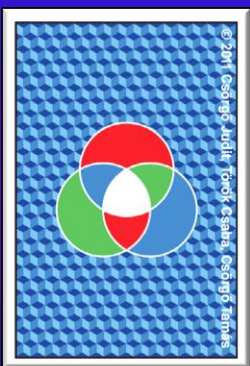
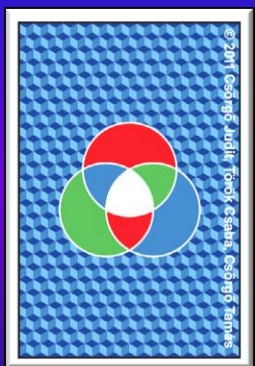
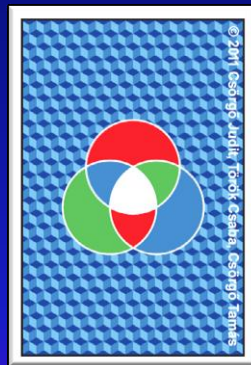
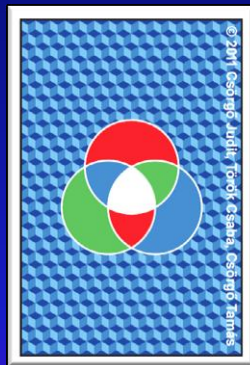
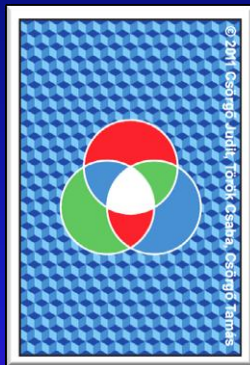
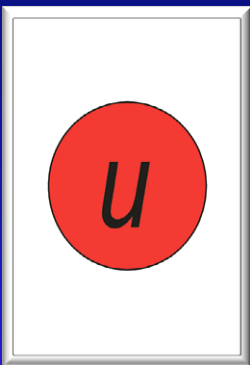
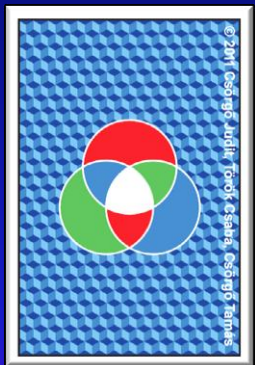
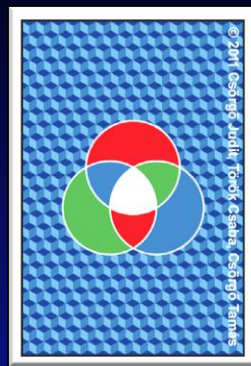
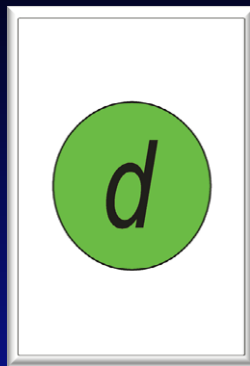
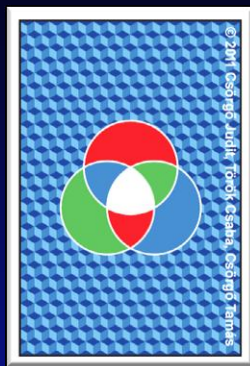
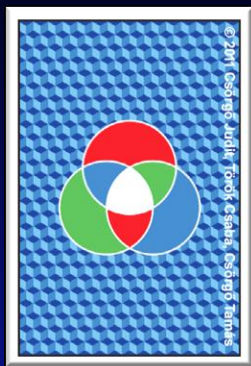
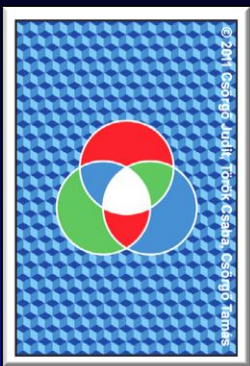
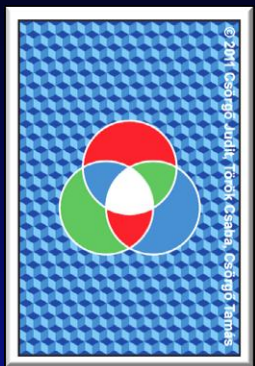


# A KVARKANYAG MEMÓRIÁJA - LEPTONPÁR

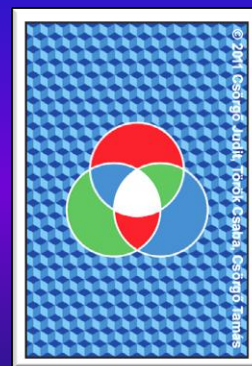
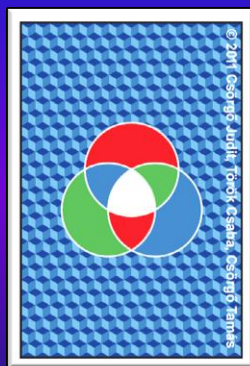
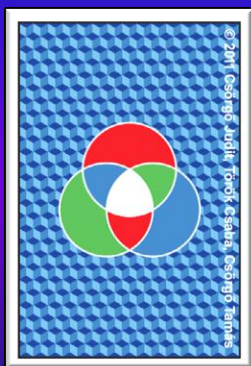
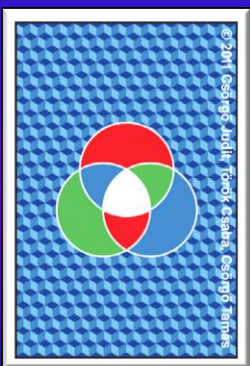
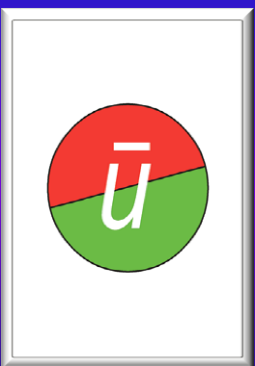
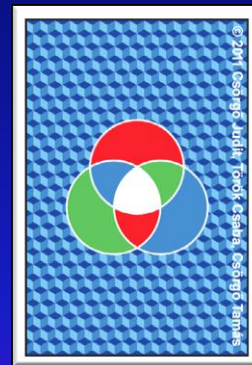
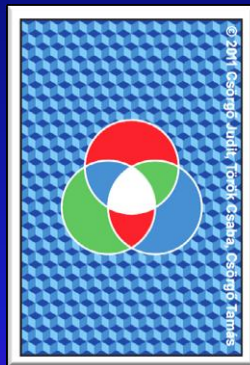
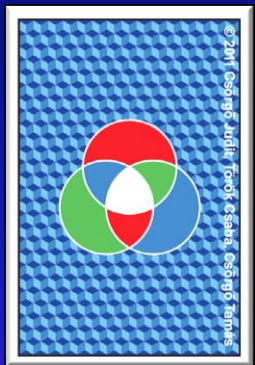
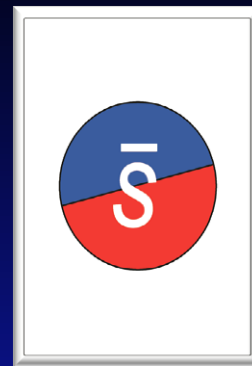
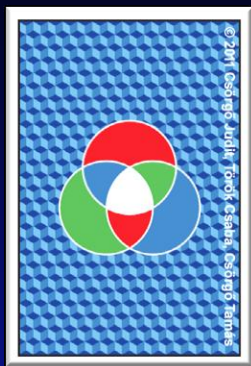
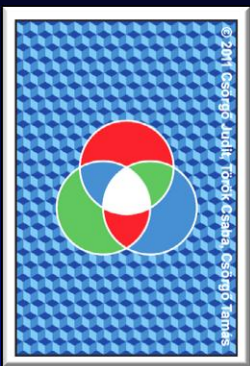
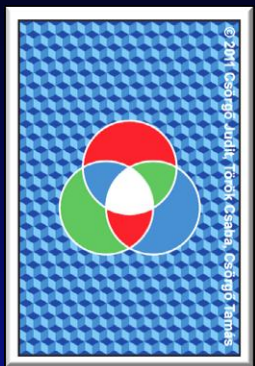


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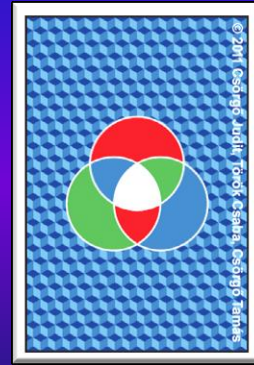
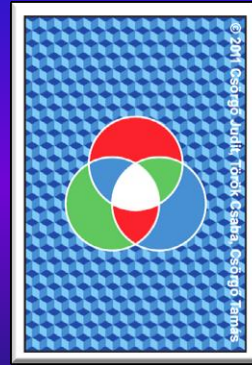
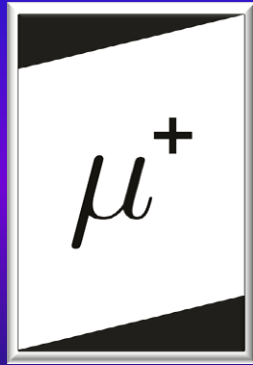
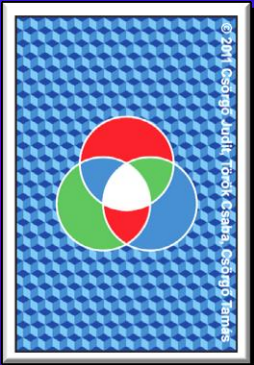
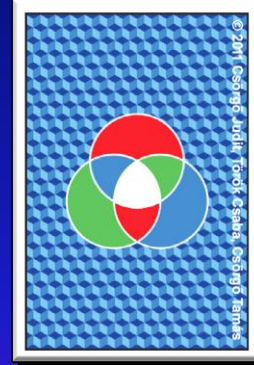
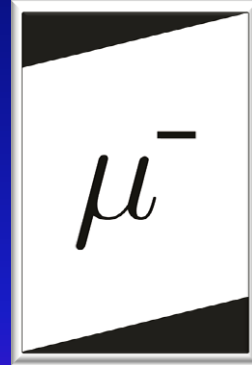
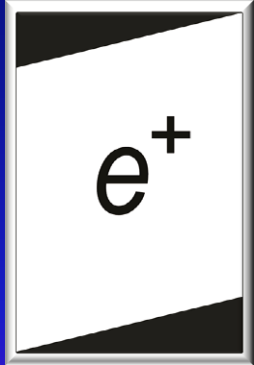
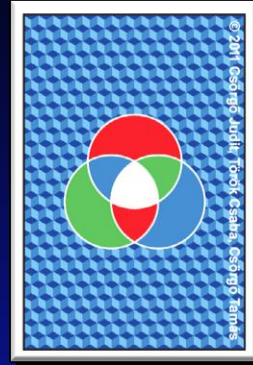
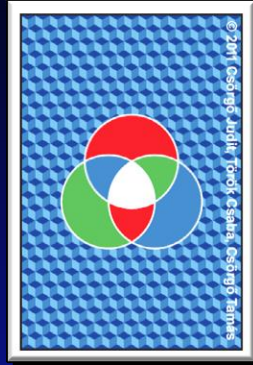
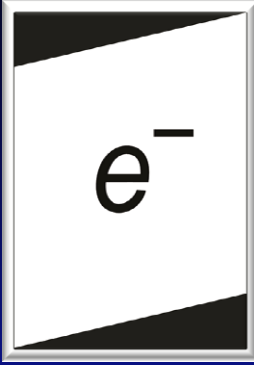
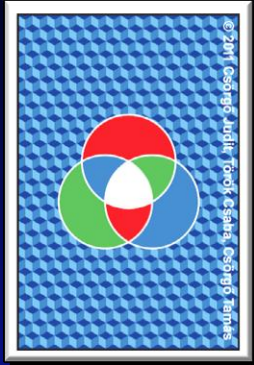

# A KVARKANYAG MEMÓRIÁJA - EGY BARION



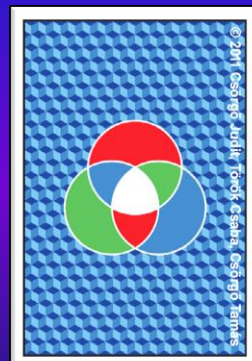
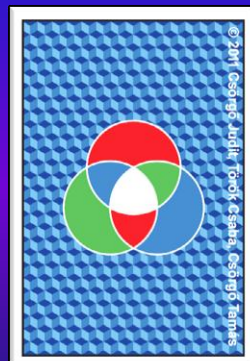
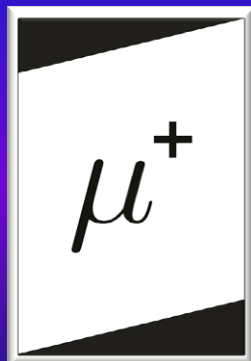
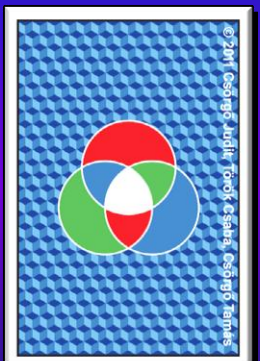
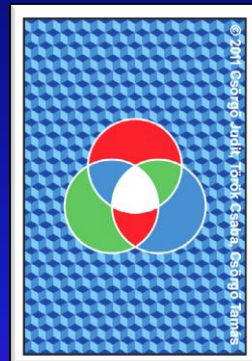
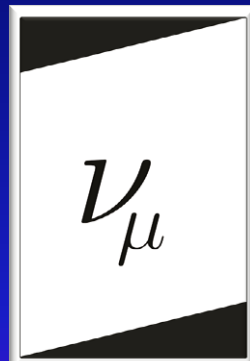
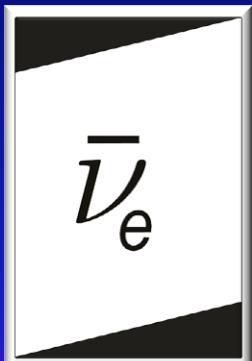
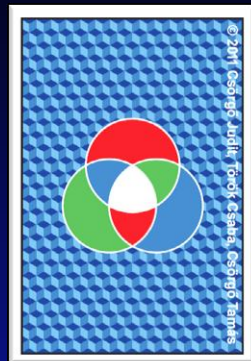
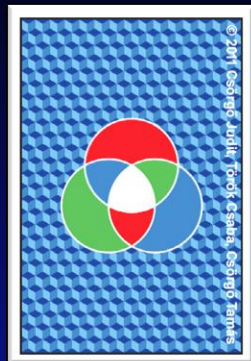
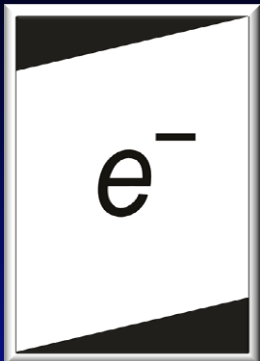
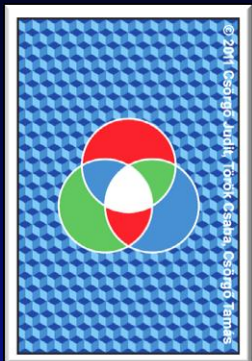
# A KVARKANYAG MEMÓRIÁJA - ANTIBARION



# JÁTÉKOS HIGGS-BOZONT: $H^0 \rightarrow Z^0 Z^0 \rightarrow \ell^+ \ell^- \ell^+ \ell^-$



# JÁTÉKOS HIGGS BOZONT: $H^0 \rightarrow W^+W^- \rightarrow \ell^+\nu \ell \nu$





# ÖSSZEFOGLALÁS

Meet the Scientist – megnyitó előadás

E-könyv, először magyar nyelven

Hamarosan angol változatban is, majd

2. magyar és angol kiadás

Kvarkanyag kártyajáték

Most hozzáadva 2 új játék:

1) Kvarkanyag Memóriája

2) Hogyan csináljunk kártyából

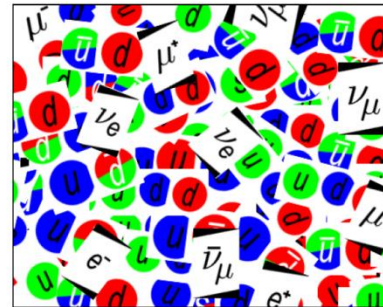
Higgs-bozont?

Részletes magyar [leírás itt letölthető.](#)

Köszönöm a figyelmet!

## QUARK MATTER CARD GAME

ELEMENTARY PARTICLES ON YOUR OWN



Judit Csörgő  
Csaba Török  
Tamás Csörgő