Perfect Fluid of Quarks - 40th of Rubik's Cube

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Csaba Török (17 years old student's) idea: PARTICLES CARD GAME

By now:

invention, patent and product…

66 cards, 4 games:

- ANTI
- Let us detect!
- Quark Matter (BNL)
- Cosmic Showers

1st edition: an e-book for

„Meet the Scientist" opening talk

Hungarian, online available

http://www.lulu.com/

International coverage, some examples

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, a trons, and their neutrinos; and antiparticles for all.

Hungarian high school students Csaba Török and Judit Csörgő inver 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 Relativi (RHIC), PHENIX cards ac

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Quark Matter at RHIC: It's in the Cards

Students and RHIC physicist develop quark-gluon plasma card game

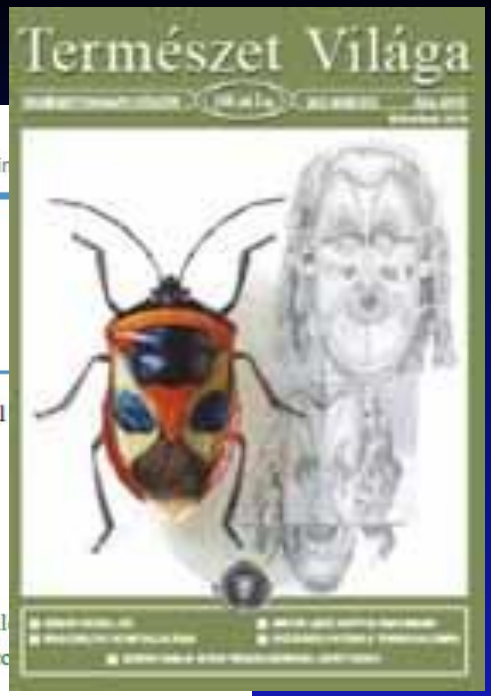
By Karen McNulty Walsh | January 4, 2011

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.

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).

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.

Press coverage, awards, tests



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>> french version

Also in this Issue:

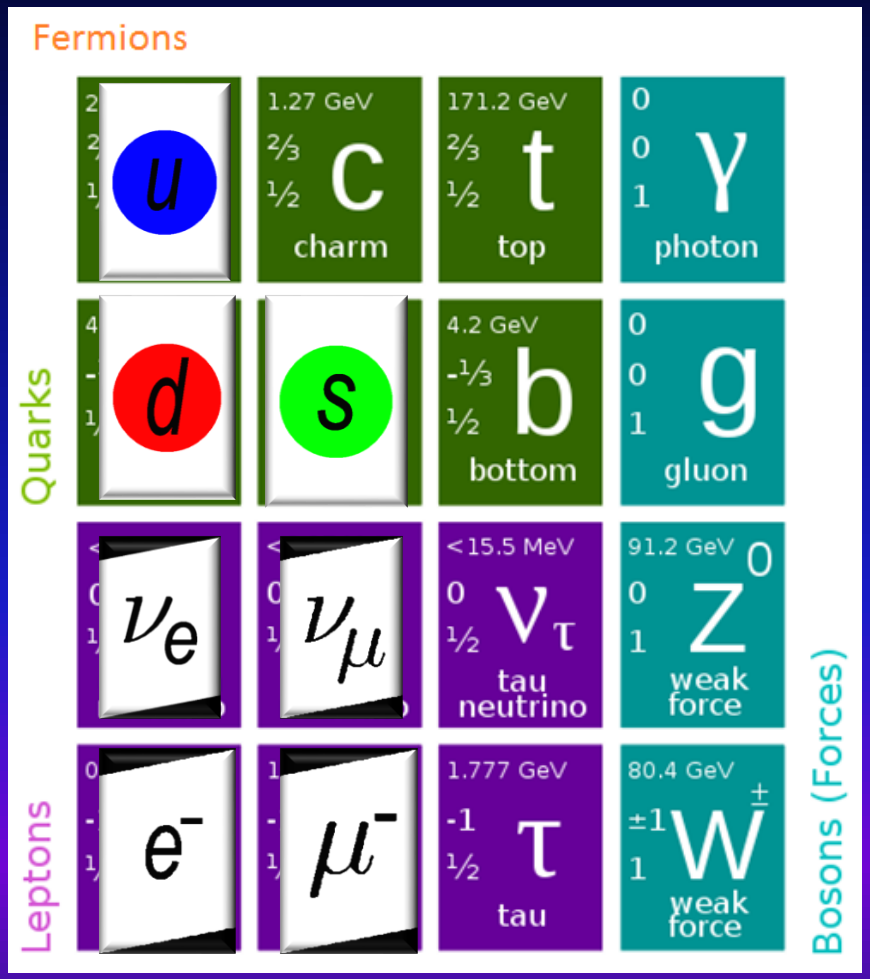
PLAYING WITH PARTICLES

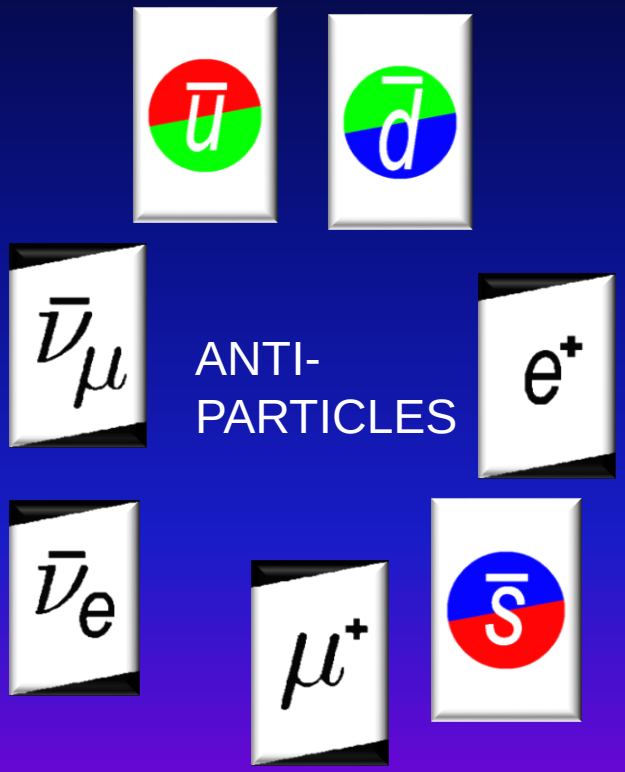
Could the principles of particle physics ever be explained by a game? Coul ever teach the Standard Model the way Monopoly teaches economics? Acc of the Quark Matter card game, the answer is an easy "yes!".

Csaba Török and Judit Csörgő (second and third from left) at the award ceremony for the Eötvös University Innovation Contest.

When he was only 17 years old, Hungarian student Csaba Török came up with the idea for the Quark Matter cards. "I wanted people to think of the Standard Model as fun – not just a serious, scientific theory," says Csaba. "The cards can turn everyone into a pseudo-physicist." He shared the idea with his friend Judit Csörgő and her physicist father, Tamás Csörgő, and together they went on to develop Quark Matter into the game it is today. Csaba and Judit were both members of the Science Club that Tamás re-organized and mentors at the Berze Secondary School in Gyöngyös, Hungary, and they are now both studying science at the ELTE University, Budapest.

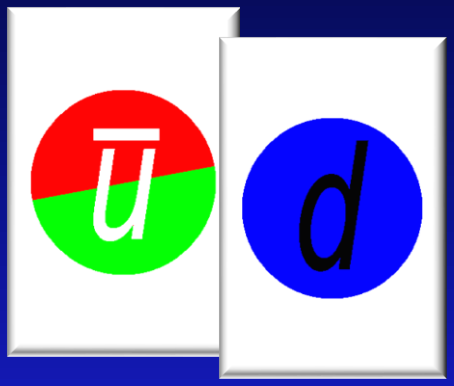
ELEMENTARY PARTICLES - PLAYFULLY

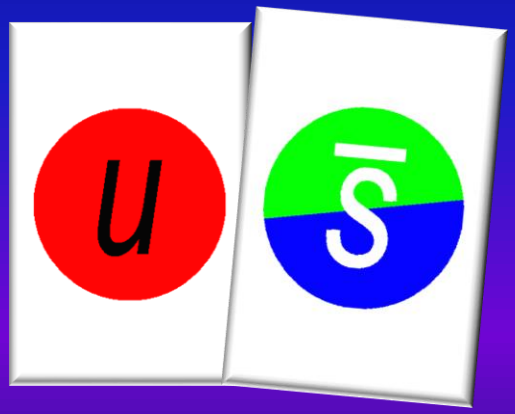




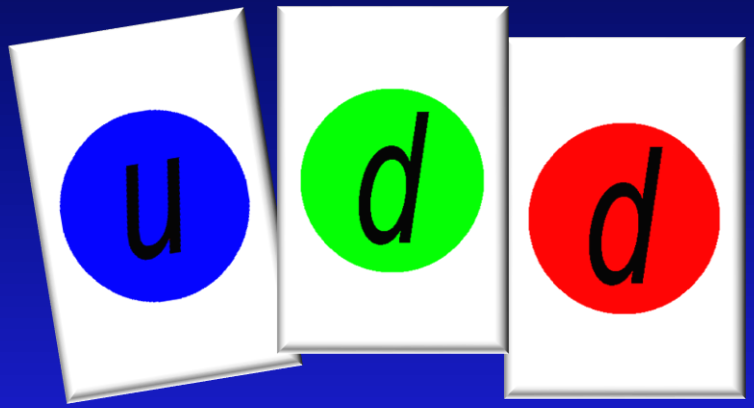
SU(3) COLOR vs OPTICAL COLOR

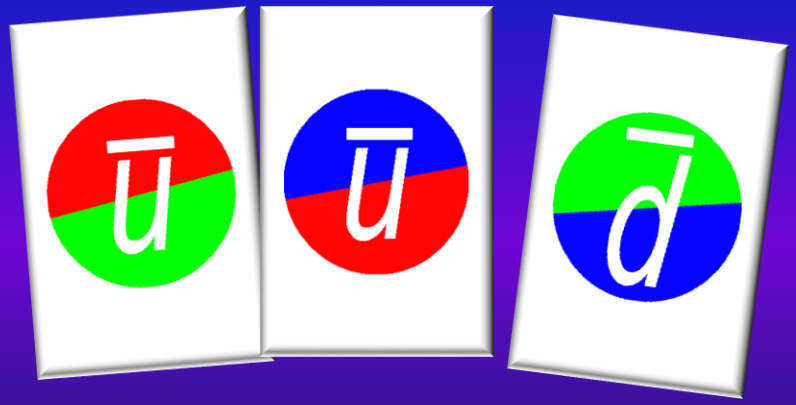
Mesons





Baryons





CARD GAME WITH PARTICLES

66 cards, 4 games:

- ANTI
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Published as an e-book

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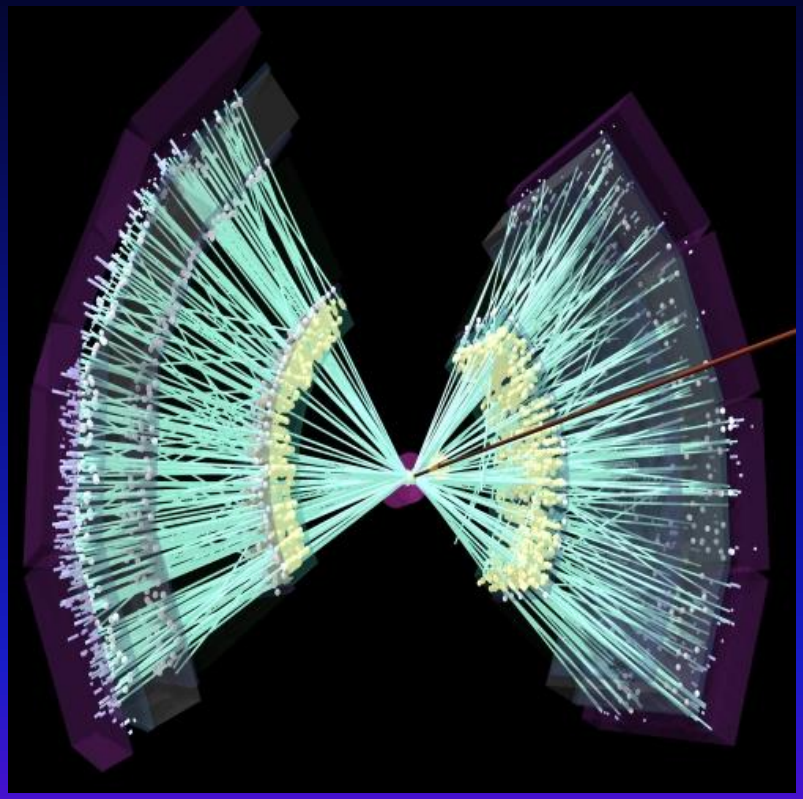
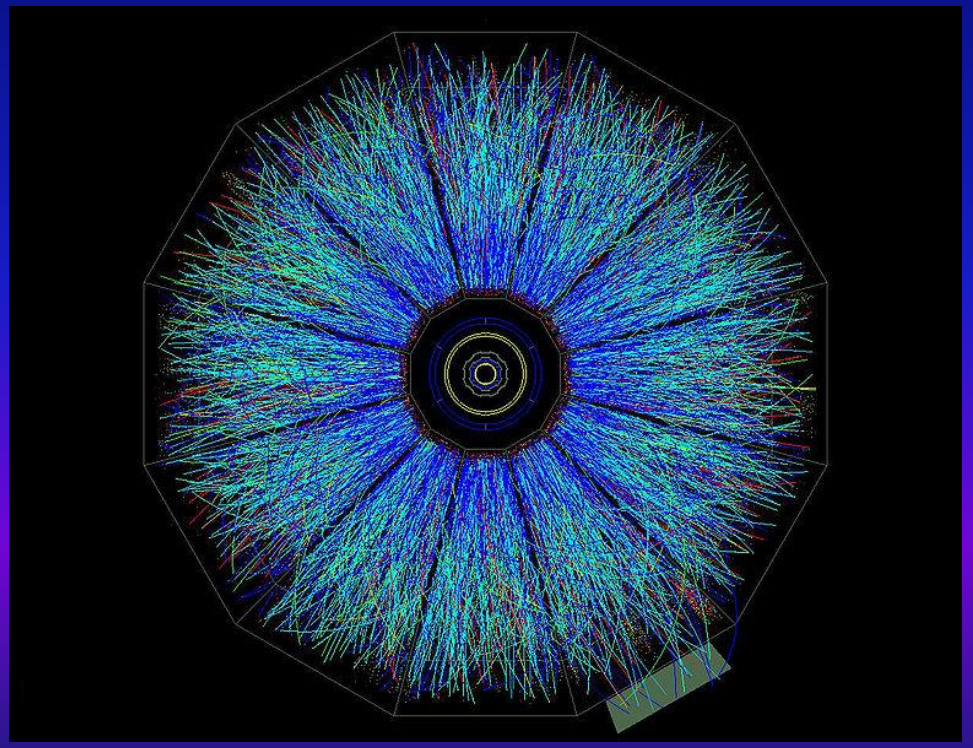
QUARK MATTER - EXPERIMENTALLY

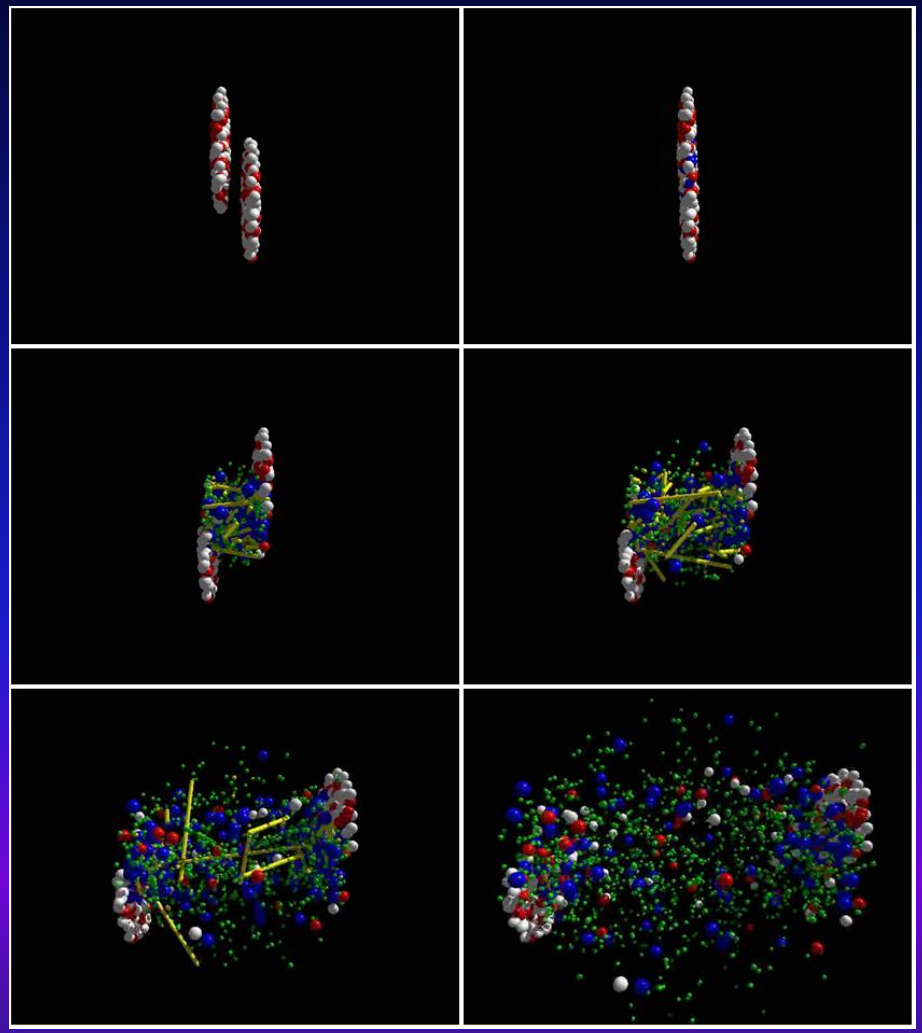


sQGP, the perfect fluid of quarks was discovered in the US in PHENIX and STAR, at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL)



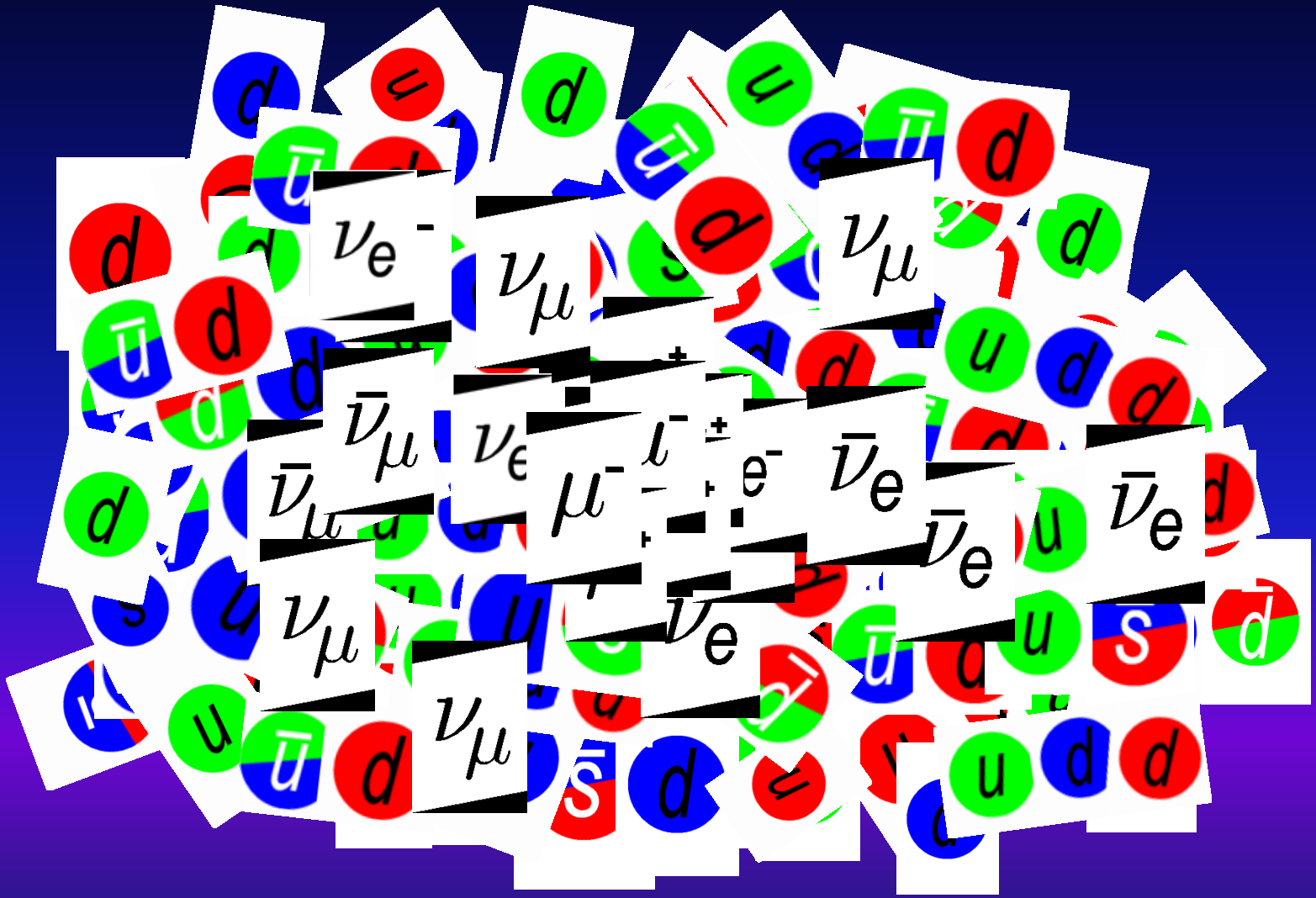
The RHIC discovery of sQGP has been confirmed by the ALICE, ALTAS and CMS experiments at CERN LHC.

QUARK MATTER - THEORETICALLY



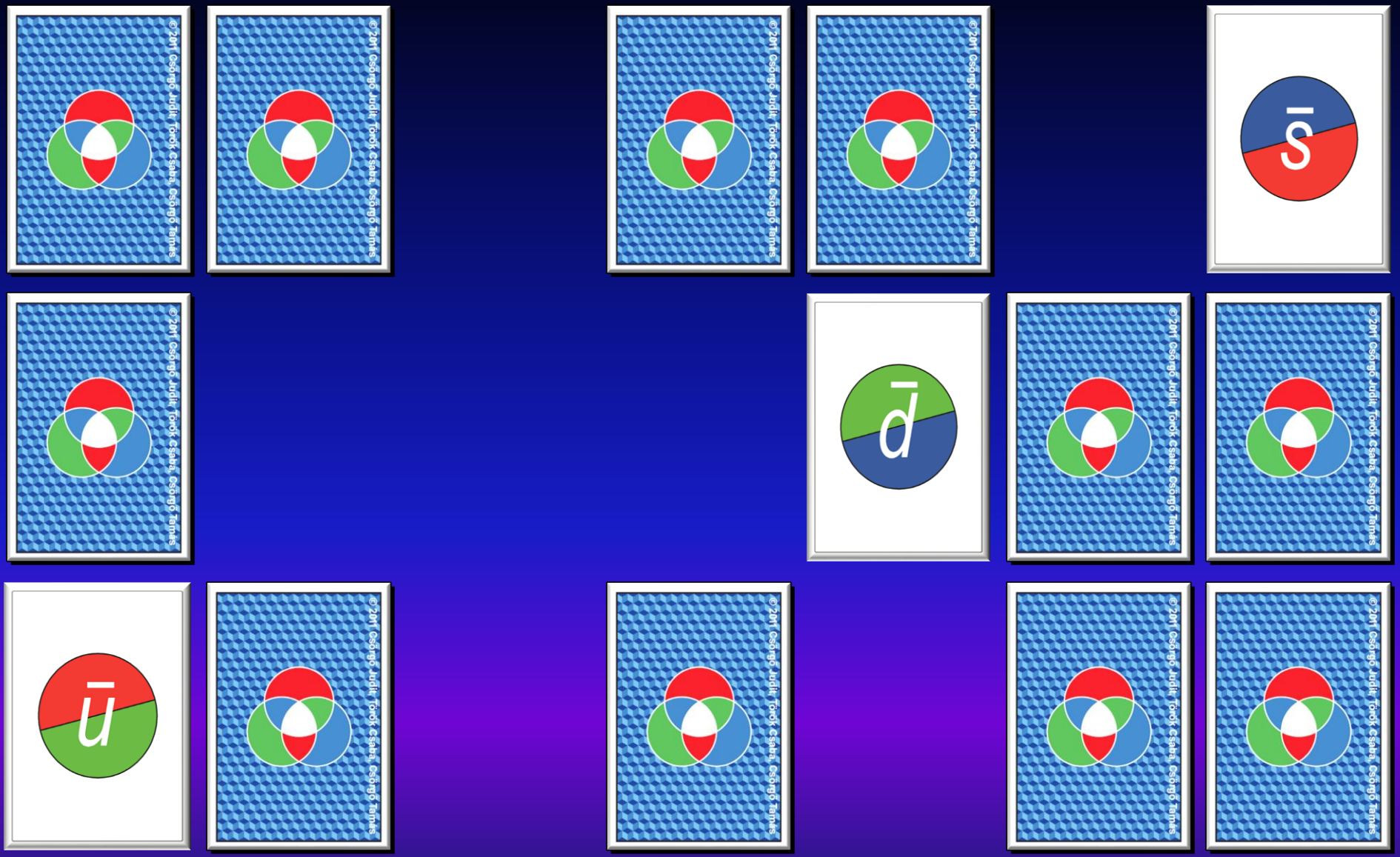
Simulation of Au+Au collisions at RHIC. In energetic collisions of Au ions a strongly interacting quark-gluon plasma is created, with surprising properties: the perfect fluid of quarks was discovered in the US at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL) and confirmed in the ALICE, ATLAS and CMS experiments at LHC (CERN, Geneva, Switzerland).

QUARK MATTER - PLAYFULLY

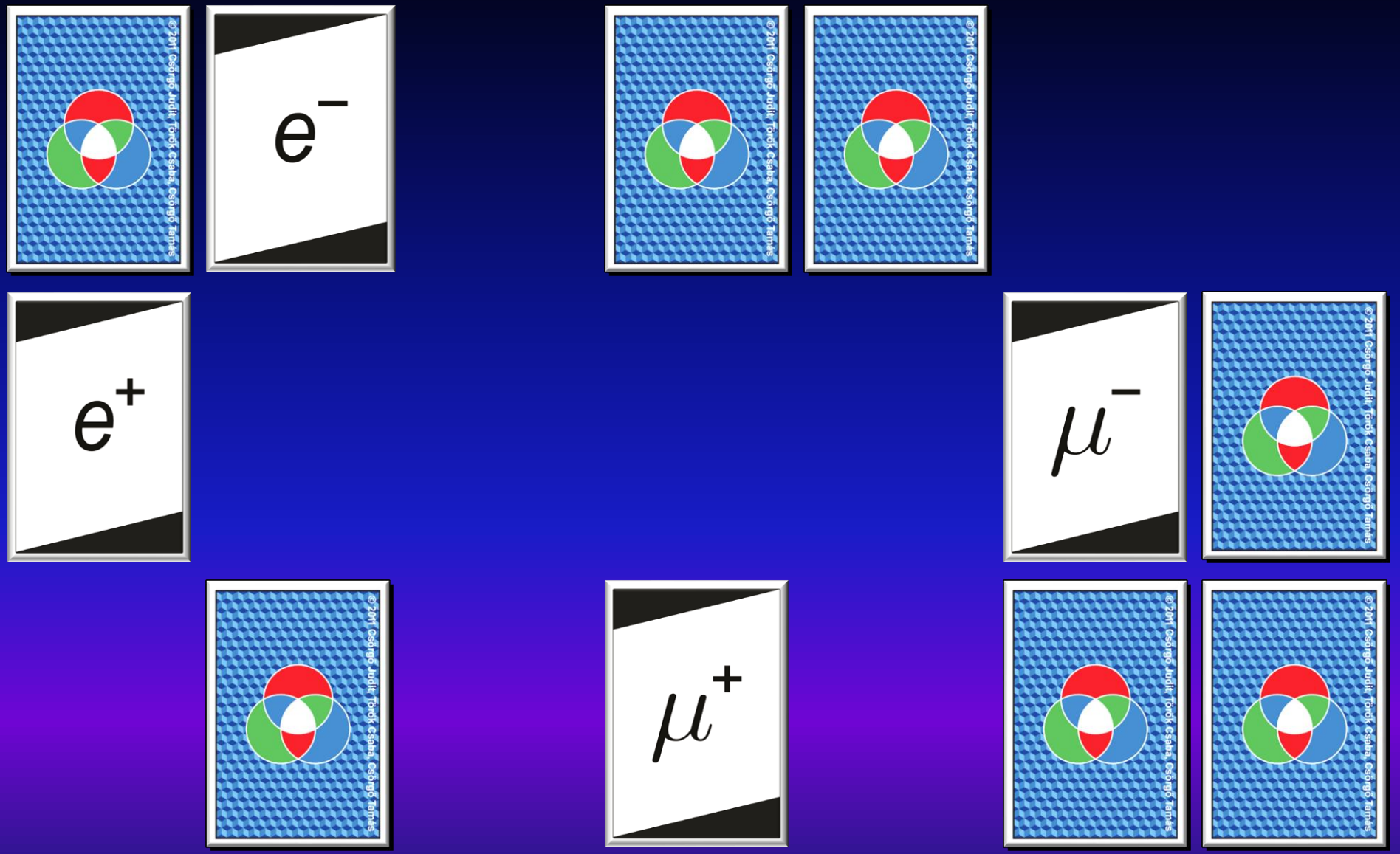


T. Csörgő

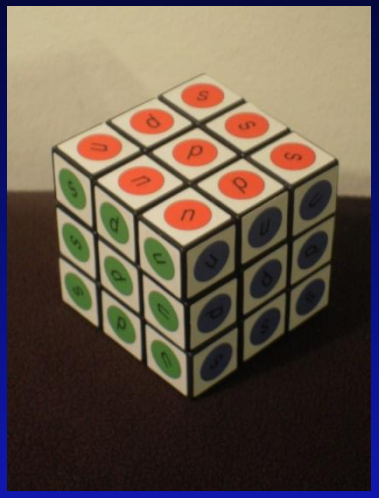
Quark Matter Memory – an antibaryon



Higgs-boson search: $H^0 \rightarrow Z^0Z^0 \rightarrow \ell^+\ell^- \ell^+\ell^-$



QUARK MATTER – PERFECT FLUID CUBE



The RHIC discovery of perfect fluid of quarks impied some features:

- Deconfined colors
- Quarks and Anti-Quarks
- Expands
- Rotates
- Overall, color neutral
- Almost no shear

SUMMARY

1944: E. Rubik was born (70th Anniversary)

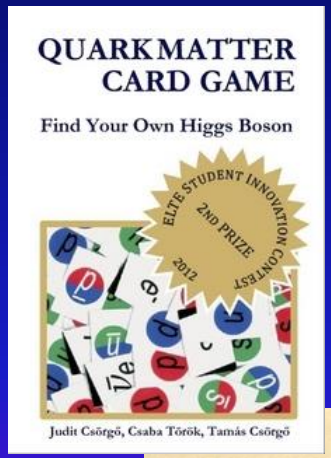
1954: Foundation of CERN (60th Anniversary)

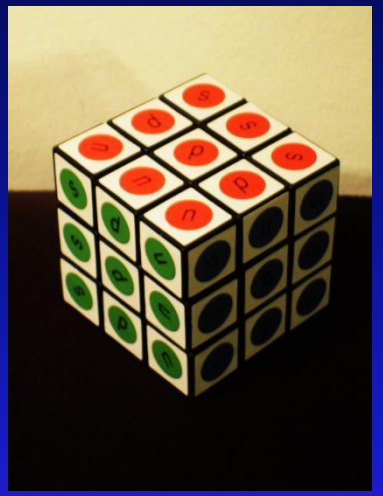
1974: Invention of Rubik's Magic Cube (40th Anniversary)

2004: Perfect Fluid of Quarks discovered at RHIC (10th Anniversary)

2014: Perfect Fluid of Quarks on Rubik's Cube

- Expands
- Flows nearly perfectly
- Color remains deconfined in all states
- Ground state: color-flavor locked





Take a perfect fluid of quarks in your hands, now!

Thank you so much for your attention - and support .