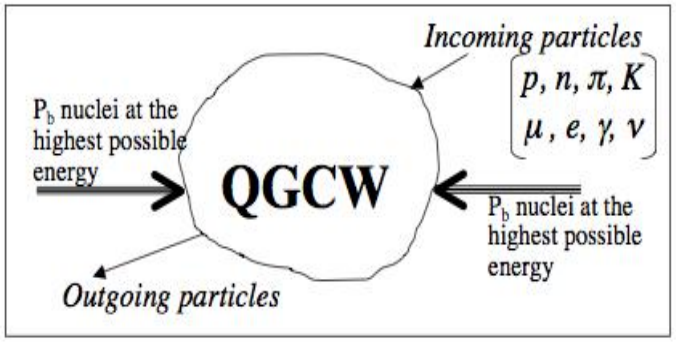
«ETTORE MAJORANA» FOUNDATION AND CENTRE FOR SCIENTIFIC CULTURE
INTERNATIONAL SCHOOL OF SUBNUCLEAR PHYSICS
STATUS OF THEORETICAL UNDERSTANDING AND OF EXPERIMENTAL POWER FOR LHC PHYSICS AND BEYOND
50TH ANNIVERSARY CELEBRATION OF THE QUARK WITH MURRAY GELL-MANN AND GEORGE ZWEIG
ERICE: 24 JUNE – 3 JULY 2014

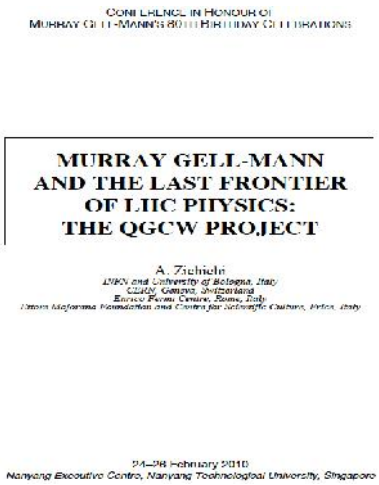
INTERNATIONAL SCHOOL OF SUBNUCLEAR PHYSICS
Talk by Horst WENNINGER
The QGCW Project
Quark-**G**luon-**C**olored-**W**orld

Some 5 years ago, when discussing RHIC heavy ion experiments during the ERICE ISSP, the idea was proposed by Prof. A. Zichichi to study with different particle probes the "Quark–Gluon–Colored–World" (QGCW), which is totally different from our world made of QCD colorless baryons and mesons.

How to study the New World



This idea was further outlined in his contribution paper presented during the 80th birthday celebration for Murray Gell-Mann in Singapore in spring 2010.


CONFERENCE IN HONOUR OF
MURRAY GELL-MANN'S 80TH BIRTHDAY CELEBRATIONS

MURRAY GELL-MANN AND THE LAST FRONTIER OF LHC PHYSICS: THE QGCW PROJECT

A. Zichichi
INFN and University of Bologna, Italy
CERN, Geneva, Switzerland
Enrico Fermi Centre, Rome, Italy
Istituto Mediterraneo Fondazione and Centre for Scientific Culture, Erice, Italy

24–26 February 2010
Nanyang Executive Centre, Nanyang Technological University, Singapore

And then also presented by me during the

INTERNATIONAL SCHOOL OF SUBNUCLEAR PHYSICS
WHAT IS KNOWN AND UNEXPECTED AT LHC
48th Course, ERICE-SICILY: Directors: G. 'T HOOFT - A. ZICHICHI
29 AUGUST - 7 SEPTEMBER 2010

in a talk entitled:

THE QGCW PROJECT:
Technological Challenges to Study the New World
« status report »

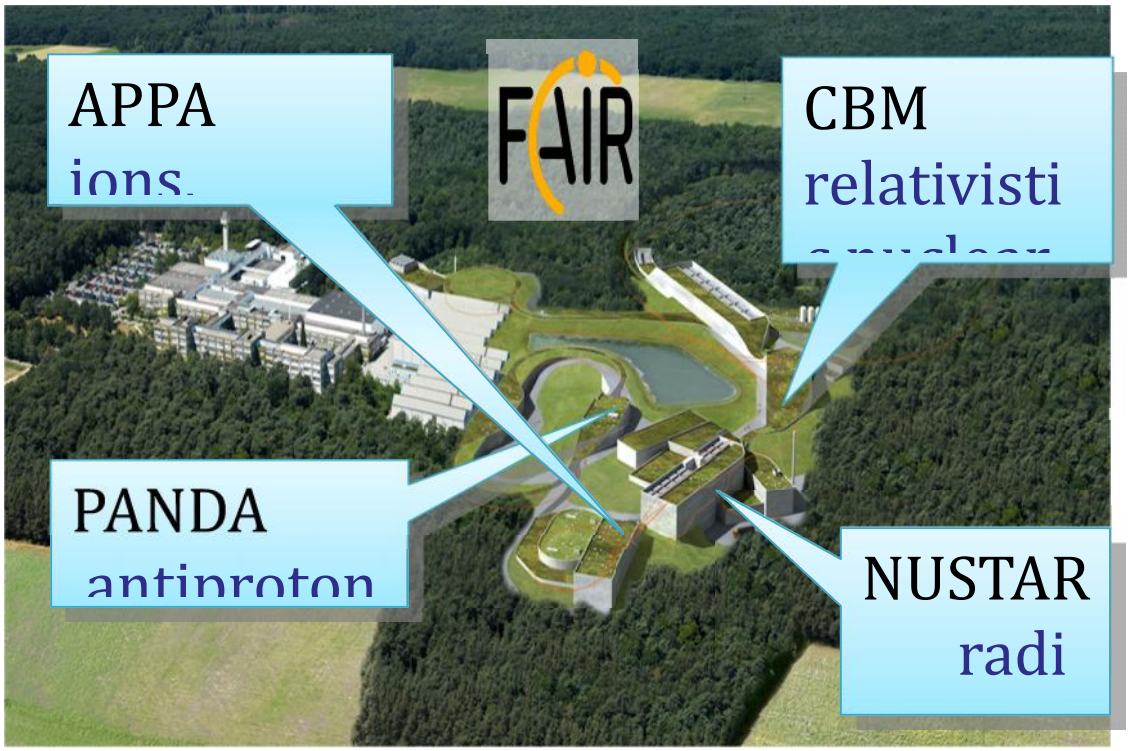
At that occasion I used a slide from **Paul Sorensen (RHIC)** to illustrate different phases and the time scales of heavy ion collisions: order ***10^{-22} – 10^{-24} seconds***.
We then concluded that one might start using probes produced together with the system they probe: i.e.: QCD matter probes such as *jets* and *heavy quarkonia* but in parallel we start a development work at 2 levels on detectors and on beam timing / synchronisation to prepare the future.

Since 2010 the results from RHIC and LHC heavy ion experiments have shown many interesting properties of the QGCW. The important contribution to the results obtained with instruments such as the LAA - MRPC (base of Bologna TOF) – which allowed to measure precisely the properties of sub-nuclear particles coming out from the QGCW in ALICE is shown in slides by Roberto Preghenella from the Centro Fermi – Roma.

While the time-resolution achievable by particle detectors is continuously being improved new development in MRPC technology are looking very promising : now 15ps already achieved, more work has to go into the topic of timing and synchronisation.

Advanced R&D on the topic of beam synchronisation has started also for FAIR (Facility for Antiproton and Ion Research) at GSI. The "Bunch-phase Timing System (BuTiS)" for FAIR concentrates on the research of thermal stability properties of optical fibres. The work is done by the communications institute of TU Darmstadt under contract with GSI. The term "bunch phase" shall emphasize the kind of timing precision that is dealt with in the system.

The FAIR - Facility for Antiproton and Ion Research overview of R&D for the new FAIR detectors and accelerator systems provide also interesting opportunities for young talents of this ISSP school, as it is an international project, co-financed by its member-states. At present a merger of the FAIR project into the GSI laboratory is prepared.



In the following slides I presented the detectors prepared by the 4 communities which will share the beams of the new FAIR laboratory

Final Remarks

- FAIR offers unique opportunities
- The process of building has now been started in a first reduced version offering already a viable program for all four communities

  APPA CBM panda NUSTAR
- Stay tuned! New website: http://www.fair-center.eu/

I end by reminding us of the statement from Prof. A. Zichichi in his OPENING LECTURE:

We should be prepared with powerful experimental instruments, technologically at the frontier of our knowledge, to discover
Totally Unexpected Events