

Physics monitor

Who will succeed in rescuing the quark damsel confined in her tower? Alvaro De Rujula's view of the current scene in particle theory.

QCD roadshow rolls on

Is quantum chromodynamics (QCD) the ultimate theory of hadronic phenomena? Or, put more sceptically, can one tell QCD from a hole in the ground? This is the title of a new theory roadshow, which after a successful premiere at CERN went on to attract a large audience at Erice, Sicily, during the recent international school of subnuclear physics.

Conceived, written and directed by Alvaro De Rujula, John Ellis, Roberto Petronzio, Giuliano Preparata and Bill Scott and presented by Mary K. Gaillard, the spectacular — a drama in five acts — covers the development and present status of our understanding (if at all) of deep hadronic structure.

The plot involves a new religion (Quod Cern Demonstraturum) attempting to impose itself upon an imaginary world. Its proponents and defenders struggle to decide whether QCD describes reality, whether it can be proved that it does so, and whether its much-publicized 'miracles' are fake.

The characters are: The Ayatellis (played by himself) — a prophet of QCD who, as if by divine inspiration, knows the ultimate truth all the time; Biscotte (alias experimentalist Bill Scott) — a sorcerer's apprentice in the form of a Deus ex (400 GeV) machina who performs the prodigious feats which prove the prophet's most recent truth; De Oracle (played by himself) — interpreter of the dogma and arbiter of the tournaments, who preaches to the masses and predicts the past; Giuliano Bruno (played by himself) — a heretic who castigates QCD and harasses its blind followers; Pestilonzio (also played by himself) — an infidel and devil's advocate who



attempts to undermine QCD from within.

The Ayatellis wears a coat of many colours and a peculiar hat. He carries with him a small bell, which he rings to herald his many important pronouncements. Biscotte is armed with a large briefcase containing much computer output together with transparencies and a hand calculator. During the play, he is kept busy displaying experimental evi-

dence. De Oracle wears what appears to be a torn sheet and seats himself behind a large sign 'Theatrical Division'.

Giuliano Bruno wears a conical hat labelled 'light cone' which has 'future' inscribed on the front and 'past' on the back. Pestilonzio has horns on his head and wears a black cape from which emerges a long black tail. He carries a multicoloured pitchfork.

The quantum chromodynamics prophet Ayatellis (alias John Ellis) preaches to the masses. The other characters in the divertissement are (left to right), the experimentalist (played by Bill Scott), the heretic (Giuliano Preparata), the infidel (Roberto Petronzio) and the oracle (Alvaro De Rújula).

(Photo CERN 296.6.79)



The action begins at the 'dawn of prehistory', way back in 1967 when a great prophet in the West, after meditating for many days in the wilderness of Palo Alto, revealed the deep inelastic truth.

It is prophesied that hadrons undergoing deep inelastic scattering appear to behave like bundles of free particles, called partons. Thus under these conditions, strong interactions are solved — they simply do not exist! How can this paradoxical result be reconciled with a field theory of hadron constituents?

Scene Two marks the Coming of Gauge, when new prophets arise who show how field theory can be reincarnated, the trick being to disregard conventional Abelian principles and go non-Abelian instead. This is hardly surprising as apparently the original Abelians were an ascetic sect who practised chastity after marriage and therefore died out.

In response to objections from the heretic, the prophet then embarks on a quest for the 'Wholly Scaling Variable' which takes account of the finiteness of the nucleon mass and other complications. This enables dramatic new tests to be made which purport to demonstrate the power of QCD, but there is heated debate as to whether the experimental data is evidence for or against QCD.

'Are moments magic?' is the title of the fourth act where the latest experimental data comes under further scrutiny. Telegrams arrive from far and wide pointing out that QCD predictions can be reproduced by more general arguments or that the experiments have the wrong kinematics.

No matter what evidence or argument is put forward, the Ayatellis skilfully manages to manipulate it to work in his favour. On the other hand,

the long-suffering heretic claims to have been vindicated, but gloomily assumes the QCD proponents will continue to deny the facts and 'twist' their theory to fake the right answer. If only they would stop burning their opponents at the stake!

The play comes to an end with the question still in doubt, but nevertheless there is a happy ending because all the characters are happy. The Ayatellis, convinced that QCD cannot be questioned, goes on to more exotic pastures. Pestilonzio says that the QCD proponents are following the correct path, despite having jumped to too many conclusions in the past. De Oracle holds that quantitative QCD is in its infancy and there is lots of work to keep everyone busy. The heretic, having dissociated himself from the QCD throng, is happily gathering experimental evidence to support his ideas, and the experimentalist is already working on his next project.

Mathematics and Physics in Lausanne



Physics has always needed mathematics to find solutions to its problems, and conversely, the most fruitful stimulus for mathematics has been the need for new tools to handle physical problems. A good example was the birth of quantum mechanics, when the theory of partial differential equations and of Hilbert spaces provided essential tools for physicists, and where mathematicians were led by the needs of physics to develop certain noncommuting algebras (Von Neumann algebras).