

A portrait of John Ellis, an older man with a grey beard and balding head, wearing a light-colored checkered shirt. He is smiling slightly and looking towards the camera. The background is a blurred green outdoor setting.

Remembering Graham

Vision & generosity

From “Brain universality” to the brane universe

John Ellis

KING'S
College
LONDON

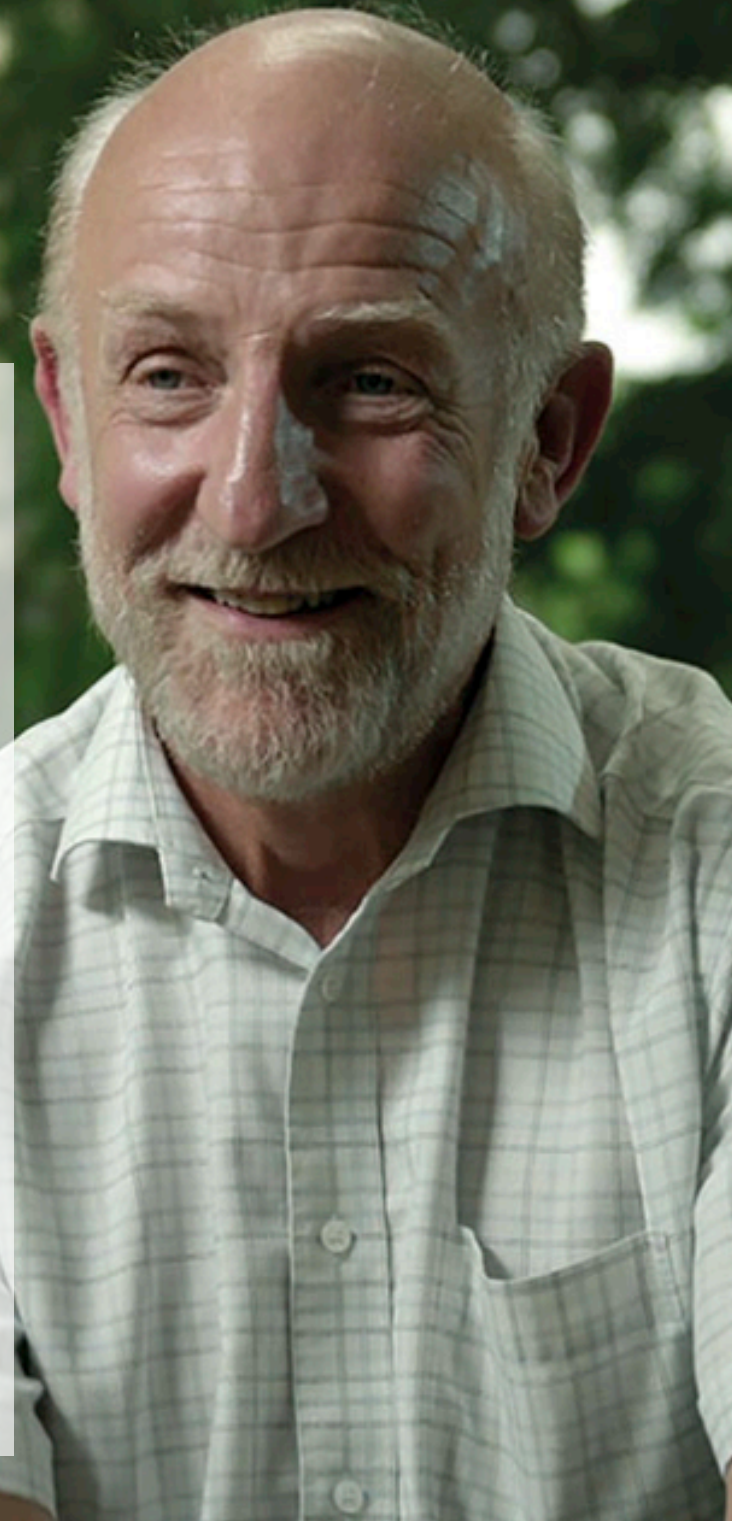
Early Days

- Strong interactions in Durham (P.D.B. Collins, Bob Johnson, Alan Martin, Ewan Squires)
- Early adopter of gauge theories at the Rutherford Lab (David Bailin, Alex Love, Dimitri Nanopoulos, David Politzer, R.K.P Zia)

Caught my interest!

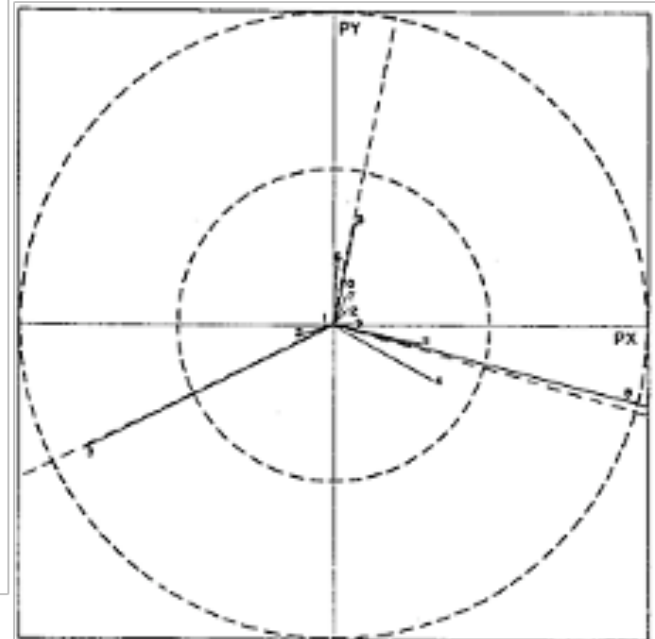
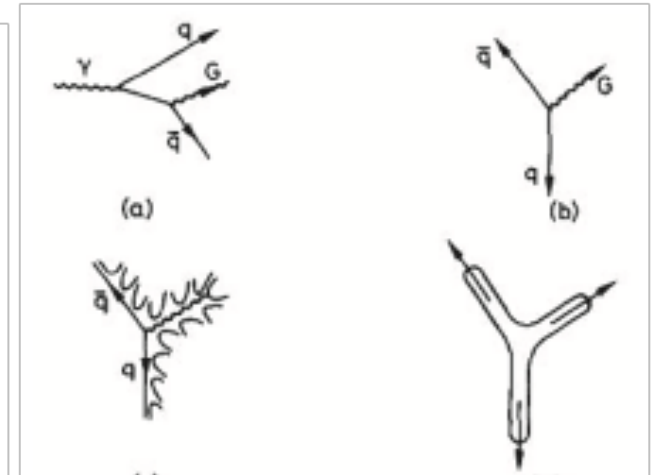
- More gauge theories as Fellow at CERN (M.A. Ahmed, G.V. Dass)

Came to know each other and became friends



The Discovery of the Gluon

- 1976: Gluon widely thought to exist
- No direct proof
- Graham, Mary Gaillard and I suggested discovery method
- Radiation of gluon by quark
- Discovered at DESY laboratory in Hamburg in 1979
- **Second force particle discovered**



Our Other Joint Papers

A Quest for a Wholly Scaling Variable (Riccardo Barbieri, Mary Gaillard)

Mass Corrections to Scaling in Deep Inelastic Processes (Riccardo Barbieri, Mary Gaillard)

Grand Unification with Large Supersymmetry Breaking (Luis Ibáñez)

Will the Universe Become Supersymmetric? (Chris Llewellyn Smith)

Low-Energy Phenomenology of Broken Supersymmetry (Graciela Gemini, Cecilia Jarlskog, Jose Valle)

Supersymmetric Grand Unification (Luis Ibáñez)

Phenomenology of Supersymmetry with Broken R Parity

Can one Probe the Structure Function of the Pomeron?

Hierarchy of R-Violating Interactions from Family Symmetries (Magda Lola)

Probing the Structure of the Pomeron (Jenny Williams)



The QCD Parton Model

- Caltech, 1978
- Basis in perturbative QCD for all calculations of hard scattering processes at the LHC



Physics Letters B
Volume 78, Issues 2-3, 25 September 1978, Pages 281-284



Factorization and the parton model in QCD

R.Keith Ellis ^{1,*}, Howard Georgi ^{2,*}, Marie Machacek ^{2,*}, H.David Politzer ^{3,*}, Graham G. Ross ^{3,*}

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[https://doi.org/10.1016/0370-2693\(78\)90023-0](https://doi.org/10.1016/0370-2693(78)90023-0)

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Abstract

We argue that mass-singularities of inclusive cross sections in QCD factor to all orders in perturbation theory as required for a parton model interpretation.



Nuclear Physics B
Volume 152, Issue 2, 28 May 1979, Pages 285-329



Perturbation theory and the parton model in QCD

R.Keith Ellis ^{*}, Howard Georgi ^{†, **}, Marie Machacek [‡], H.David Politzer ^{** ††}, Graham G. Ross ^{‡‡, ***}

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[https://doi.org/10.1016/0550-3213\(79\)90105-6](https://doi.org/10.1016/0550-3213(79)90105-6)

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Abstract

We prove that for any process which admits a parton-model interpretation, the naive parton model can be modified to include the effects of QCD interactions to all orders in perturbation theory. This requires that the mass singularities in quark and gluon inclusive cross sections factor into universal functions which renormalize the naive parton model distribution and decay functions. We prove that this factorization takes place for all leading and non-leading logs and thus check consistency of the parton model to all orders in perturbation theory.

Supersymmetric GUTs

- Oxford 1981/2
- Supersymmetric GUT prediction for $\sin^2 \theta_W$, excellent agreement with later LEP measurement
circumstantial evidence for SUSY
- Radiative corrections in SUSY GUT as dynamical mechanism for electroweak symmetry breaking



Low-energy predictions in supersymmetric grand unified theories

L.E. Ibáñez, G.G. Ross

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[https://doi.org/10.1016/0370-2693\(81\)91200-4](https://doi.org/10.1016/0370-2693(81)91200-4)

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Abstract

Globally supersymmetric theories provide a solution to the gauge hierarchy problem without the need for a strongly interacting sector. We consider various such theories which generalise the standard $SU(3) \times SU(2) \times U(1)$ model and compute their predictions for the unification scale M_X , $\sin^2 \theta_W$ and fermion mass ratios.



$SU(2)_L \times U(1)$ symmetry breaking as a radiative effect of supersymmetry breaking in GUTs

Luis Ibáñez¹, Graham G. Ross²

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[https://doi.org/10.1016/0370-2693\(82\)91239-4](https://doi.org/10.1016/0370-2693(82)91239-4)

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Abstract

It is shown how in a globally supersymmetric $SU(3) \times SU(2) \times U(1)$ model supersymmetry breaking can, via radiative corrections, induce an effective Higgs potential which spontaneously breaks $SU(2) \times U(1)_Q$. We discuss the spectrum of the resulting theory particularly the many new fermions and scalar particles which should be produced by the next generation of accelerator. The inclusion of the model in supersymmetric GUTs is considered and a model is constructed in which no unnatural adjustment of parameters is required.

String Phenomenology

- Oxford, 1986
- Pioneering construction of a (semi-)realistic model based on string compactification
- Showed the way for others to follow



Physics Letters B

Volume 180, Issues 1–2, 6 November 1986, Pages 69–76



A superstring-inspired standard model

Brian R. Greene^{1, *}, Kelley H. Kirklin^{1, *}, Paul J. Miron^{*}, Graham G. Ross^{*}

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[https://doi.org/10.1016/0370-2693\(86\)90137-1](https://doi.org/10.1016/0370-2693(86)90137-1)

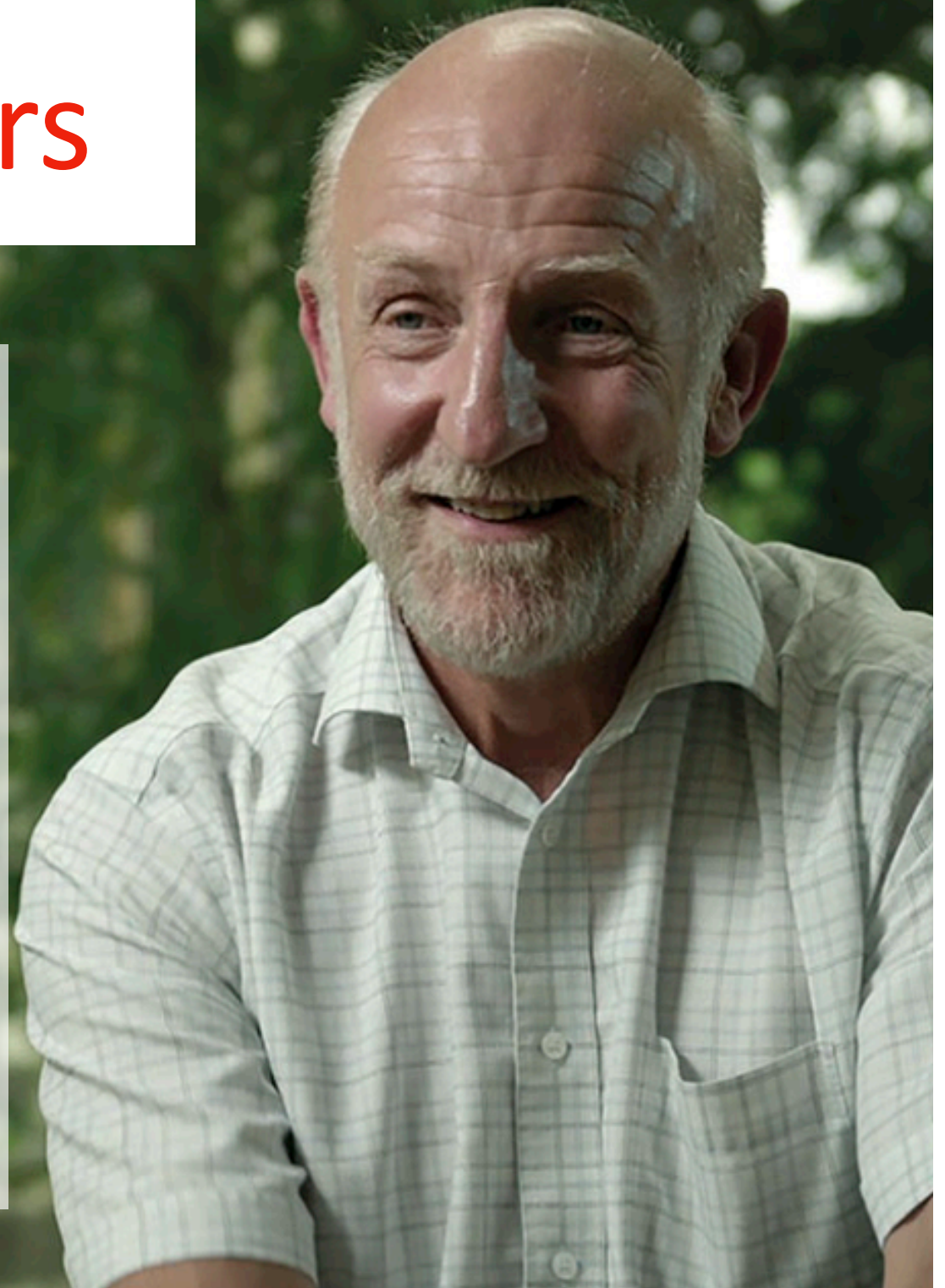
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Abstract

An analysis is presented of an $E_8 \otimes E_8$ superstring-inspired ten-dimensional supergravity model following from compactification on a particular Calabi-Yau manifold which gives rise to three generations. The multiplet structure and discrete symmetries after compactification are determined. It is shown that the model has flat directions which allow for breaking of the gauge group to the standard $SU(3) \otimes SU(2) \otimes U(1)$ model at a high scale. The resulting low-energy theory has a realistic spectrum and, remarkably, the discrete symmetries predict a reasonable structure for the Kobayashi-Maskawa mixing matrix. Without unnatural adjustments, proton decay is inhibited and neutrino masses consistent with experimental limits are obtained.

Many others

- EMC effect
- Supersymmetric inflation
- Fermion masses
- Brane universes
- Polonyi problem
- Infrared fixed point
-

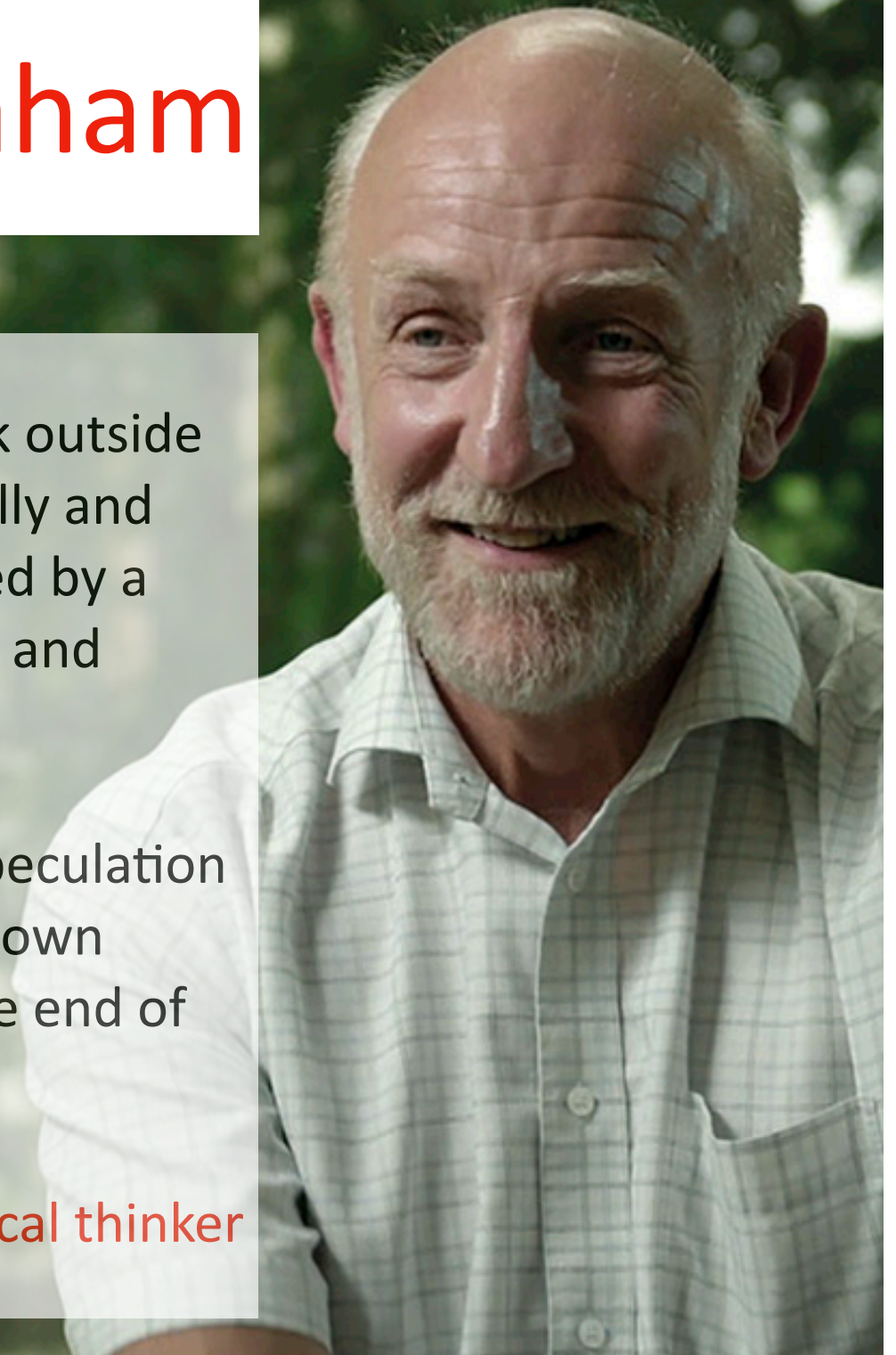


Remembering Graham

Graham had a remarkable ability to think outside the box, and to analyse new ideas critically and systematically. His work was characterised by a combination of deep thought, originality and careful analysis.

He was never interested in theoretical speculation or mathematical developments for their own sakes, but as means towards the ultimate end of understanding nature.

Graham was a deeply original, yet practical thinker



Remembering Graham

Many theoretical physicists are competitive and pursue their ambitions aggressively. But this was not Graham's way. Pursuing his ambitions with persistence and good humour, he was greatly admired as a talented physicist but also universally liked and admired, particularly by the many younger physicists whom he mentored at Oxford.

He was a great teacher and an inspiration, not just to his formal students but also his daughters, Gilly and Emma, and latterly his grandchildren, James, Charlie and Wilfie.

We remember Graham with warmth and gratitude

