Selling Particle Physics to The Treasury

Mark Lancaster - UCL

Doing nothing is not an option

STFC's slice of the RCUK pot diminished in CSR07.

"It's all very well to demonstrate that we can land a craft on Mars, it's all very well to discover whether or not there is a Higgs boson; but I would just suggest that we need to pull people towards perhaps the bigger challenges where the outcome for our civilisation is really crucial."

"What if Tim Berners Lee had been working in a solar power laboratory? Perhaps he would have done it there as well. The spin-out would have come from the brilliant individual."

Doing nothing is not an option

Government message deliberately mixed but the intention is clear.

"But, of course, any research base which does not include a substantial element of fundamental, curiosity-driven research conducted by researchers who simply want to know, will not be relevant economically in anything but the shortest of terms.

Knowledge for knowledge's sake is also well worth having…

While the driver of fundamental research is curiosity, we shouldn't, though, lose interest in its links with economic value."

Doing nothing is not an option

"We can't give a little bit to everybody, that would be a derogation of duty. We have got to make hard choices….."

"…. This [economic impact] is a way of informing what will be funded."

"In part it means undertaking the fundamental research which will inform our responses. But it's more than that….."

John Denham
Feb/Mar 2009

Doing Nothing Isn't An Option

"It can't be right to expect billions of pounds of funding and then systematically deny the taxpayer any insight into its potential applications to the economy, public policy or popular understanding.."

Labour

Cons.

"but scientists themselves were not the most helpful in persuading my fellow ministers. Scientists thought it was self-evident that they should remain immune to cuts, but too often failed to articulate how they could help the community through tough times. I accused one organization of "whingeing" on public radio, as that is how it sounded."

"creation of a powerful Innovative Projects Agency (IPA) alongside the Research Councils to refocus spending on innovation into areas of national interest ….
The IPA would recognize that good work comes not just from university labs but from industry too and would encourage collaboration and creative engineering.

This would mean a radical shift in the government approach to science funding…"

Cons.

So Economic Impact

"It is difficult to measure the economic impact of innovations which may be delayed in time and indirect in consequence. It is important to measure outcomes, however difficult, rather than outputs."

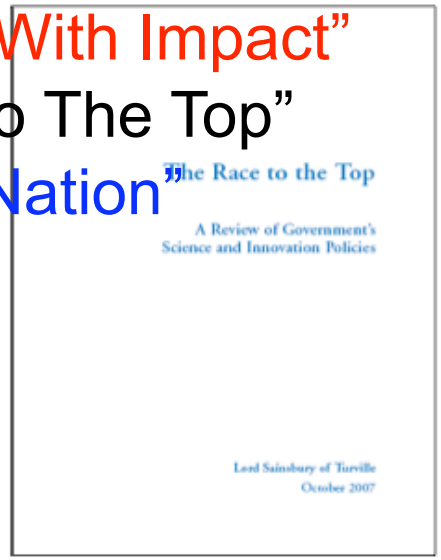
RCUK

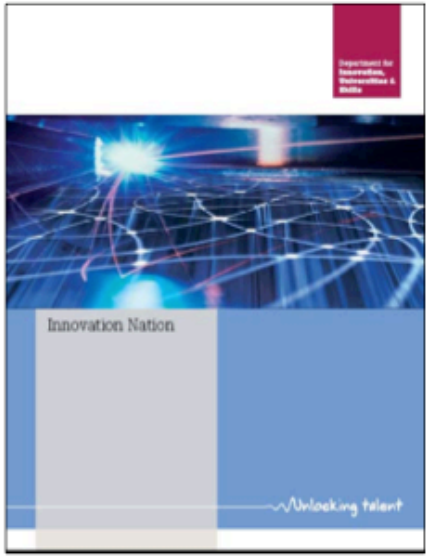
2006 – Warry Report has spawned buzzword bingo, revenue to highly-paid consultants.

"Excellence With Impact"

"The Race To The Top"

"Innovation Nation"





Economic Impact So Far …

There have and are now quite a few projects going on in the EI area.

But there has not been a sophisticated EI study for PP since some CERN studies in the mid-1980s.

We can't be complacent in PP and assume that someone is doing this for us and that the case will be unambiguously made for PP.

IoP HEP Group Started Some Work

PP2020 KE Group

Phil Allport	Detector Development (Liverpool)
Barbara Camanzi	Cancer Therapy (RAL PPD)
Mike Poole	Director ASTeC (Accelerator Science) STFC
Tim Short	Ex-Particle Physicist (Banker)
Marcus French	Head of RAL Microelectronics STFC
Jason McFall	Ex-Particle Physicist (Computing)
Val O'Shea	Detector Development (Glasgow)
Steve Lloyd	e-Science (QMUL)
Stephen Watts	Detector Development (Manchester)
Mark Lancaster	ex-officio from PP220 Science (UCL)

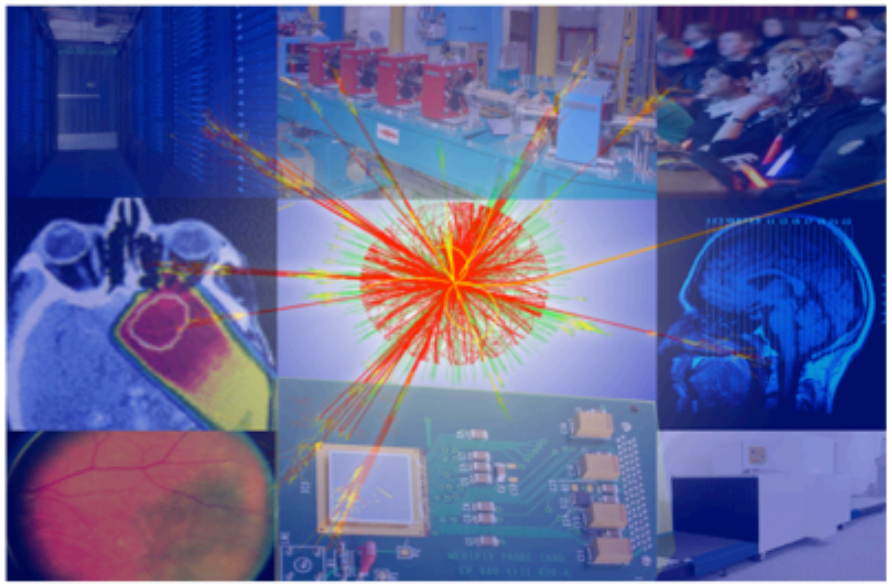
Outputs

FUNDAMENTAL IMPACTS

A Study of the Cross-Discipline and Societal Benefits of UK Research in Particle Physics

Institute *of* **Physics**

High Energy Particle Physics Group



30 page document to Wakeham Panel

http://www.pp2020.info

8 page + then 2 page glossy in production with IoP

Lessons we learnt are the same as everyone else

- Anecdotal evidence and quotes are relatively easy to get
- We now have a network of contacts, list of spin-offs information but no sophisticated EI analysis (apart from UG survey).

- Consultants are expensive ….

- We've been advised that a positive outcome EI study which isn't rigorous, expert, and independent is worse than a robust one with a "negative" outcome.

- We should employ (academic) economists, sociologists science policy scholars & historians who've the tools & credibility to help.

- Found in universities and were cheap pre-fEC

Different Aspects to EI

Cultural Benefits

"It has no security benefit except to make the country worth defending" - R. Wilson

Education Training

UK needs a 30% uplift in STEM graduates in next 5 years to retain economic competitiveness

There is no Knowledge Exchange without knowledge

Technological Innovation Enhancing Industrial Capability

Not one single argument will win the day – need all three.

Arguments from 2008…..

We provide a lot of bankers ….

We have employed a number of PhDs in particle physics at aAIM and we have found them to be highly flexible and numerate, with an analytic mindset and the type of international experience which enables them to make a significant contribution very quickly. We would definitely like to see more people with this background becoming available for employment in the City."
Mark Tagliaferri – Chairmna aAIM Group

From The Times

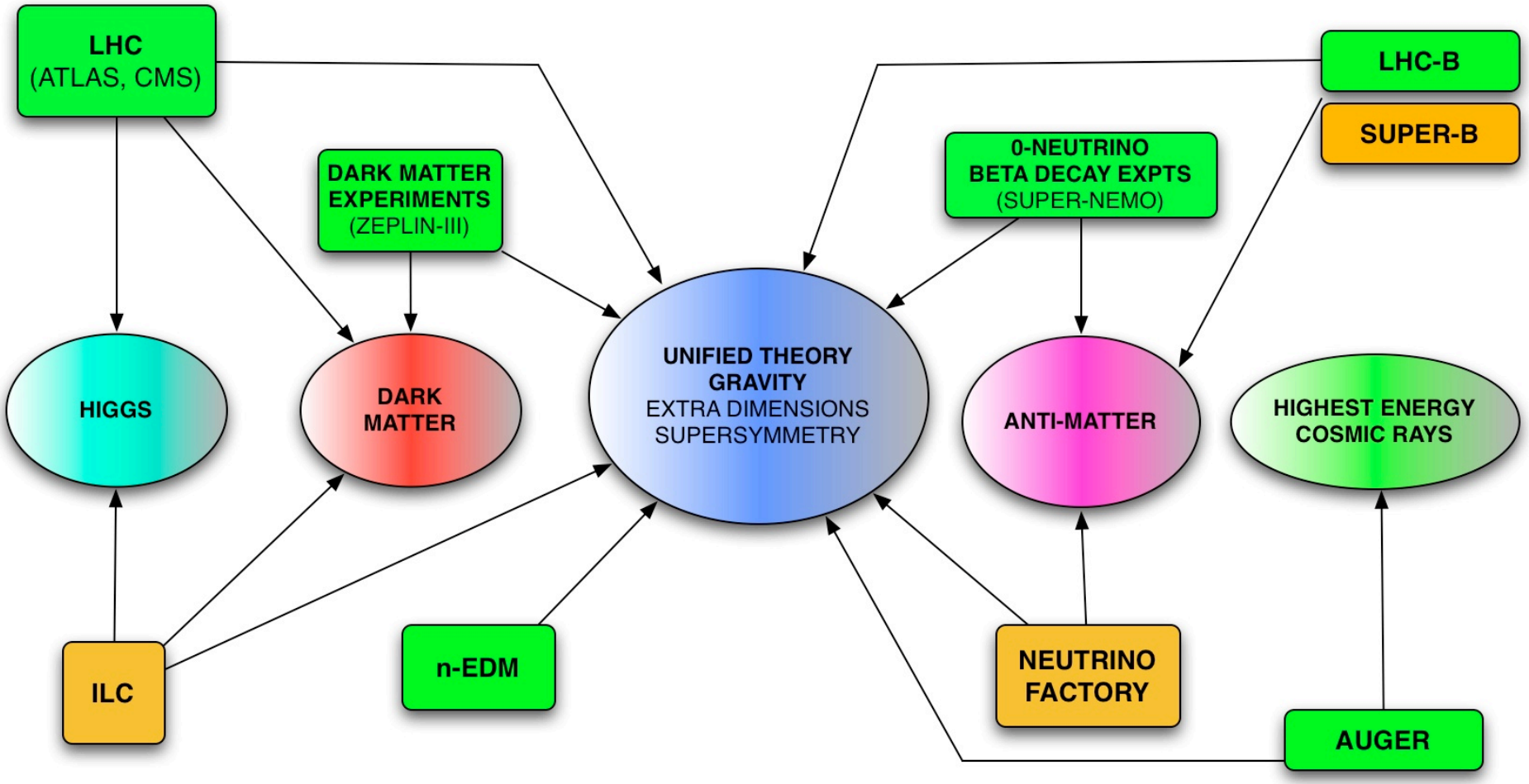
December 4, 2008

Celebrity crunch: property firm to the stars, aAim, goes bust

Cultural Benefits Stem From a Genuine Interest in PP Questions

25% of New Scientist feature questions below – when they do sales increase by 15%

Films, Books, Magazines etc



Education & Training

UG survey : 830 1st & final year students at 8 universities

1st Year Students – motivation for studying physics

90% expressed a significant interest in at least one STFC area

Only 37% expressed a significant interest in applied/medical physics

Final Year Students

71% had significant interest in at least one STFC science area

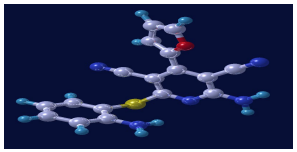
Particle Physics - lowest no interest and highest significant interest

How about a survey of school-children/teachers ?
– quantify impact of LHC startup – uptake in A-level physics ?

The subject captivates the public and school-children and draws students in to study physics.

Most EI studies try to quantify spin-off benefits

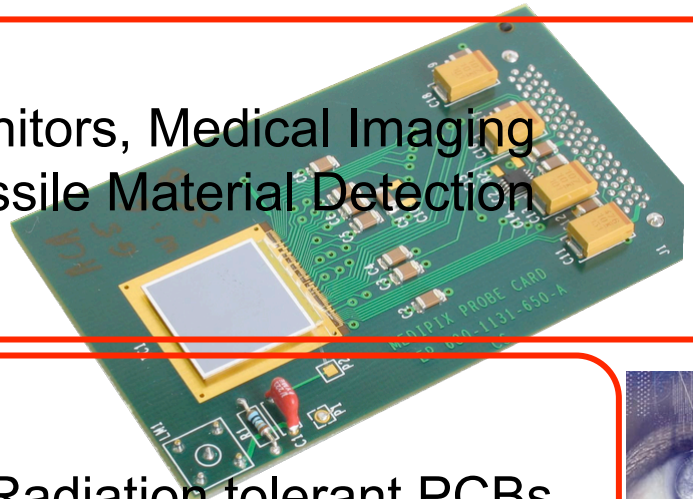
Accelerators



Cancer Therapy; Pharmaceutical Imaging
Food Sterilisation; Nuclear Waste Transmutation
Nuclear Thorium Reactors
Ion Doping of Semiconductors

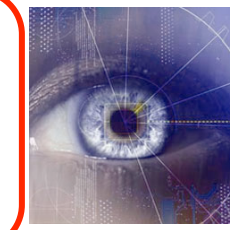
Detectors

Radiation Dose Monitors, Medical Imaging
Cargo scanners, Fissile Material Detection



MicroElectronics

Eye Implants, Radiation tolerant PCBs
Pixel medical detectors



Computing

New drug simulations
Design of new medical treatments

Economic Impact Studies

1. CERN (1980s) / ESA (recent)
   - CERN returns 20% after costs and ¾ is non-HEP sectors
   - ESA returns 60% after costs but ¾ remains in space-sector

   Both return around 15% outside of sector…

   (Other studies on "basic science" have given 25-30%)

2. PA Consulting for RCUK (Oct 2007)
   - salaries of ex-PPARC students (not compared ….)
   - list of PIPPS awards
   - quantifying economic impact (£50k/life) early cancer detection

Economic Impact Studies

3. STFC : Liz Towns-Andrews, Claire Dougan

- picking specific examples – non PP.
- this is the best study out there by some considerable distance (150 pages)

- SRS – 200M spin-out company
  - benefit of understanding mad cow disease (UK cost was 5% of QE)
  - quantified benefits as £700M return from £468M investment

4. IoP with RAS/STFC : OxfordEconomics (in London!)

– again picking certain areas
  - so far “flexible plastic display panels”
  - next thinking of a PP application
    - myself and Phil Allport are meeting them on Monday

Economic Impact Studies

5. UCL Institute of Fiscal Studies (ML + UCL MSSL)

- aim is to get help from academic economists not consultants
- dangerous – we may not get the answer we want
- cheaper – we can talk to them without watching the clock.

We've had some useful advice:

- pick at most 2 or 3 examples and do these well

Three methods for quantifying EI:

1. What is the net gain if product X is invented sooner because of PP
(Faraday/Maxwell speeded up "electricity" invention – if this was only one year the gain is $40B)
   - e.g. world-wide web

2. What is net gain from a quicker/better medical diagnosis
   e.g. faster and hi-resolution scintillator crystals
   – net benefit to GDP of living longer (at the right age…)

Economic Impact Studies

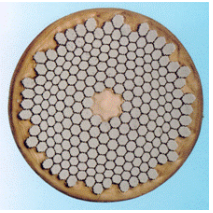
3. Product cost reduction and enhanced capability/utility

Academic economists are interested to use a "nested multinomal logit" as the metric

Now becoming accepted as a robust standard based on work that was done to quantify "value" of CT scanning

We're hoping to secure funding from STFC/RCUK to fund an Economics PhD in the Institute of Fiscal Studies

"Every program in super-conductivity that there is today owes itself in some measure to the fact that Fermilab built the Tevatron and it worked" : Robert Marsh US Nb-Ti manufacturer.



- 500 million miles of s/c fibre in LHC !
-super-conductivity is a $5B/pa business.

Economic Impact Studies

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Employed an ex-banker for 2 pints of Guinness to explain nested multi-nomal logits technique

- Method doesn't work for radical innovation since relies on analysing increase in uptake of a product vs product improvements ("innovation benefit")

- Every $1M spent in improving CT scanners increased uptake by 2.5%

- Define utility as number people who want/benefit from a product – thrown in some Gaussian smearing and define a figure of merit for innovation: easy for CT scanners: scan time, image resolution, reconstruction time

- Looks like a course in statistical thermodynamics….

Summary

We are in competition for funds and we need to have the arguments ready and for more people to be versed in them for the elevator pitch.

WE NEED A PP ECONOMIC IMPACT STUDY

If you're interested in helping – get in touch.

www.pp2020.info - watch this space

LET'S NOT FORGOT ABOUT THE SCIENCE !!