

Title: The Most Wanted Particle

Date: Apr 01, 2015 07:00 PM

URL: <http://pirsa.org/15040116>

Abstract: <p>Jon Butterworth, University College London

The Most Wanted Particle

Perimeter Institute Public Lecture

WEDNESDAY, April 1 at 7:00 pm

Mike Lazaridis Theatre of Ideas

Perimeter Institute

31 Caroline St. N., Waterloo</p>

<p>Tickets available online on Monday, March 16 at 9:00 am.</p>



PERIMETER
INSTITUTE
FOR THEORETICAL PHYSICS

Tonight's Public Lecture

JONATHAN BUTTERWORTH

THE MOST WANTED PARTICLE

April 1, 2015



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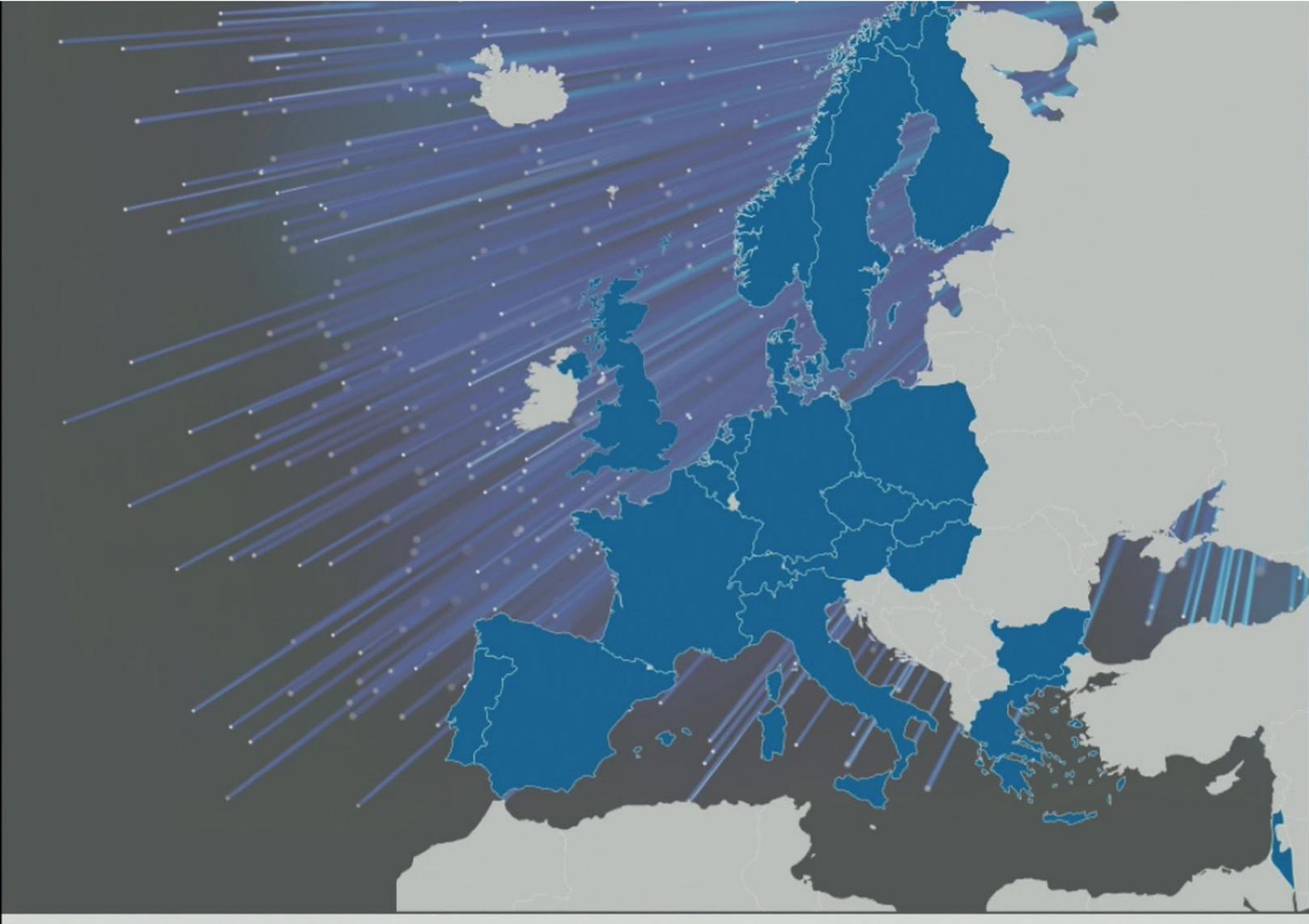
PUBLIC LECTURE
Series

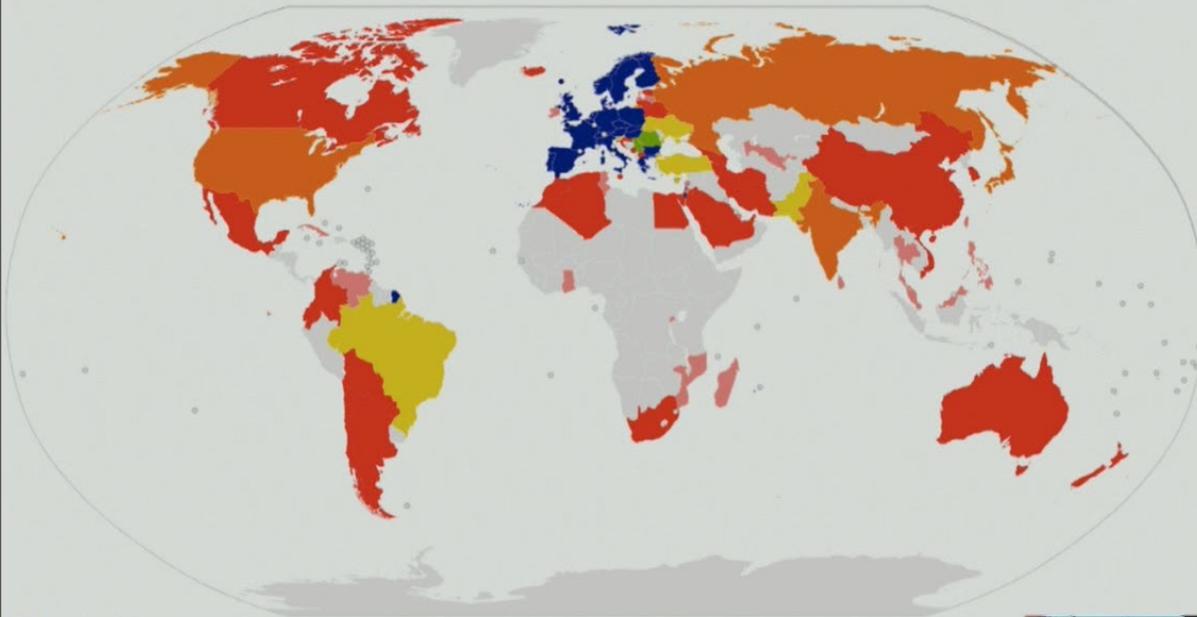
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Sun
Life Financial





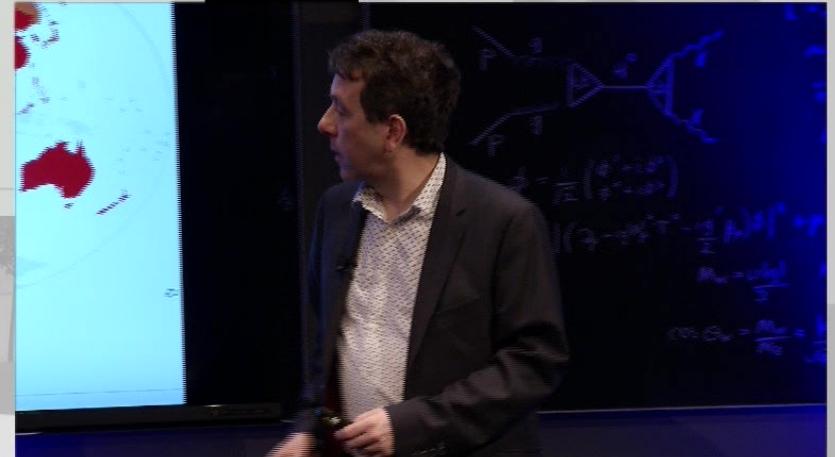


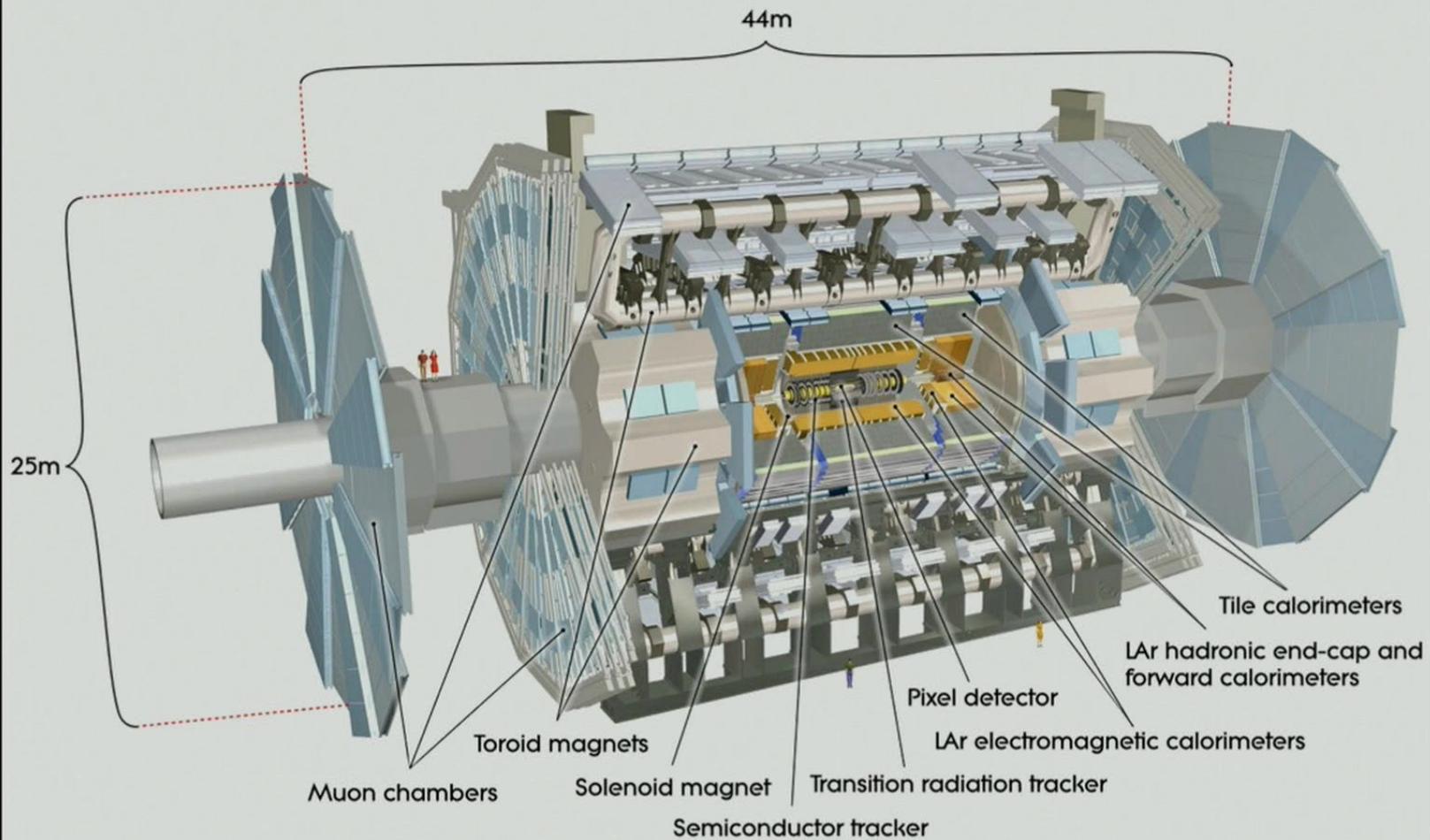


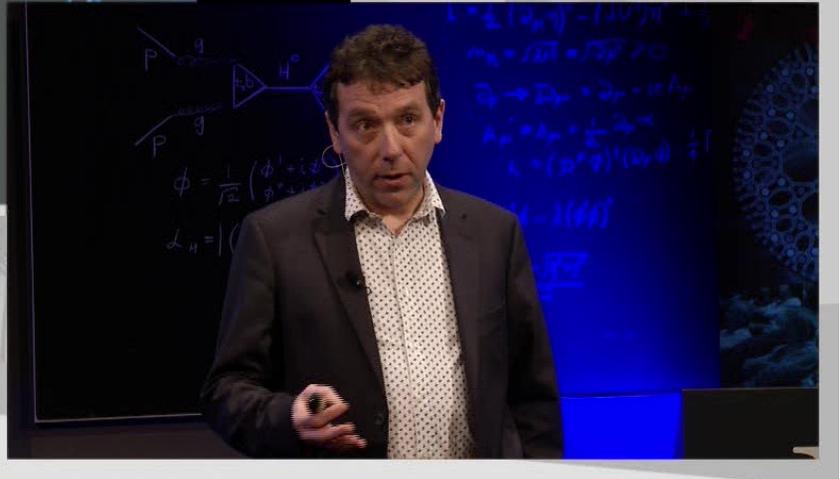
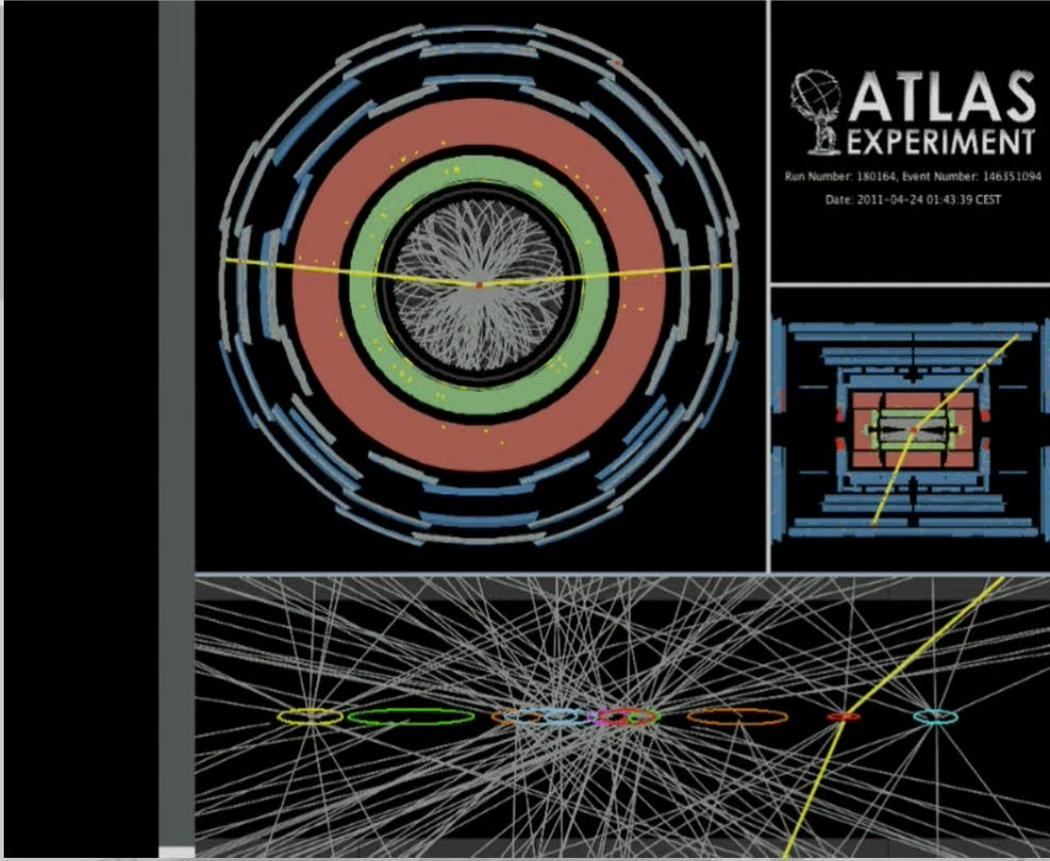
- CERN member states: 20 c.
- Accession in progress: 4 c.
- Declared intent to join: 2 c.
- Observers: 4 c. + EU, Turkey
- Cooperation agreement: 35 c. + Slovenia, Cyprus
- Scientific contacts: 19 c.

THE MOST WANTED PARTICLE

PERIMETER INSTITUTE - WATERLOO, ONTARIO, CANADA

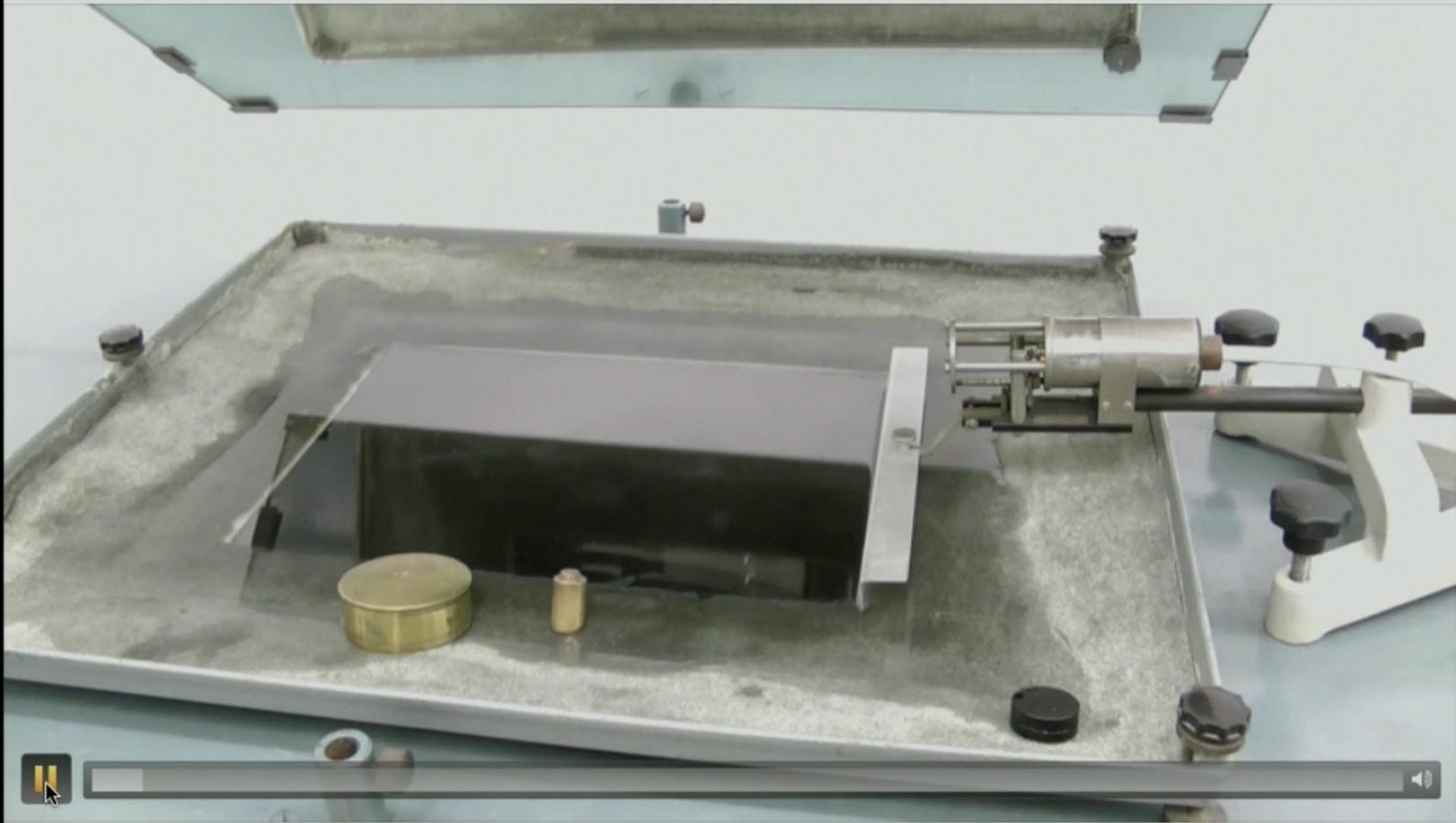


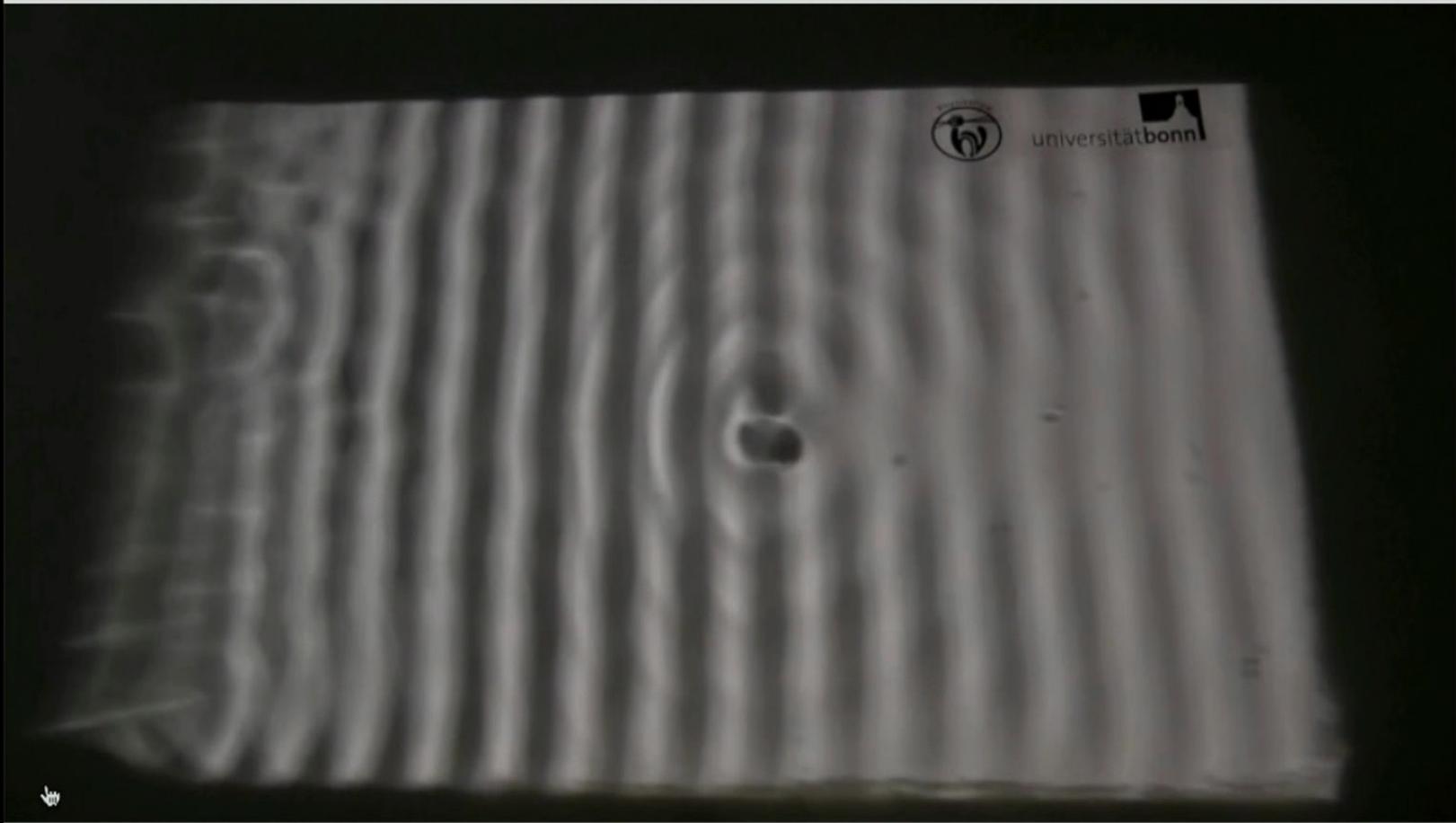




Why high energy?







Physikshow, Universität Bonn

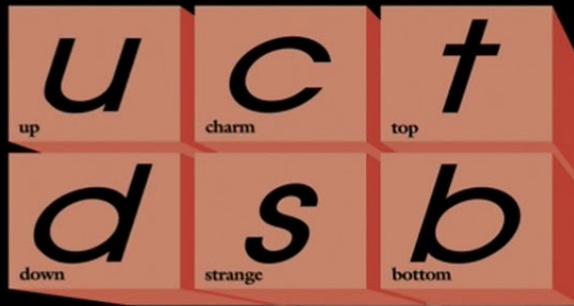
FILMED BY: MICHAEL KORTMANN & HERBI DREINER

DATE: MARCH 27, 2014

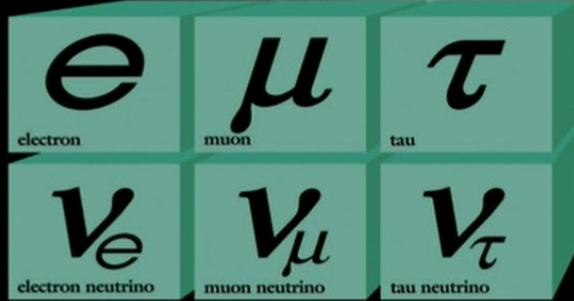
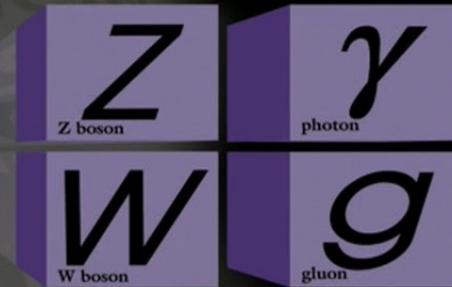
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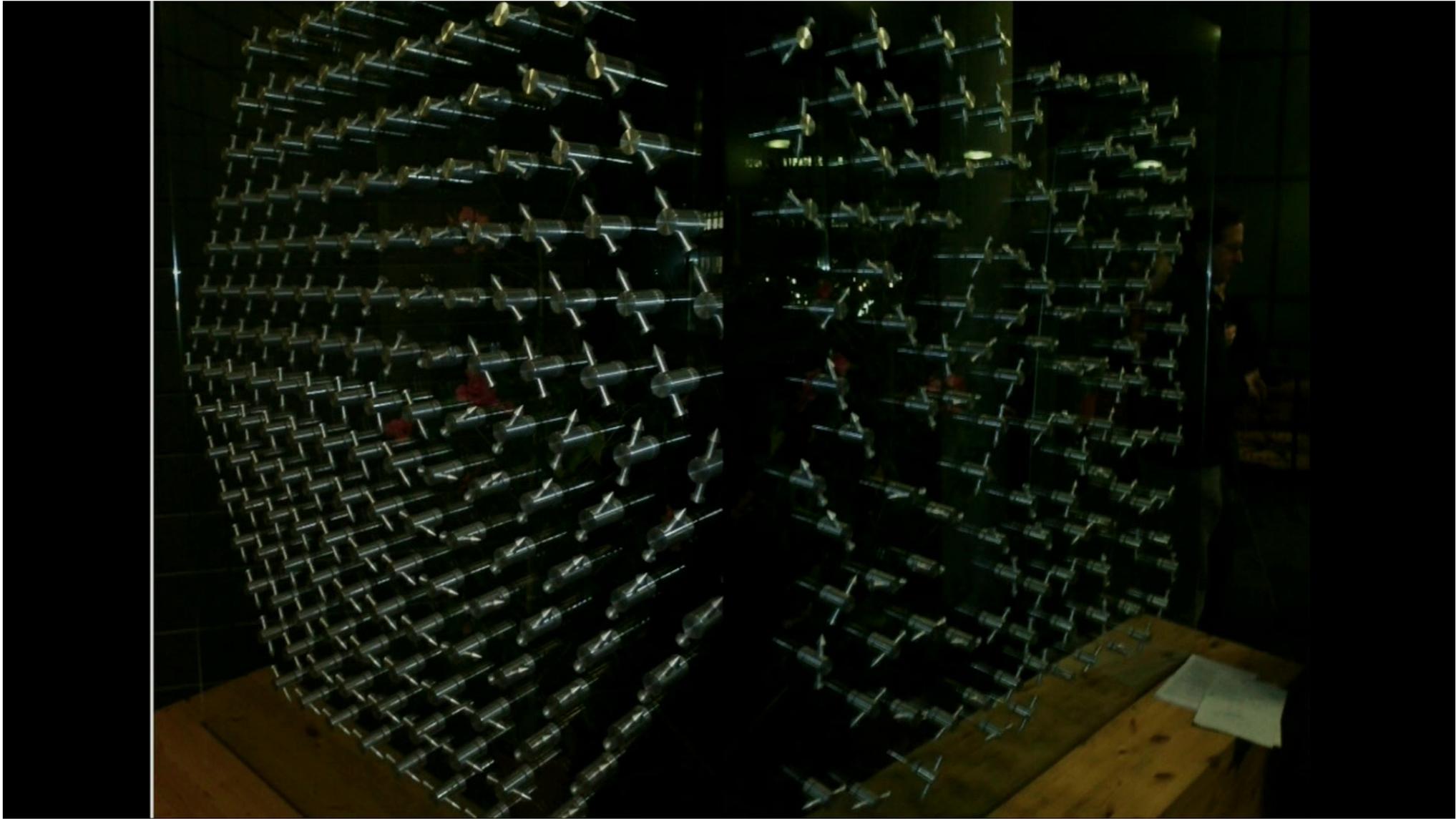
Quarks

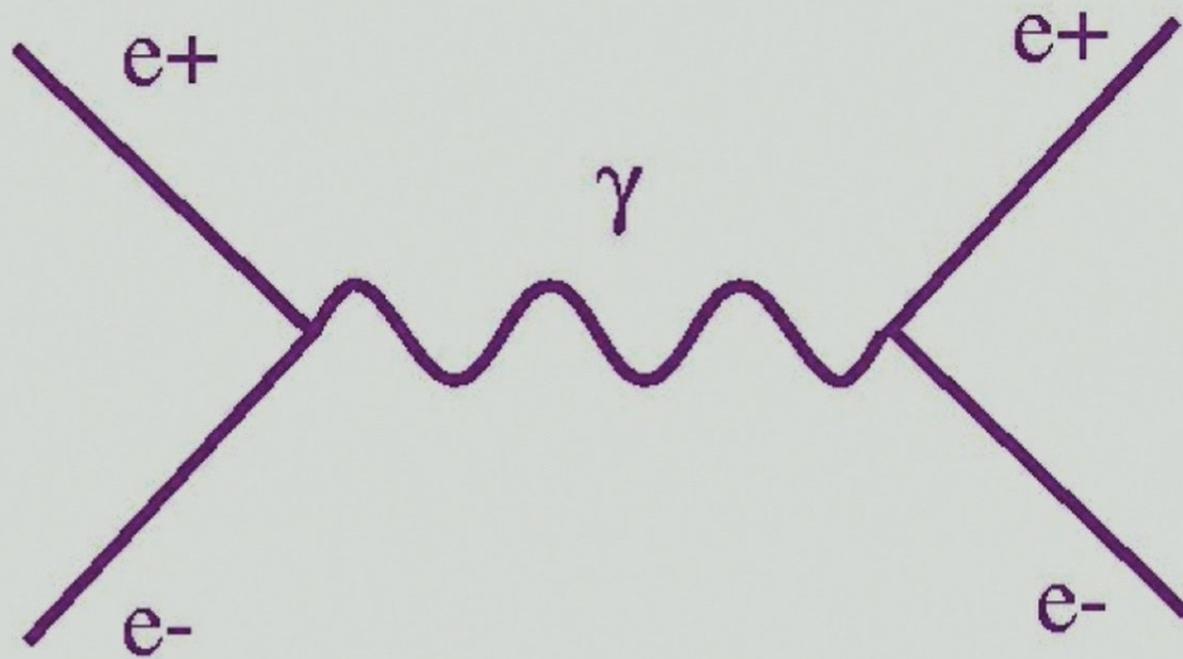


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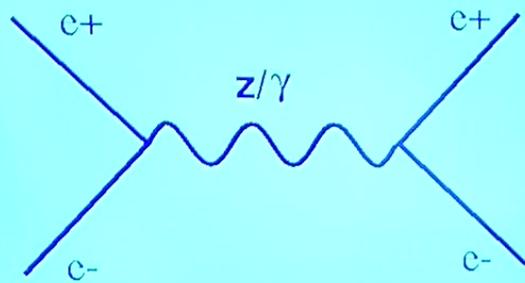


Leptons





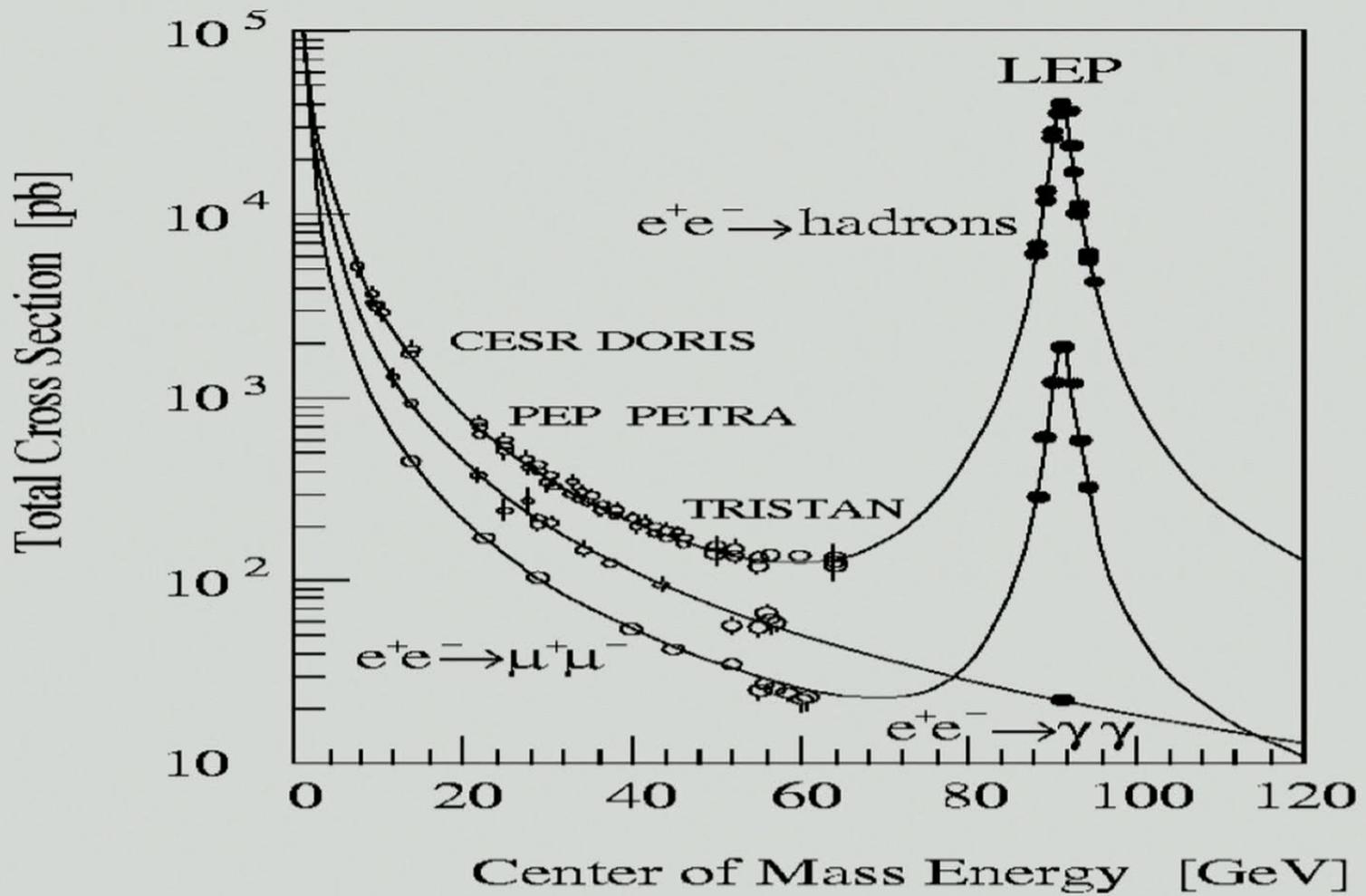


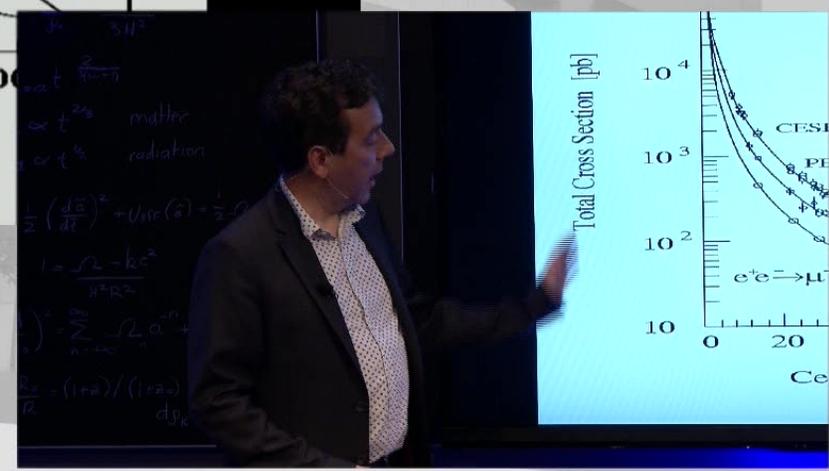
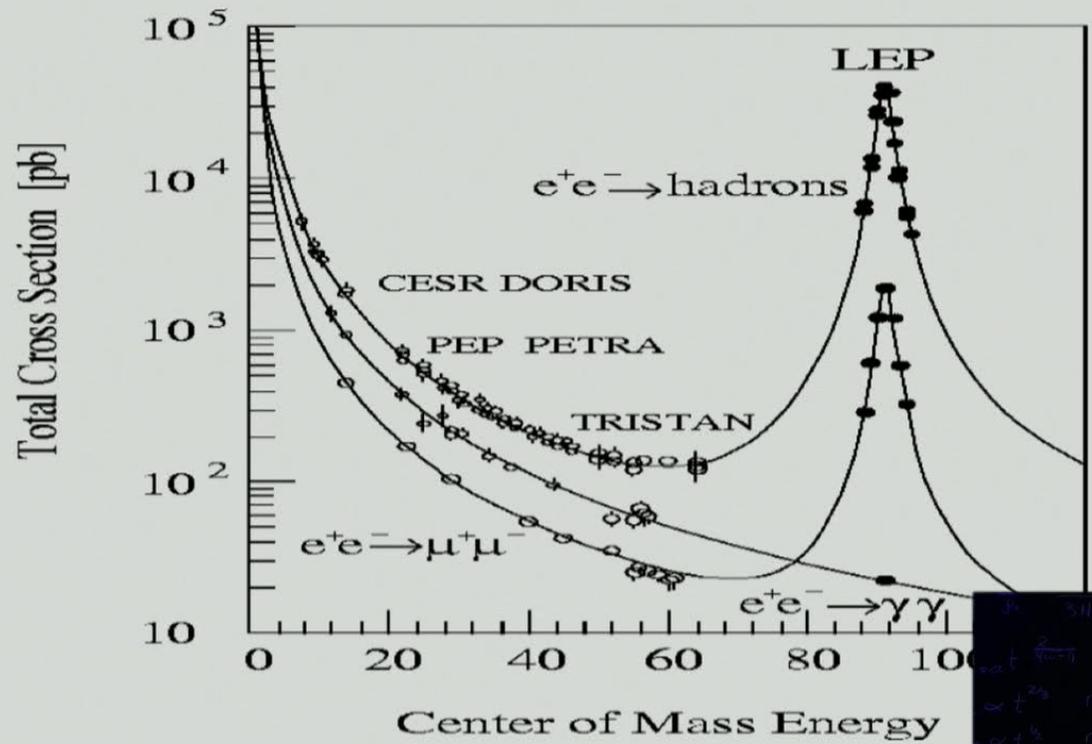


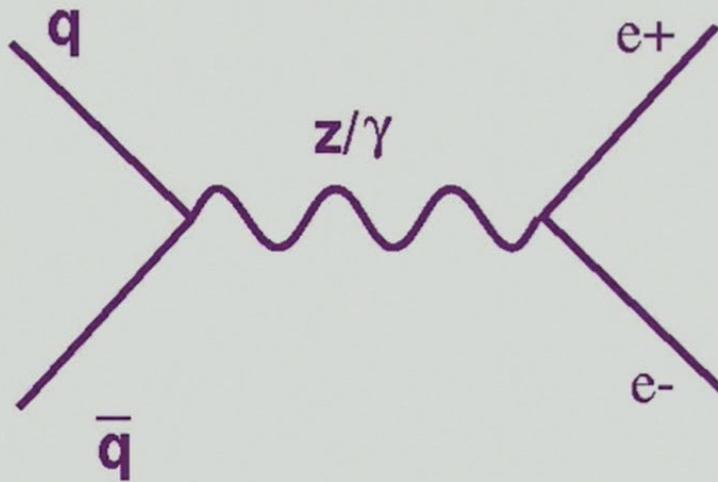
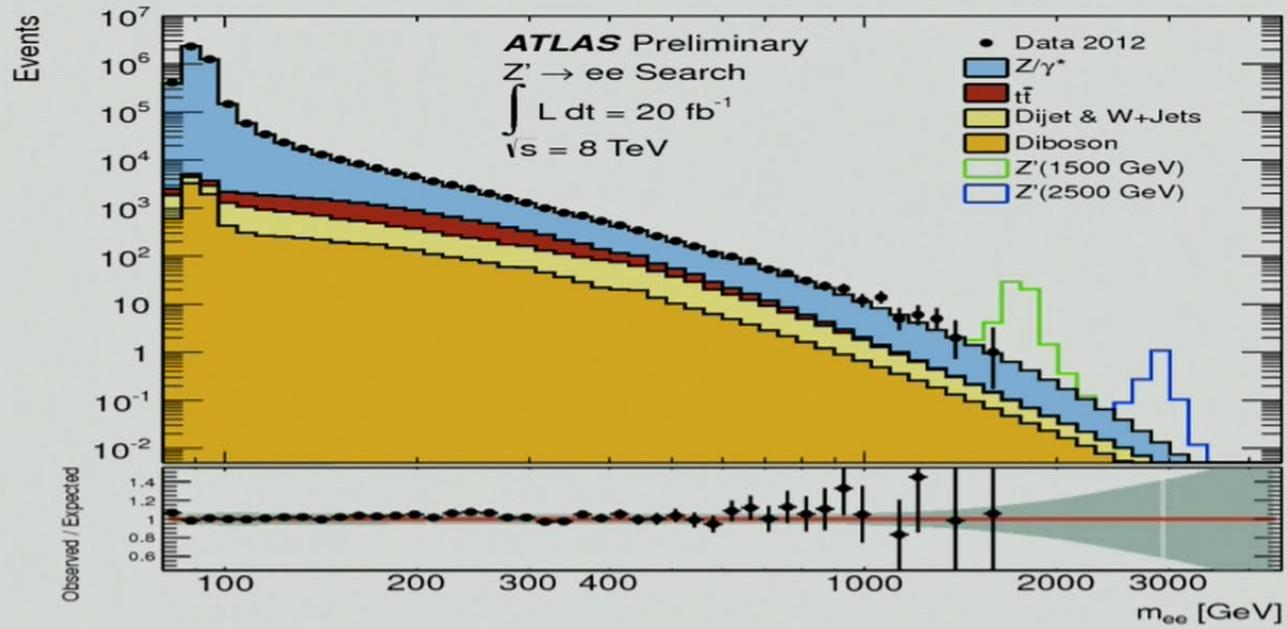
Energy, $E = mc^2$

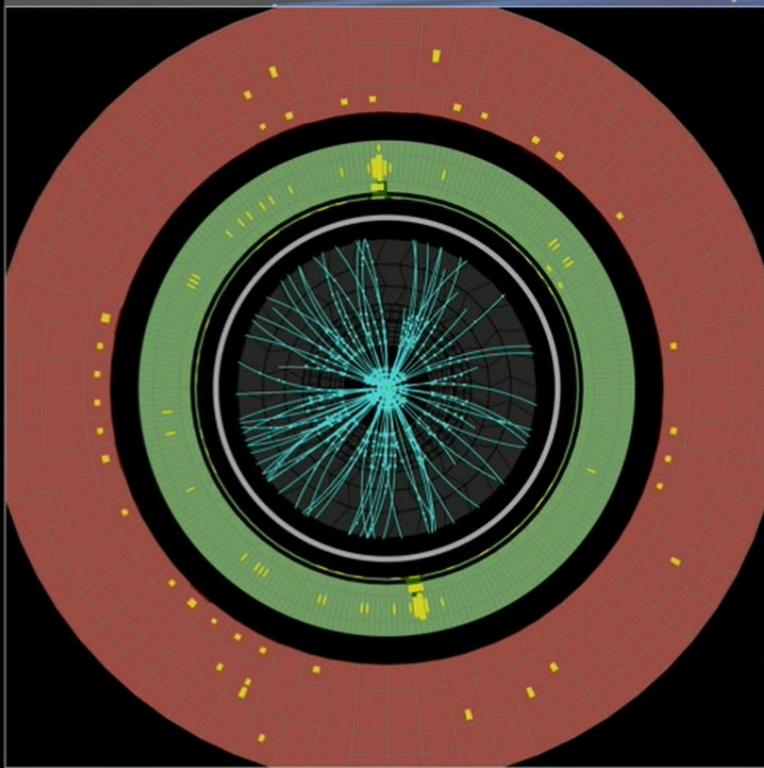


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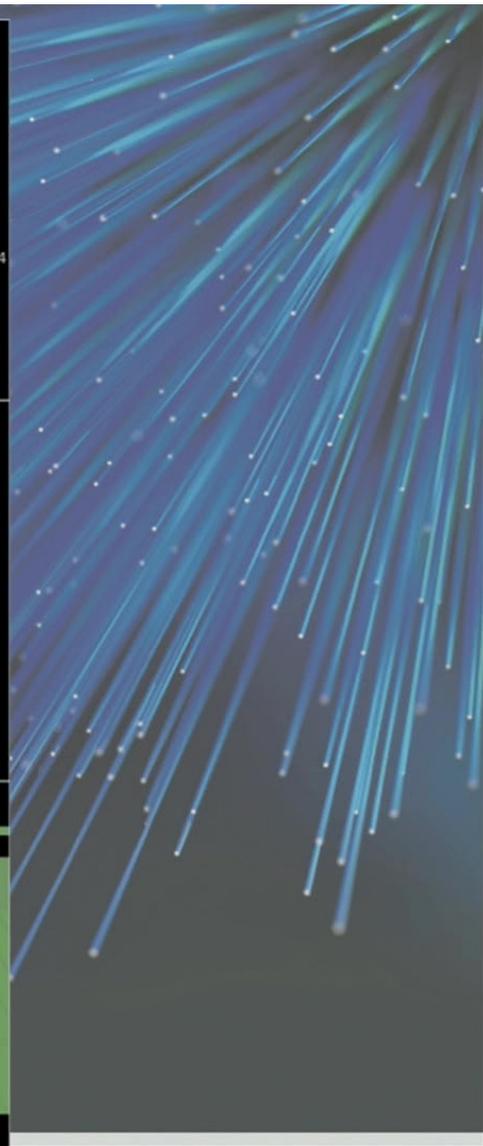
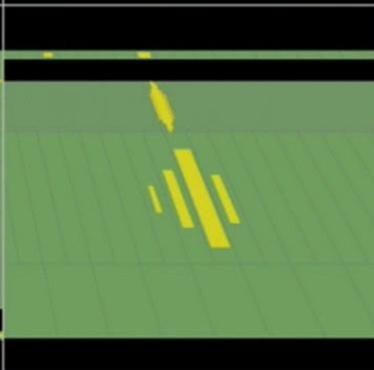
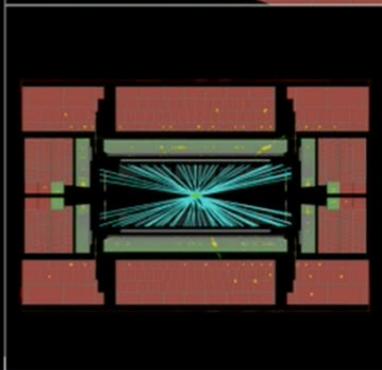
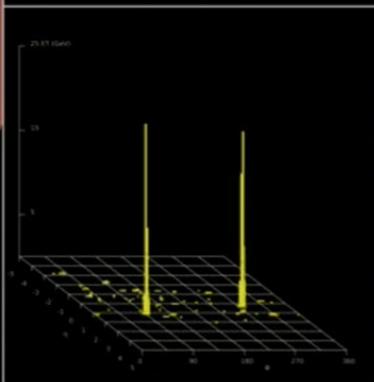


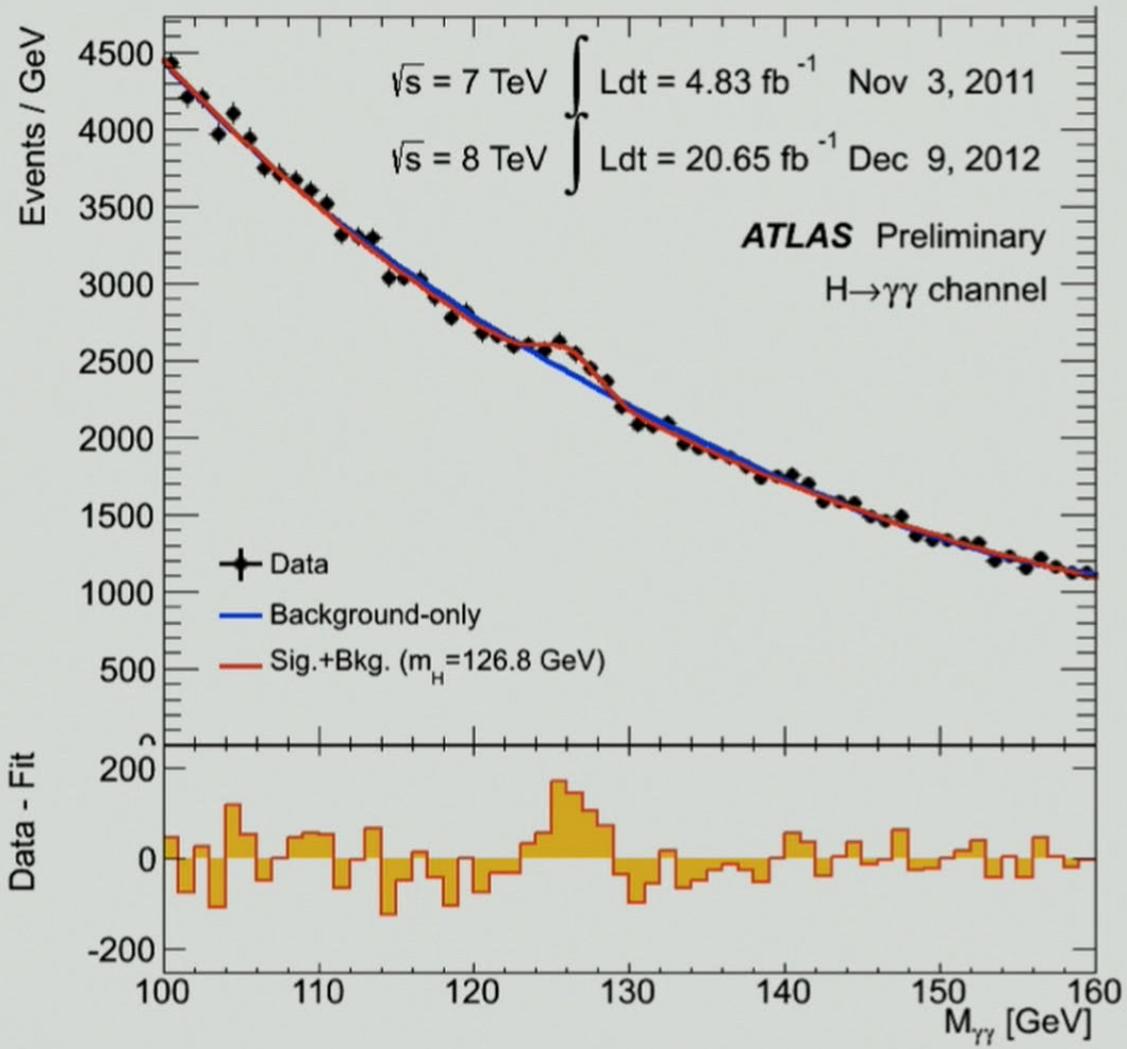


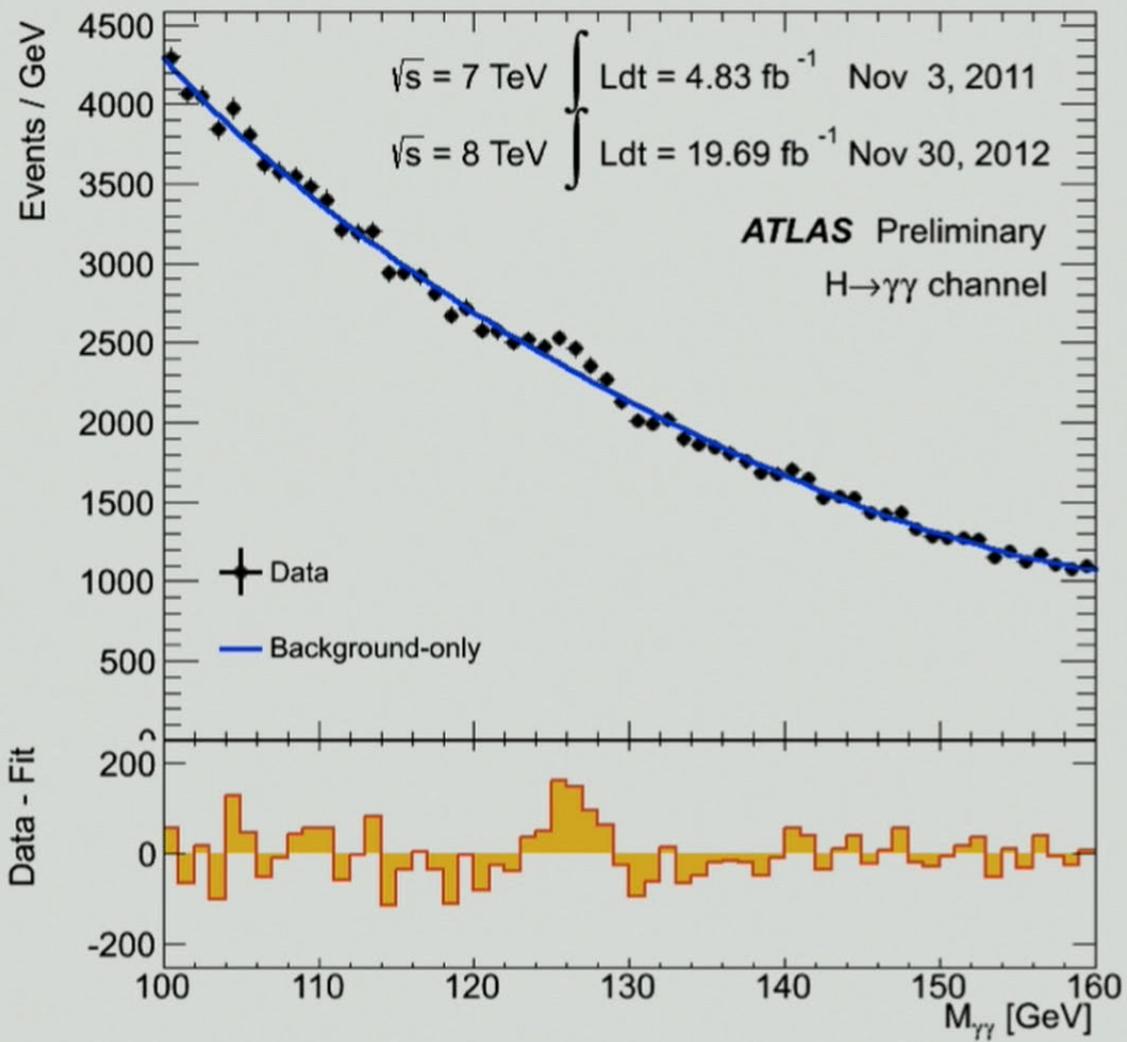
ATLAS EXPERIMENT

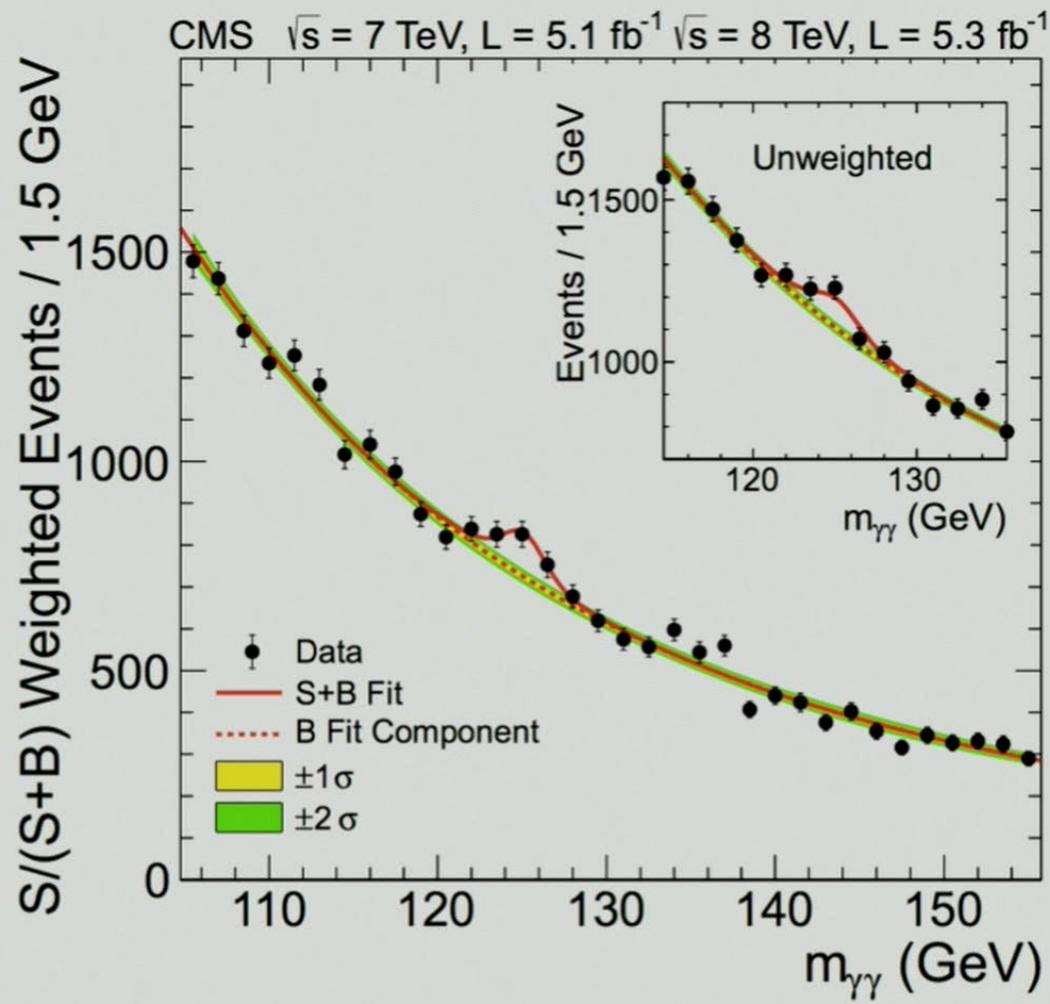
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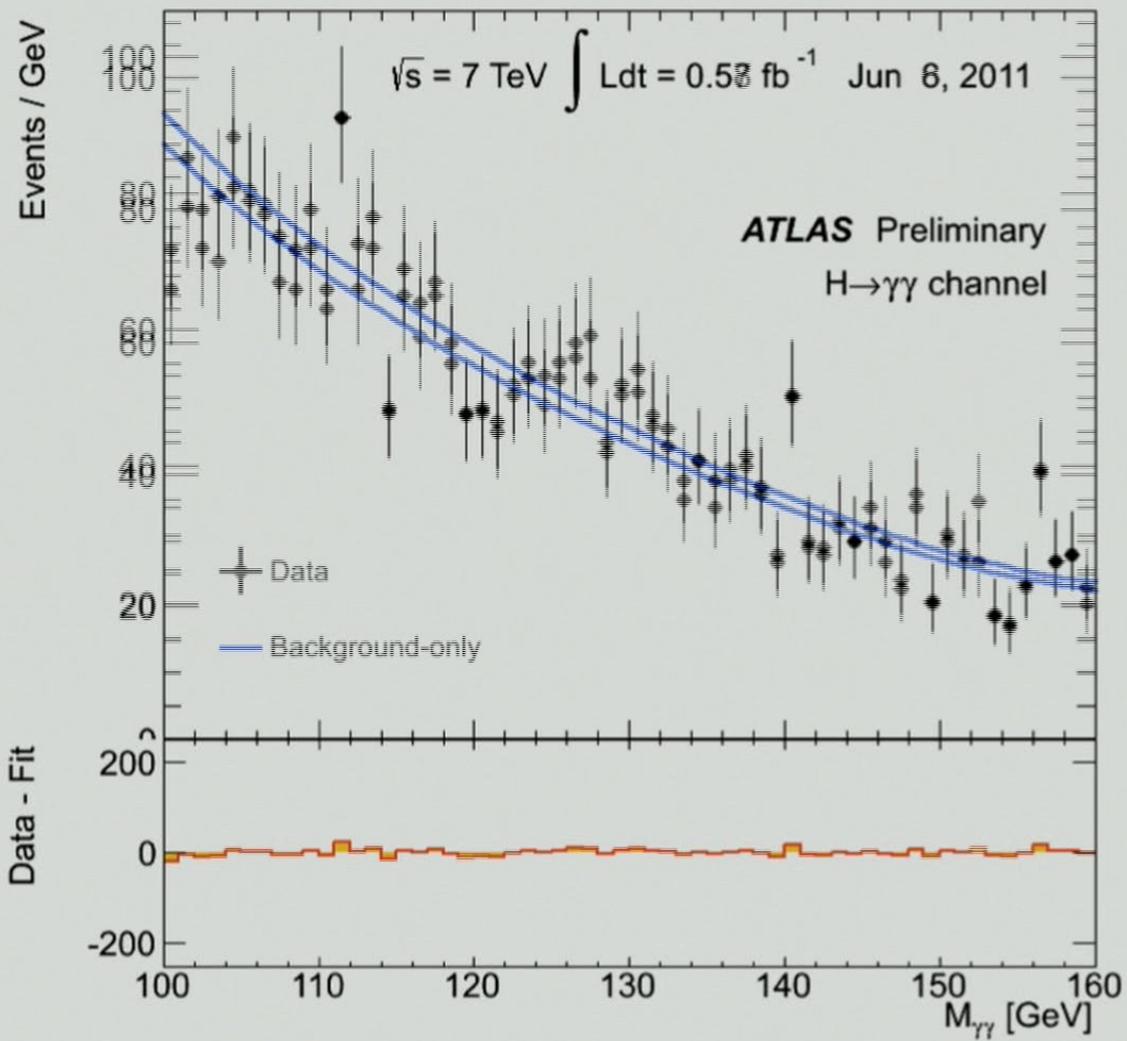
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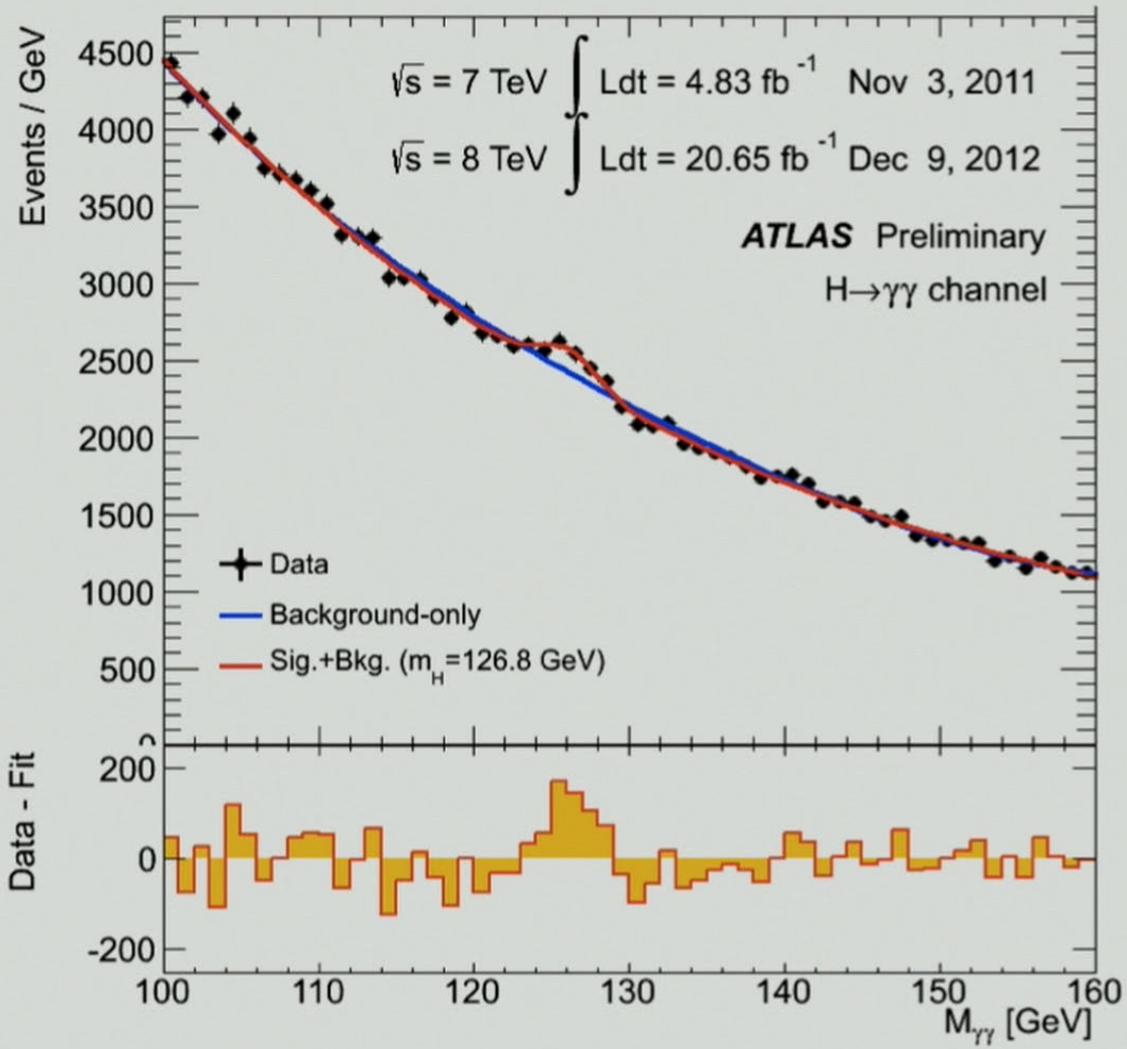


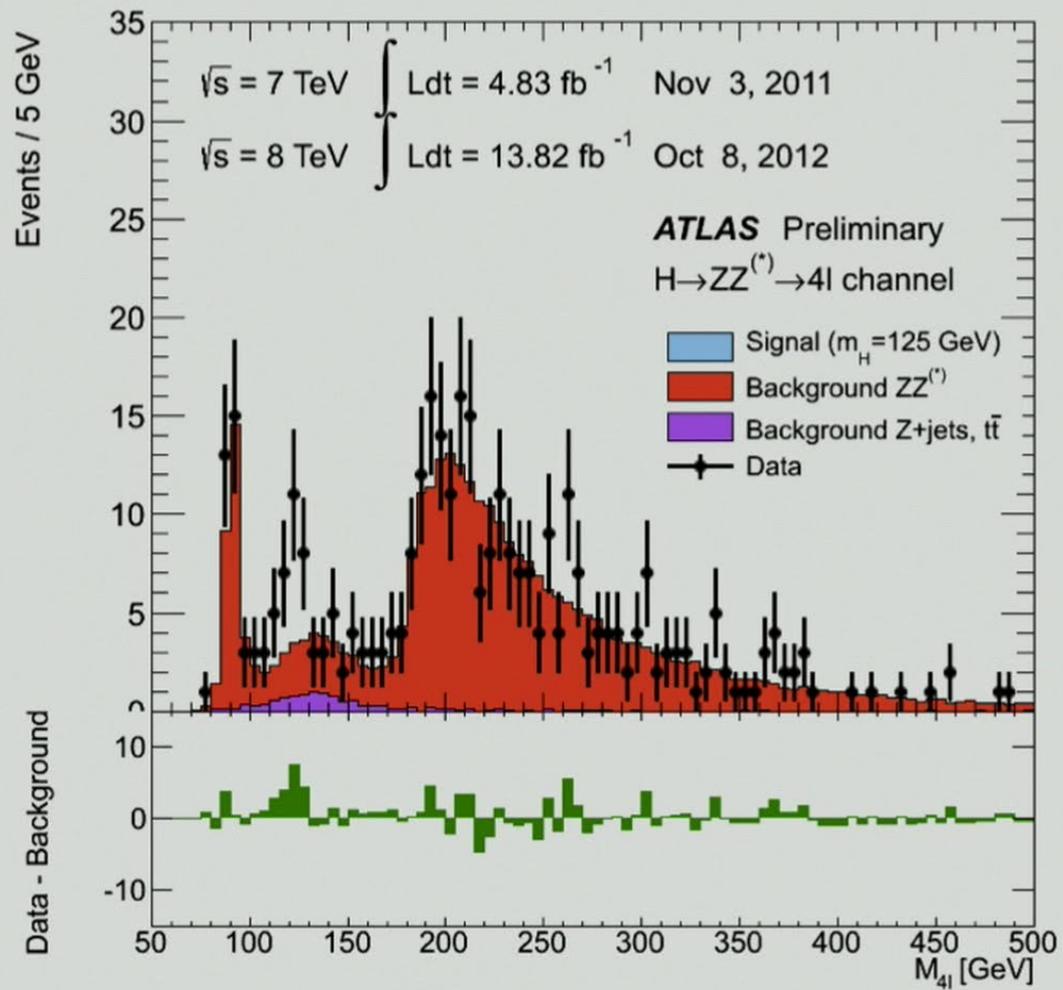


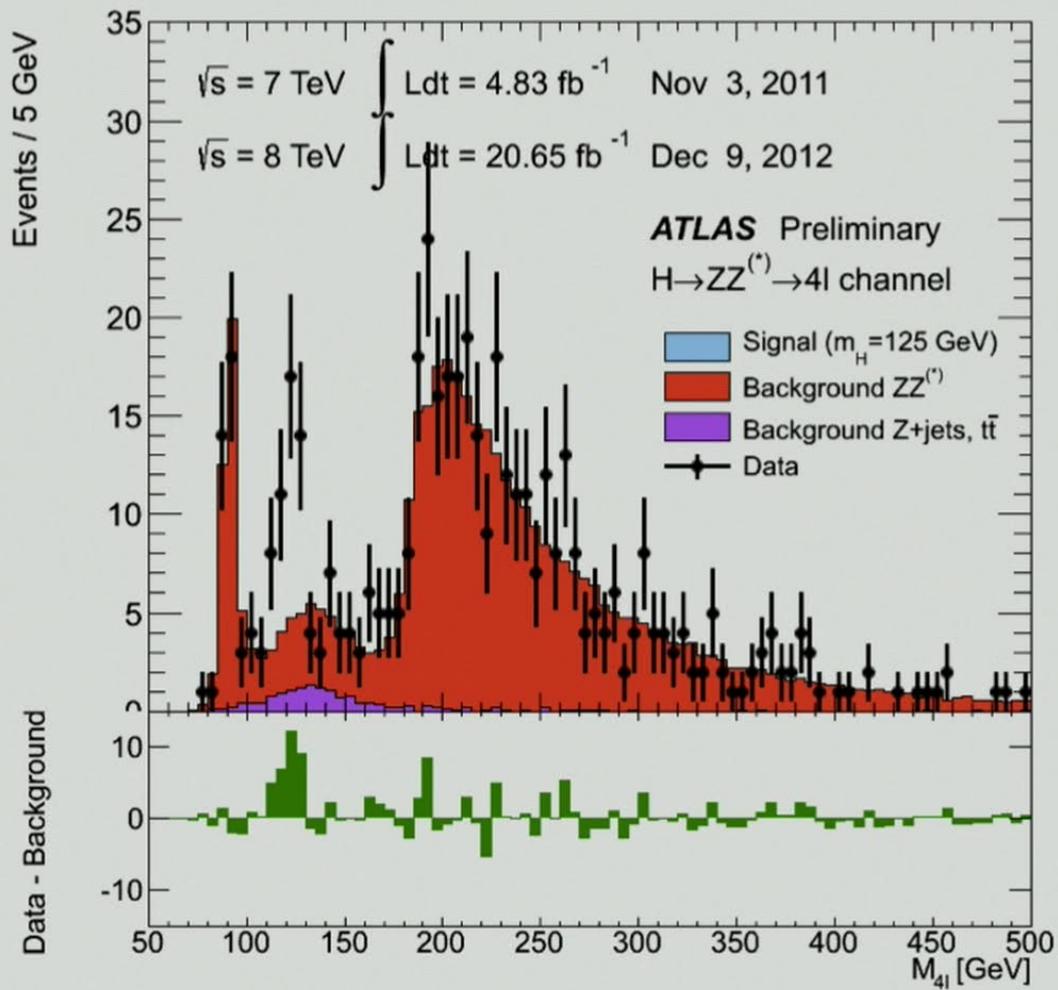


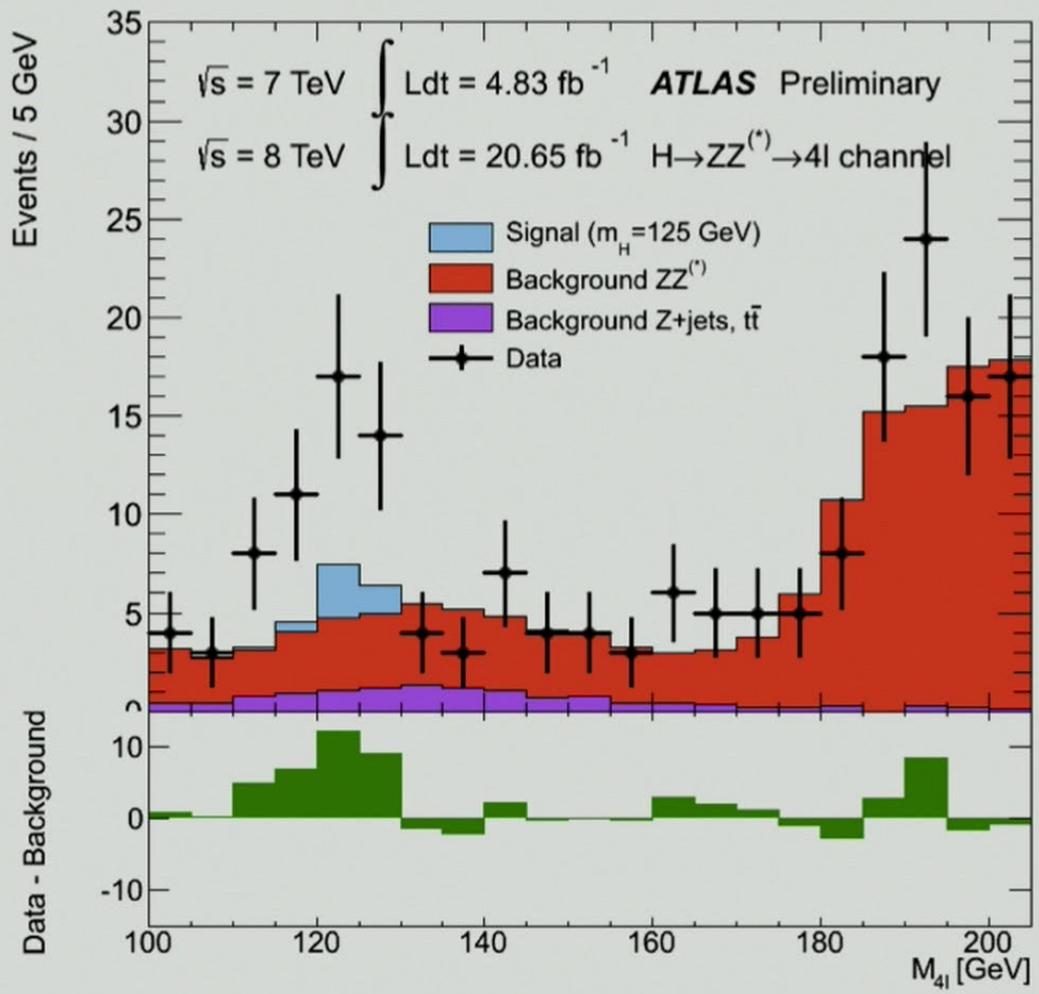


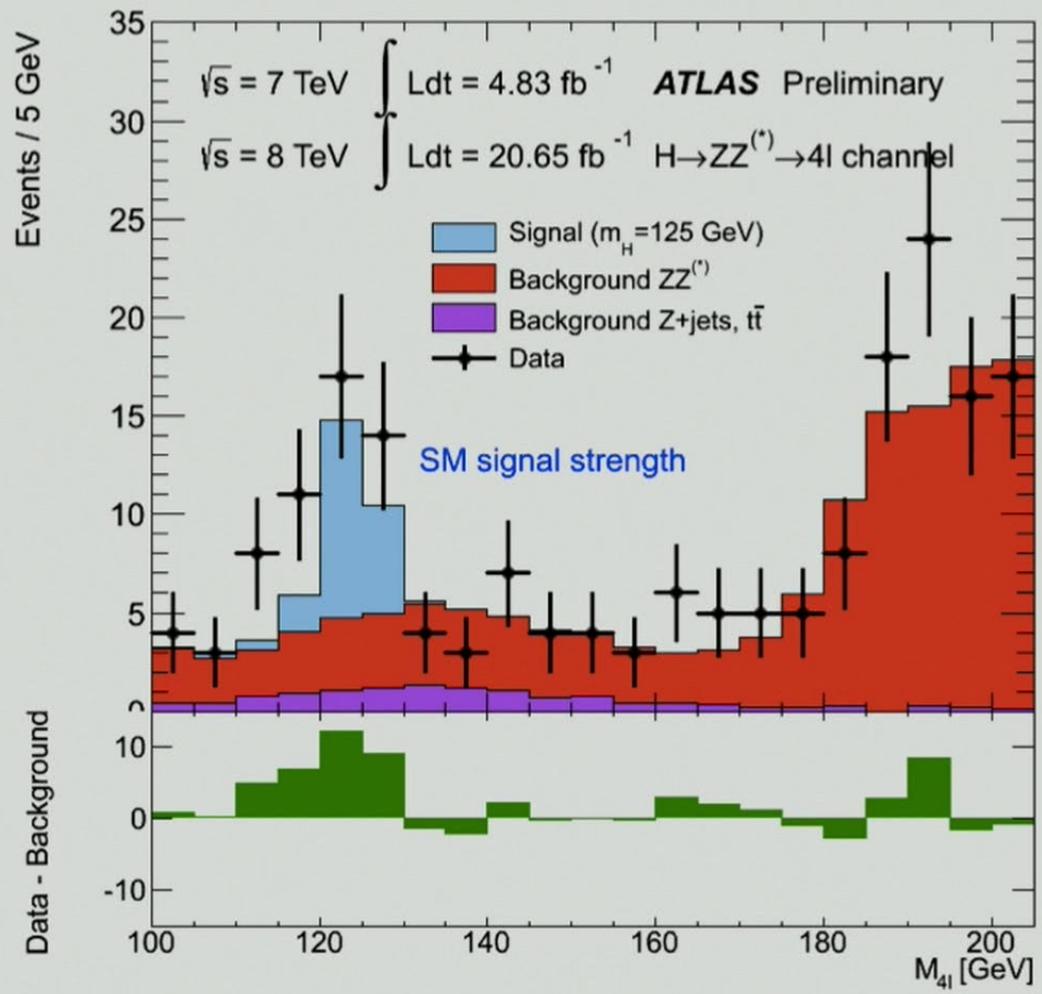


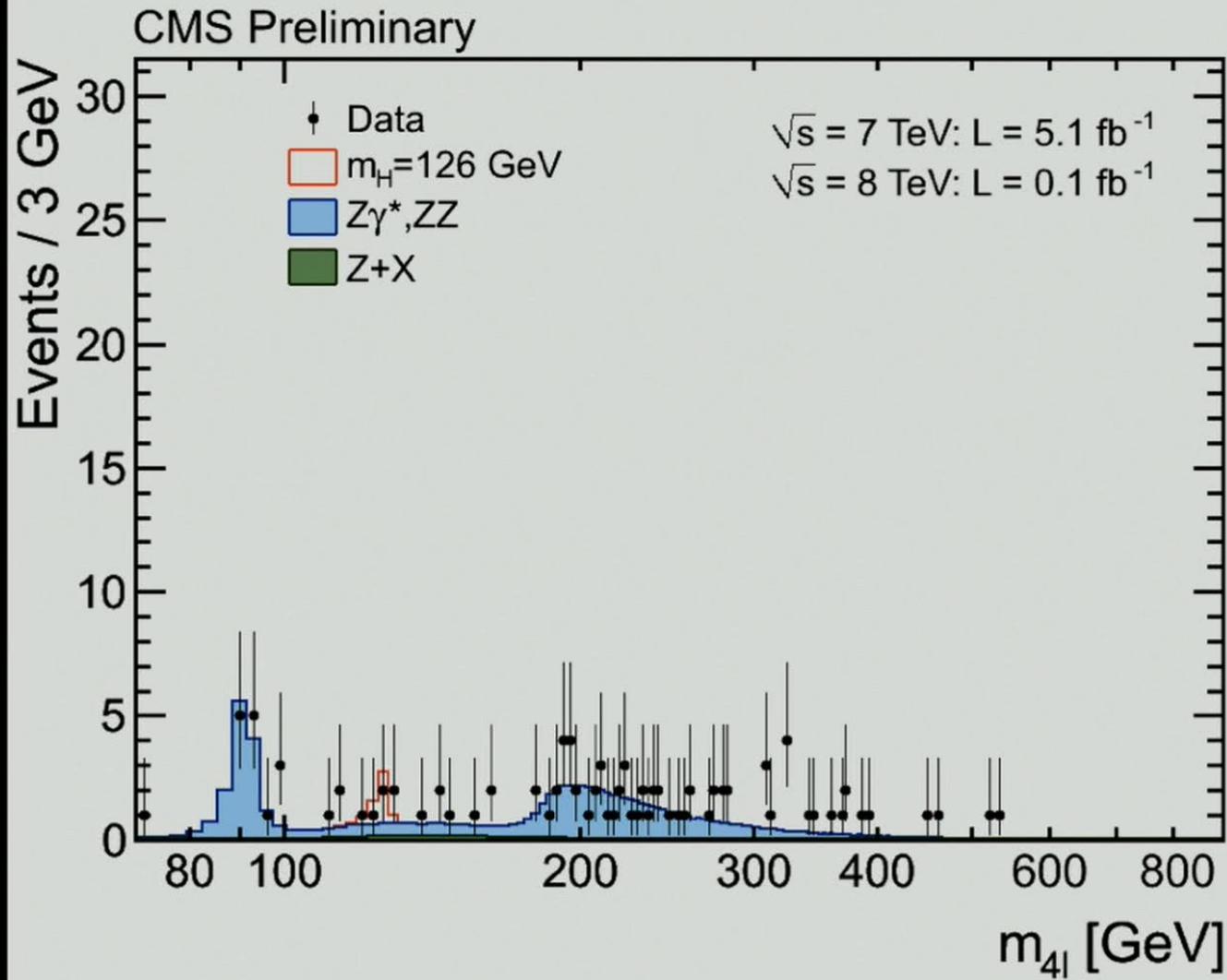


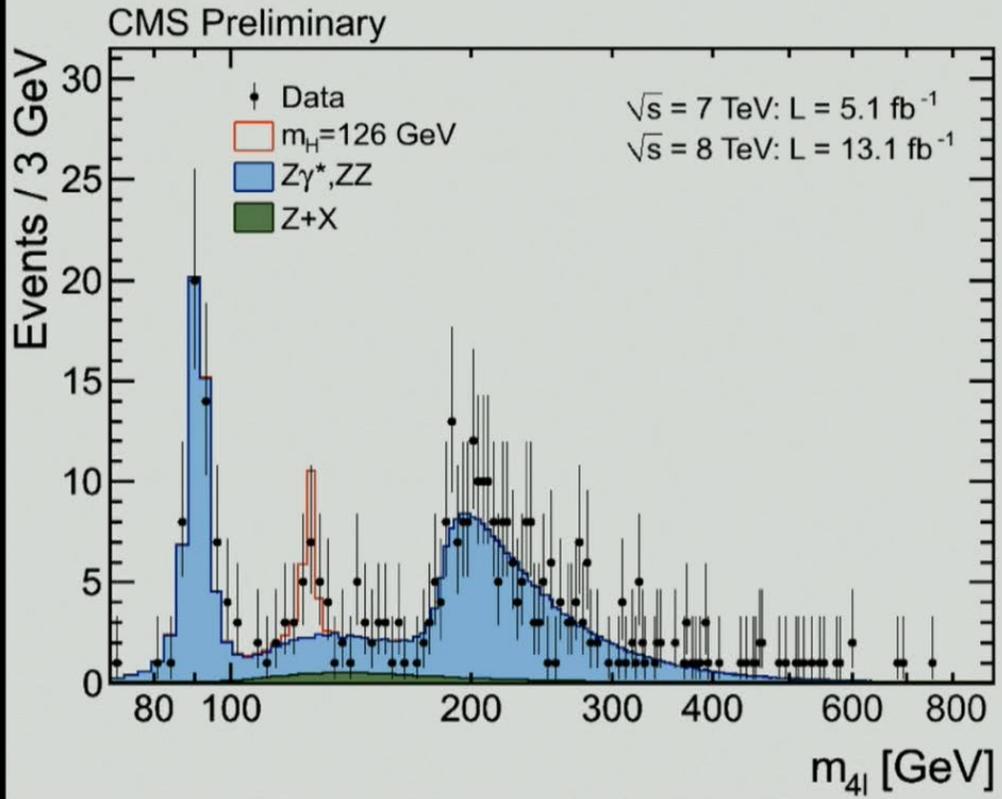


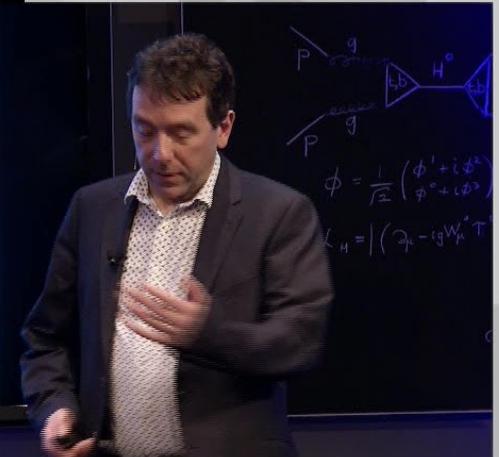
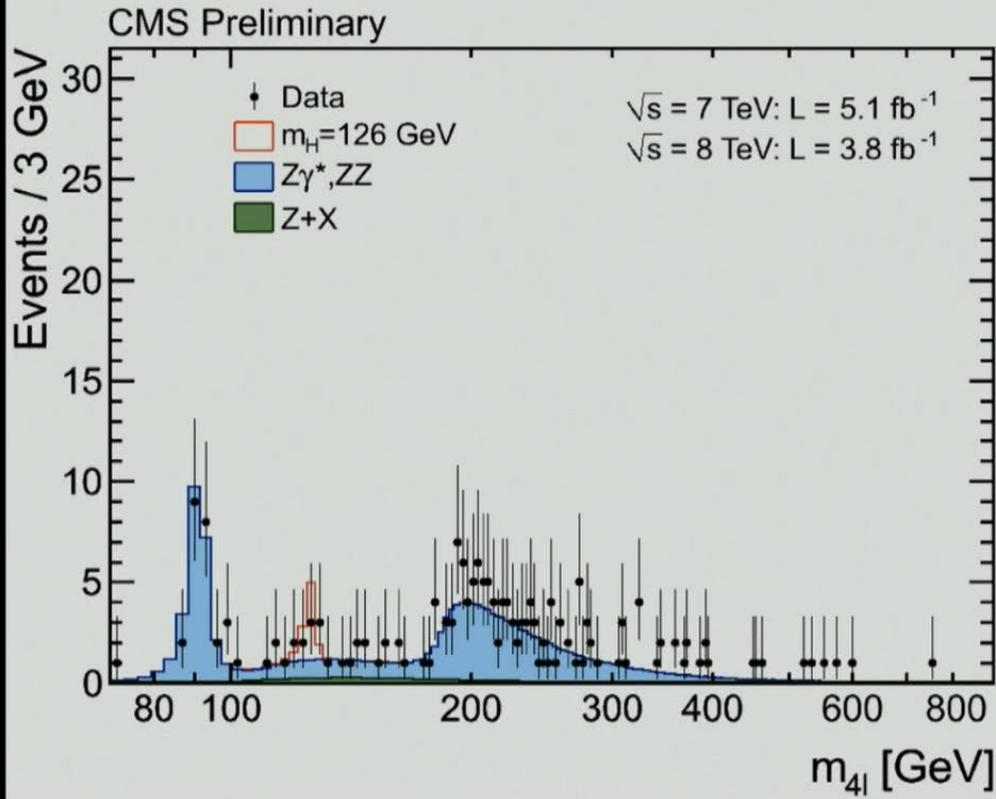










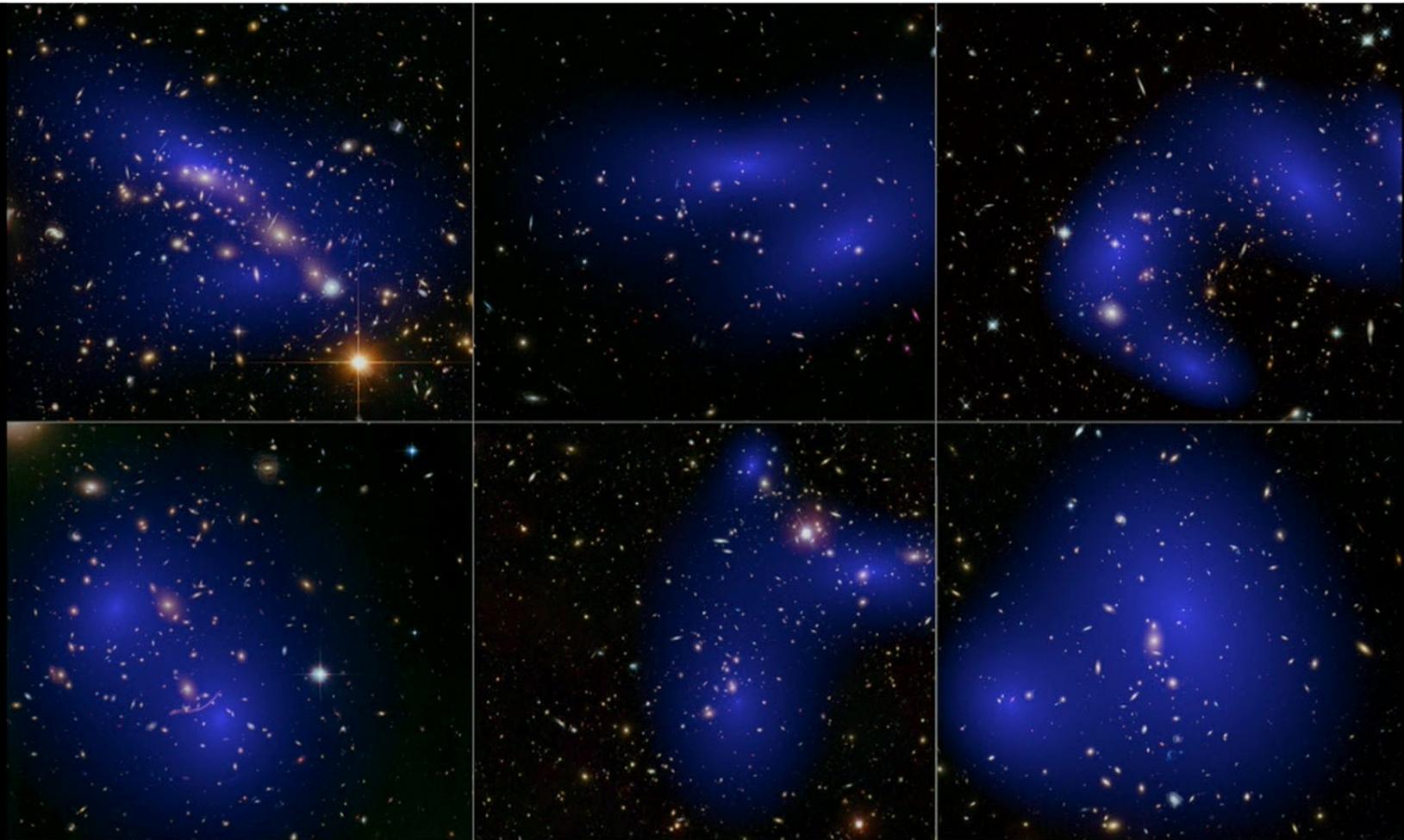


Where are we now?



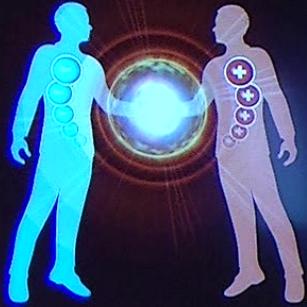






NASA/ESA Hubble Space Telescope, Chandra X-ray observatory
Science 27/3/2015

After the Big Bang, matter and antimatter should have formed in equal measure. When they meet, matter and antimatter annihilate each other on contact...



There must have been a subtle difference, that allowed matter to survive and dominate the Universe today

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$m_H = 125 \text{ GeV}$

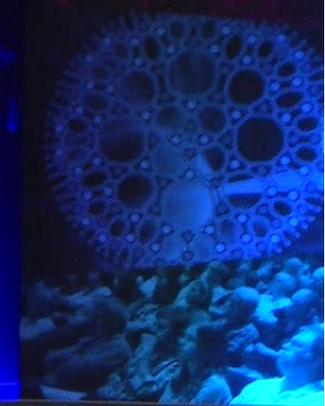
$A = \sqrt{\frac{2}{3}} v$

$L = \frac{1}{2} (2q\psi - (2q)^2 \psi^2) +$
 $m_\psi = 100 = \sqrt{2} / 2$
 $2\psi \rightarrow 2q_\psi = 2q_\psi - 2q_\psi$
 $A_\mu = 2q_\psi + \frac{1}{2} (2q\psi)^2$
 $L = \frac{1}{2} (2q\psi)^2 - (2q\psi)^2$

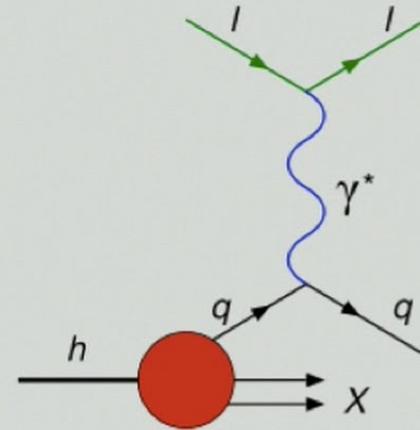
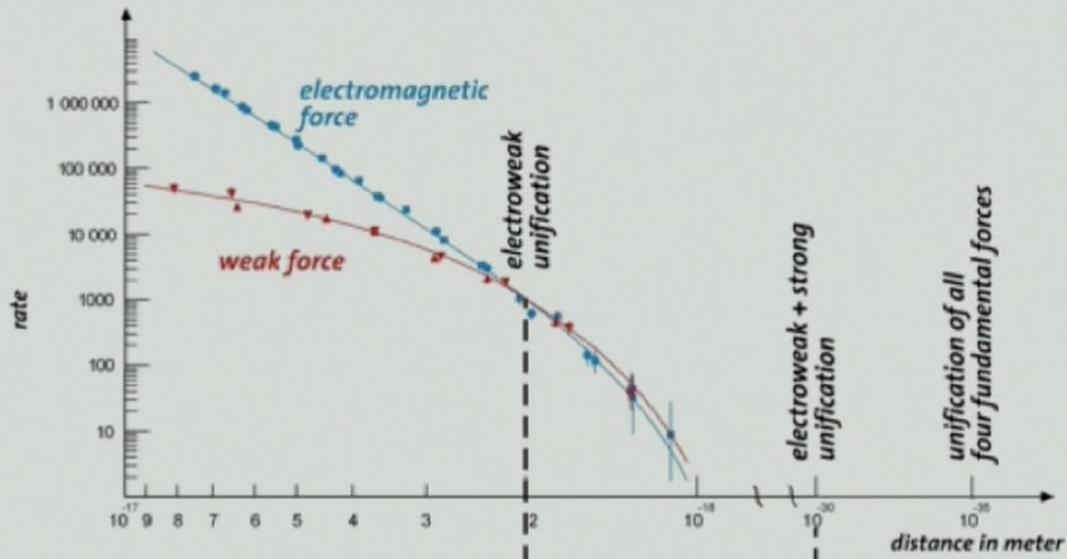
$\frac{d\psi}{dt} = \frac{1}{2} (2q\psi)^2$
 $- (2q\psi)^2 T = - \frac{1}{2} (2q\psi)^2 \psi^2 + \frac{1}{2} (2q\psi)^2 \psi^2$

$M_W = \frac{1}{2} g v$ $M_Z = \frac{1}{2} \sqrt{g^2 + g'^2} v$

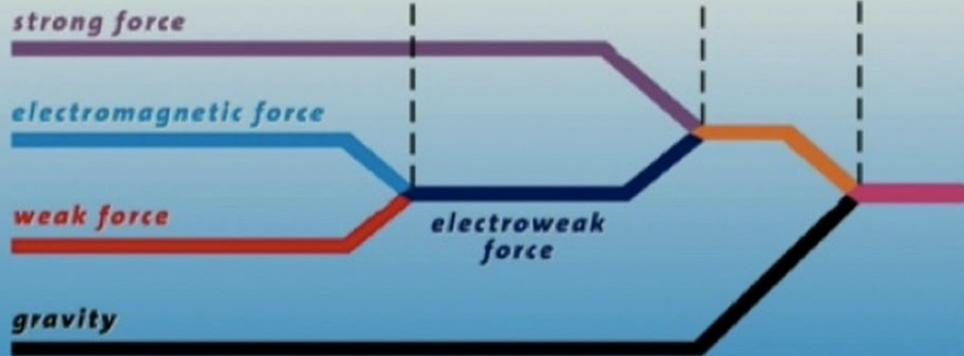
$(D_\mu \psi)_\alpha = \frac{1}{2} g_\alpha \psi + \frac{1}{2} g'_\alpha \psi$

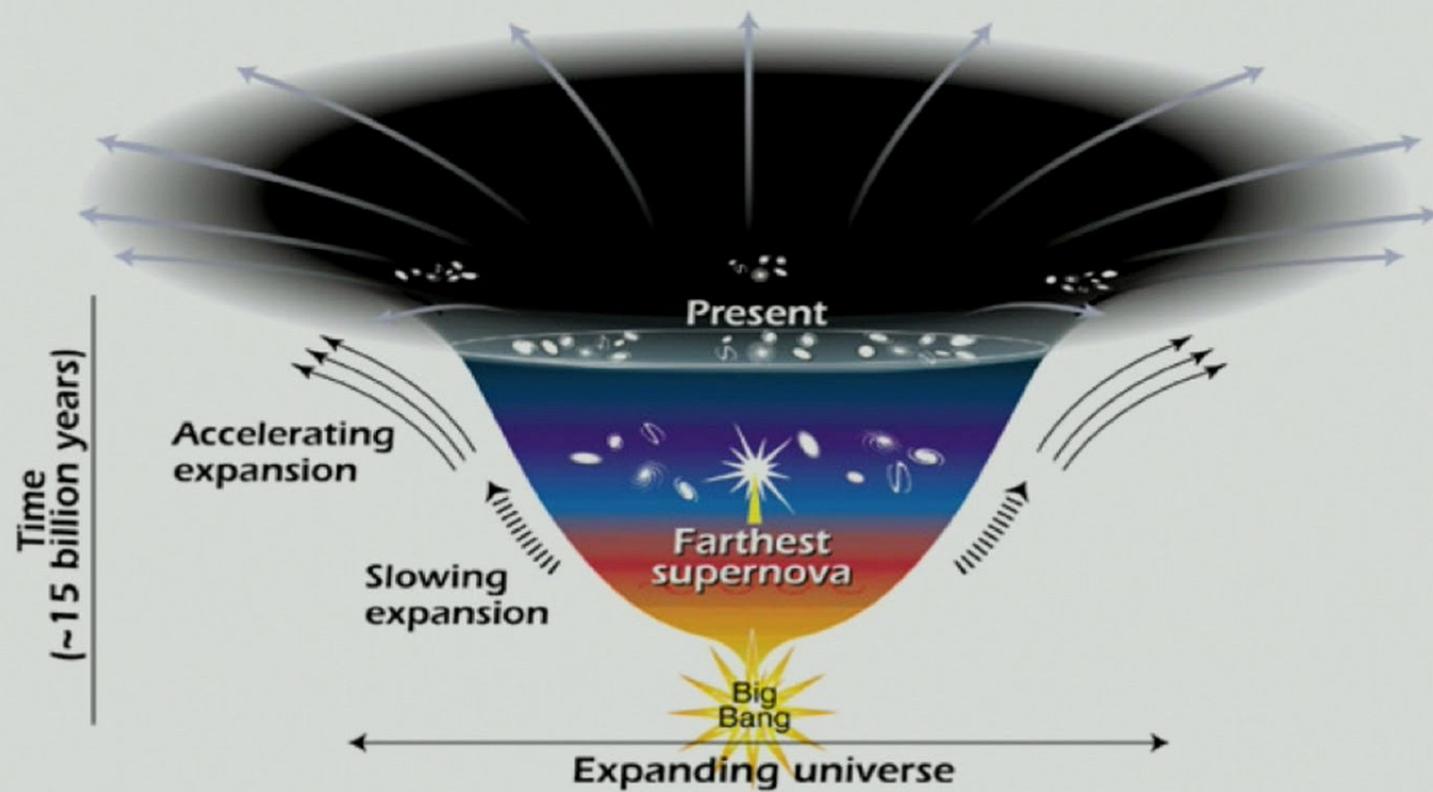


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big bang

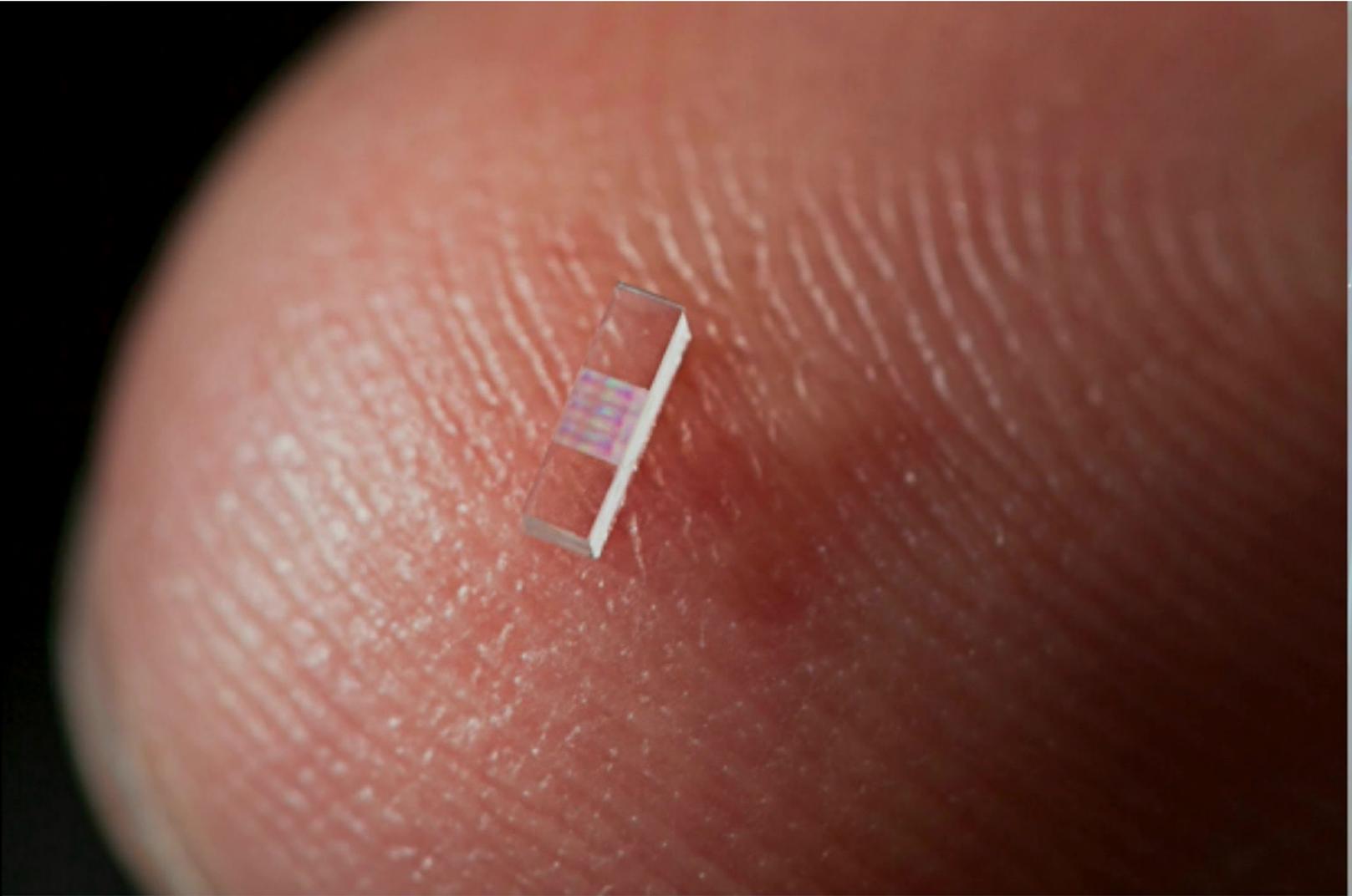




This diagram reveals changes in the rate of expansion since the universe's birth 15 billion years ago. The more shallow the curve, the faster the rate of expansion. The curve changes noticeably about 7.5 billion years ago, when objects in the universe began flying apart at a faster rate. Astronomers theorize that the faster expansion rate is due to a mysterious, dark force that is pushing galaxies apart.

Image: Ann Feild (STScI)





SLAC/Stanford

