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Galileo Galilei (1564-1642)

Sex^{mo} Principe.

Gulileo Galilei Humilis^o Seruo della Ser.^a V.^a inuigilan-
do assiduamente, et co ogni spirito p^o potere n^o solam^{te} satisfare
alcuno che tiene della lettura di Matematici nello stu-
dio di Padoua,

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lo nuovo artificio nel maggior segreto et solam^{te} a disposizione
di S. Ser.^a L'Occiale canato dalle piu uide speculazioni di
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p^o due hore et piu di tempo prima ch'egli scuopra noi et distinguendo
il numero et la qualita dei Vasselli giudicare le sue forze
pallottarsi alla caccia al combattimento o alla fuga, o pure anco
nella campagna aperta uedere et particolarmente distinguere ogni suo
moto et preparatione.

Adi 7. di Gennaio

Gione si uede asi

Adi 8 asi

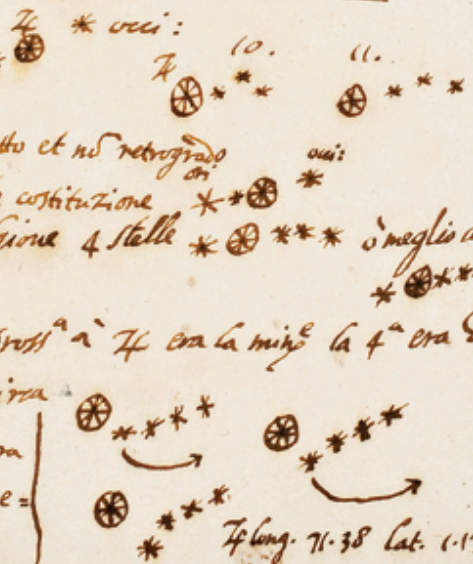
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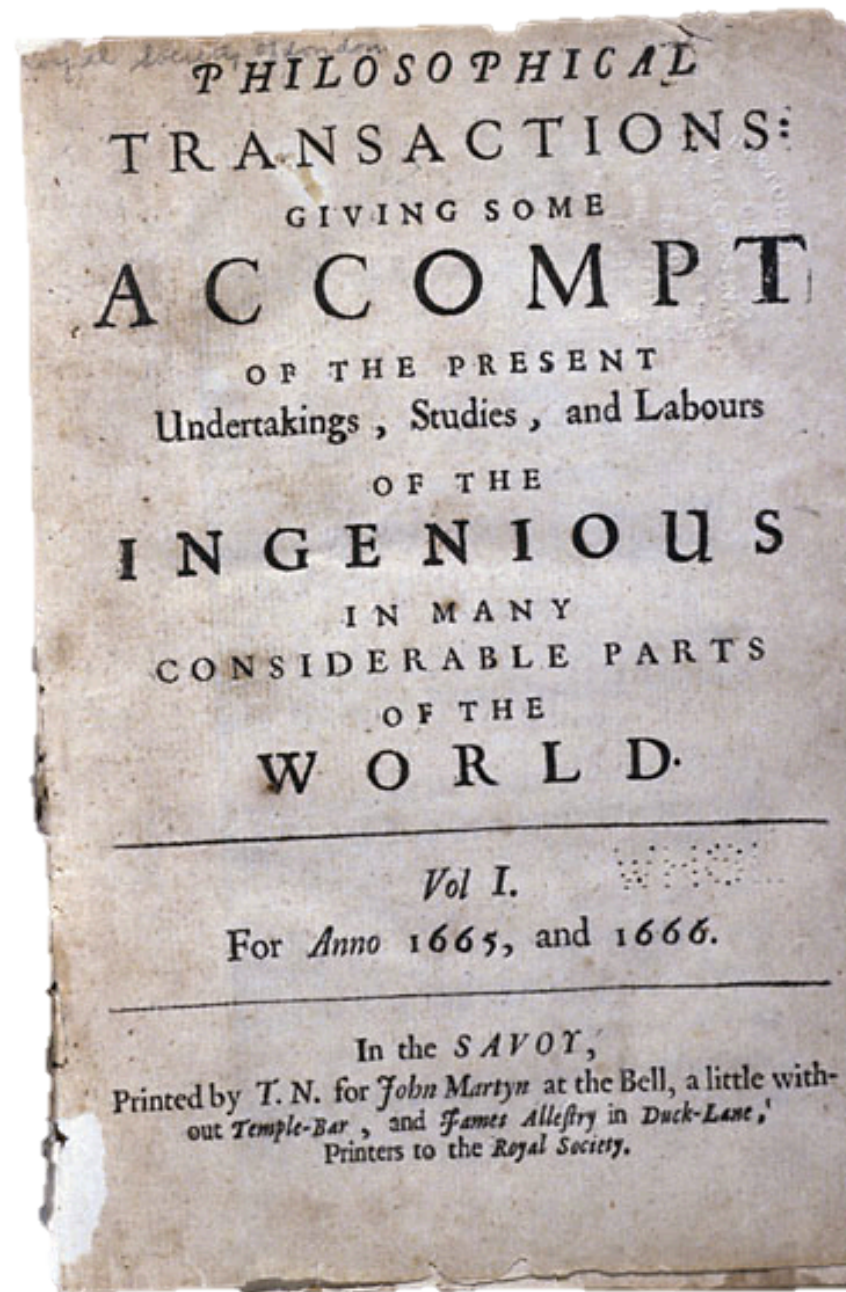




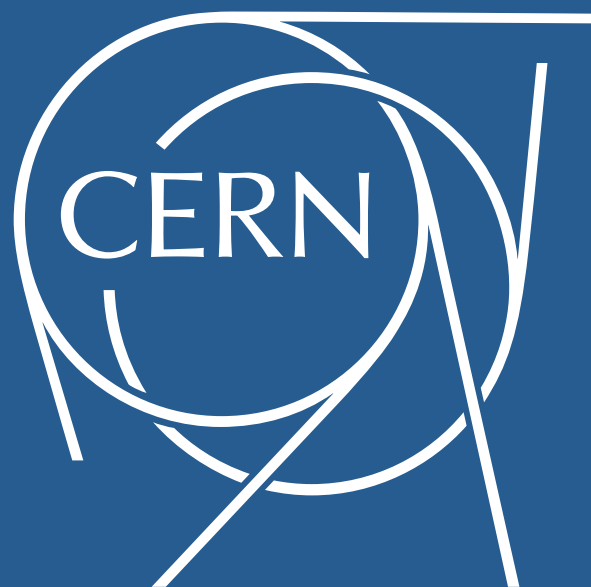
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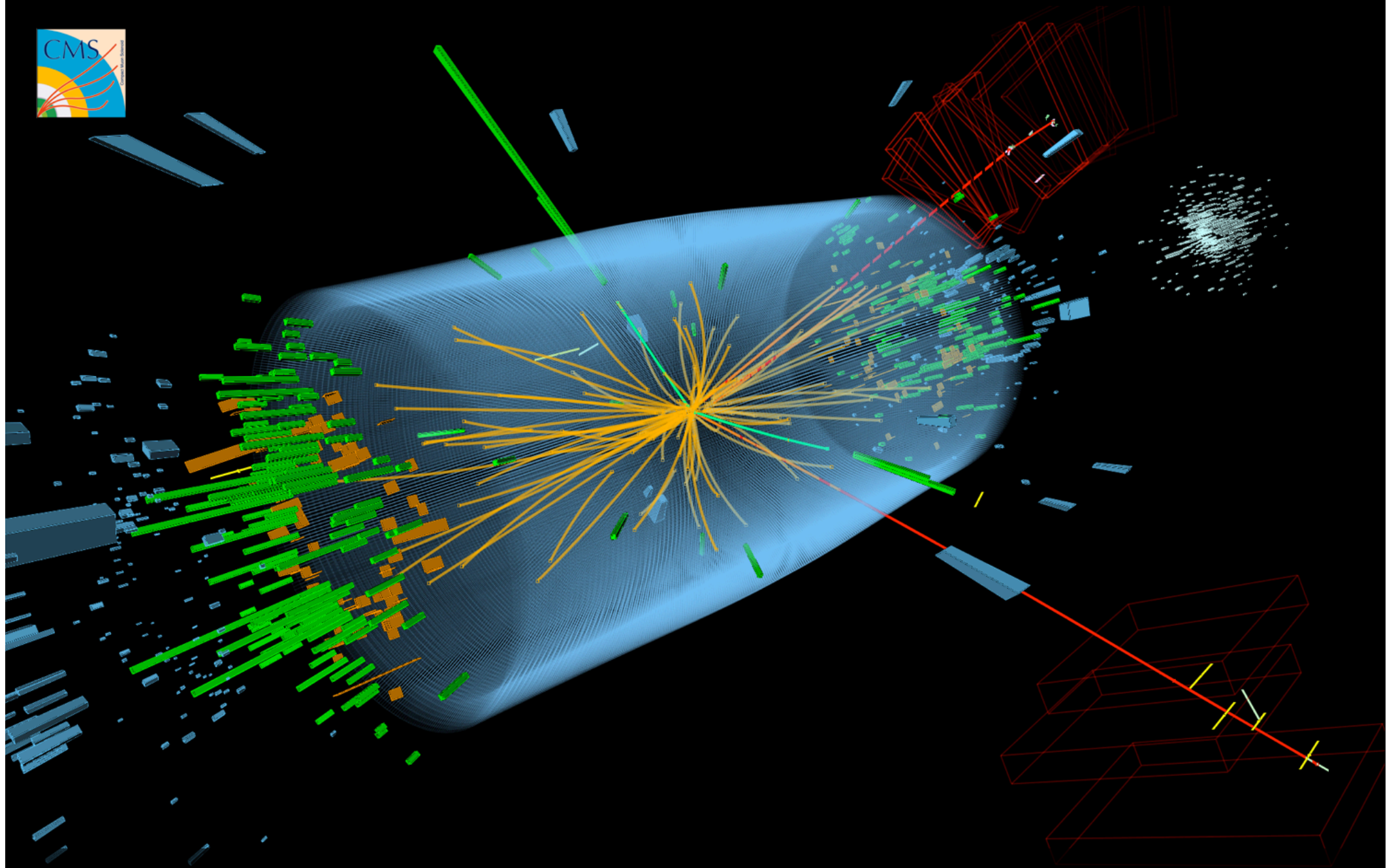
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Discovery of the Higgs boson


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[High Energy Physics – Experiment](#)

Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC

The [ATLAS Collaboration](#)

(Submitted on 31 Jul 2012 (v1), last revised 31 Aug 2012 (this version, v2))

A search for the Standard Model Higgs boson in proton-proton collisions with the ATLAS detector at the LHC is presented. The datasets used correspond to integrated luminosities of approximately 4.8 fb⁻¹ collected at sqrt(s) = 7 TeV in 2011 and 5.8 fb⁻¹ at sqrt(s) = 8 TeV in 2012. Individual searches in the channels H → ZZ^{*} → llll, H → gamma gamma and H → WW → e nu mu nu in the 8 TeV data are combined with previously published results of searches for H → ZZ^{*}, WW^{*}, bbbar and tau tau in the 7 TeV data and results from improved analyses of the H → ZZ^{*} → llll and H → gamma gamma channels in the 7 TeV data. Clear evidence for the production of a neutral boson with a measured mass of 126.0 ± 0.4(stat) ± 0.4(syst) GeV is presented. This observation, which has a significance of 5.9 standard deviations, corresponding to a background fluctuation probability of 1.7 × 10⁻⁹, is compatible with the production and decay of the Standard Model Higgs boson.

Comments: 24 pages plus author list (38 pages total), 12 figures, 7 tables, revised author list, matches version to appear in Physics Letters B
Subjects: High Energy Physics – Experiment (hep-ex)
Journal reference: Phys.Lett. B716 (2012) 1–29
DOI: [10.1016/j.physletb.2012.08.020](#)
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[High Energy Physics – Experiment](#)

Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LHC

The [CMS Collaboration](#)

(Submitted on 31 Jul 2012 (v1), last revised 28 Jan 2013 (this version, v2))

Results are presented from searches for the standard model Higgs boson in proton-proton collisions at sqrt(s) = 7 and 8 TeV in the Compact Muon Solenoid experiment at the LHC, using data samples corresponding to integrated luminosities of up to 5.1 inverse femtobarns at 7 TeV and 5.3 inverse femtobarns at 8 TeV. The search is performed in five decay modes: gamma gamma, ZZ, WW, tau tau, and b b-bar. An excess of events is observed above the expected background, with a local significance of 5.0 standard deviations, at a mass near 125 GeV, signalling the production of a new particle. The expected significance for a standard model Higgs boson of that mass is 5.8 standard deviations. The excess is most significant in the two decay modes with the best mass resolution, gamma gamma and ZZ; a fit to these signals gives a mass of 125.3 ± 0.4 (stat.) ± 0.5 (syst.) GeV. The decay to two photons indicates that the new particle is a boson with spin different from one.

Comments: Submitted to Phys. Lett. B
Subjects: High Energy Physics – Experiment (hep-ex)
Journal reference: Phys. Lett. B 716 (2012) 30
DOI: [10.1016/j.physletb.2012.08.021](#)
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Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC[☆]

ATLAS Collaboration^{*}

This paper is dedicated to the memory of our ATLAS colleagues who did not live to see the full impact and significance of their contributions to the experiment.

ARTICLE INFO

Article history:
Received 31 July 2012
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ABSTRACT

A search for the Standard Model Higgs boson in proton–proton collisions with the ATLAS detector at the LHC is presented. The datasets used correspond to integrated luminosities of approximately 4.8 fb^{-1} collected at $\sqrt{s} = 7 \text{ TeV}$ in 2011 and 5.8 fb^{-1} at $\sqrt{s} = 8 \text{ TeV}$ in 2012. Individual searches in the channels $H \rightarrow ZZ^{(*)} \rightarrow 4\ell$, $H \rightarrow \gamma\gamma$ and $H \rightarrow WW^{(*)} \rightarrow \ell\nu\mu\nu$ in the 8 TeV data are combined with previously published results of searches for $H \rightarrow ZZ^{(*)}$, $WW^{(*)}$, $b\bar{b}$ and $\tau^+\tau^-$ in the 7 TeV data and results from improved analyses of the $H \rightarrow ZZ^{(*)} \rightarrow 4\ell$ and $H \rightarrow \gamma\gamma$ channels in the 7 TeV data. Clear evidence for the production of a neutral boson with a measured mass of $126.0 \pm 0.4 \text{ (stat)} \pm 0.4 \text{ (sys)} \text{ GeV}$ is presented. This observation, which has a significance of 5.9 standard deviations, corresponding to a background fluctuation probability of 1.7×10^{-9} , is compatible with the production and decay of the Standard Model Higgs boson.

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1. Introduction

The Standard Model (SM) of particle physics [1–4] has been tested by many experiments over the last four decades and has been shown to successfully describe high energy particle interactions. However, the mechanism that breaks electroweak symmetry in the SM has not been verified experimentally. This mechanism [5–10], which gives mass to massive elementary particles, implies the existence of a scalar particle, the SM Higgs boson. The search for the Higgs boson, the only elementary particle in the SM that has not yet been observed, is one of the highlights of the Large Hadron Collider [11] (LHC) physics programme.

Indirect limits on the SM Higgs boson mass of $m_H < 158 \text{ GeV}$ at 95% confidence level (CL) have been set using global fits to precision electroweak results [12]. Direct searches at LEP [13], the Tevatron [14–16] and the LHC [17,18] have previously excluded, at 95% CL, a SM Higgs boson with mass below 600 GeV, apart from some mass regions between 116 GeV and 127 GeV.

Both the ATLAS and CMS Collaborations reported excesses of events in their 2011 datasets of proton–proton (pp) collisions at centre-of-mass energy $\sqrt{s} = 7 \text{ TeV}$ at the LHC, which were compatible with SM Higgs boson production and decay in the mass region 124–126 GeV, with significances of 2.9 and 3.1 standard deviations (σ), respectively [17,18]. The CDF and DØ experiments at the Tevatron have also recently reported a broad excess in the mass region

120–135 GeV; using the existing LHC constraints, the observed local significances for $m_H = 125 \text{ GeV}$ are 2.7σ for CDF [14], 1.1σ for DØ [15] and 2.8σ for their combination [16].

The previous ATLAS searches in $4.6\text{--}4.8 \text{ fb}^{-1}$ of data at $\sqrt{s} = 7 \text{ TeV}$ are combined here with new searches for $H \rightarrow ZZ^{(*)} \rightarrow 4\ell$,¹ $H \rightarrow \gamma\gamma$ and $H \rightarrow WW^{(*)} \rightarrow \ell\nu\mu\nu$ in the $5.8\text{--}5.9 \text{ fb}^{-1}$ of pp collision data taken at $\sqrt{s} = 8 \text{ TeV}$ between April and June 2012.

The data were recorded with instantaneous luminosities up to $6.8 \times 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$; they are therefore affected by multiple pp collisions occurring in the same or neighbouring bunch crossings (pile-up). In the 7 TeV data, the average number of interactions per bunch crossing was approximately 10; the average increased to approximately 20 in the 8 TeV data. The reconstruction, identification and isolation criteria used for electrons and photons in the 8 TeV data are improved, making the $H \rightarrow ZZ^{(*)} \rightarrow 4\ell$ and $H \rightarrow \gamma\gamma$ searches more robust against the increased pile-up. These analyses were re-optimised with simulation and frozen before looking at the 8 TeV data.

In the $H \rightarrow WW^{(*)} \rightarrow \ell\nu\ell\nu$ channel, the increased pile-up deteriorates the event missing transverse momentum, E_T^{miss} , resolution, which results in significantly larger Drell–Yan background in the same-flavour final states. Since the $e\mu$ channel provides most of the sensitivity of the search, only this final state is used in the analysis of the 8 TeV data. The kinematic region in which a SM Higgs boson with a mass between 110 GeV and 140 GeV is



Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LHC[☆]

CMS Collaboration^{*}

CERN, Switzerland

This paper is dedicated to the memory of our colleagues who worked on CMS but have since passed away. In recognition of their many contributions to the achievement of this observation.

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ABSTRACT

Results are presented from searches for the standard model Higgs boson in proton–proton collisions at $\sqrt{s} = 7$ and 8 TeV in the Compact Muon Solenoid experiment at the LHC, using data samples corresponding to integrated luminosities of up to 5.1 fb^{-1} at 7 TeV and 5.3 fb^{-1} at 8 TeV. The search is performed in five decay modes: $\gamma\gamma$, ZZ, W^+W^- , $\tau^+\tau^-$, and $b\bar{b}$. An excess of events is observed above the expected background, with a local significance of 5.0 standard deviations, at a mass near 125 GeV, signalling the production of a new particle. The expected significance for a standard model Higgs boson of that mass is 5.8 standard deviations. The excess is most significant in the two decay modes with the best mass resolution, $\gamma\gamma$ and ZZ ; a fit to these signals gives a mass of $125.3 \pm 0.4 \text{ (stat.)} \pm 0.5 \text{ (syst.)} \text{ GeV}$. The decay to two photons indicates that the new particle is a boson with spin different from one.

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1. Introduction

The standard model (SM) of elementary particles provides a remarkably accurate description of results from many accelerator and non-accelerator based experiments. The SM comprises quarks and leptons as the building blocks of matter, and describes their interactions through the exchange of force carriers: the photon for electromagnetic interactions, the W and Z bosons for weak interactions, and the gluons for strong interactions. The electromagnetic and weak interactions are unified in the electroweak theory. Although the predictions of the SM have been extensively confirmed, the question of how the W and Z gauge bosons acquire mass whilst the photon remains massless is still open.

Nearly fifty years ago it was proposed [1–6] that spontaneous symmetry breaking in gauge theories could be achieved through the introduction of a scalar field. Applying this mechanism to the electroweak theory [7–9] through a complex scalar doublet field leads to the generation of the W and Z masses, and to the prediction of the existence of the SM Higgs boson (H). The scalar field also gives mass to the fundamental fermions through the Yukawa interaction. The mass m_H of the SM Higgs boson is not predicted by theory. However, general considerations [10–13] suggest that

m_H should be smaller than $\sim 1 \text{ TeV}$, while precision electroweak measurements imply that $m_H < 152 \text{ GeV}$ at 95% confidence level (CL) [14]. Over the past twenty years, direct searches for the Higgs boson have been carried out at the LEP collider, leading to a lower bound of $m_H > 114.4 \text{ GeV}$ at 95% CL [15], and at the Tevatron proton–antiproton collider, excluding the mass range 162–166 GeV at 95% CL [16] and detecting an excess of events, recently reported in [17–19], in the range 120–135 GeV.

The discovery or exclusion of the SM Higgs boson is one of the primary scientific goals of the Large Hadron Collider (LHC) [20]. Previous direct searches at the LHC were based on data from proton–proton collisions corresponding to an integrated luminosity of 5 fb^{-1} collected at a centre-of-mass energy $\sqrt{s} = 7 \text{ TeV}$. The CMS experiment excluded at 95% CL a range of masses from 127 to 600 GeV [21]. The ATLAS experiment excluded at 95% CL the ranges 111.4–116.6, 119.4–122.1 and 129.2–541 GeV [22]. Within the remaining allowed mass region, an excess of events near 125 GeV was reported by both experiments. In 2012 the proton–proton centre-of-mass energy was increased to 8 TeV and by the end of June an additional integrated luminosity of more than 5 fb^{-1} had been recorded by each of these experiments, thereby enhancing significantly the sensitivity of the search for the Higgs boson.

This Letter reports the results of a search for the SM Higgs boson using samples collected by the CMS experiment, comprising data recorded at $\sqrt{s} = 7$ and 8 TeV. The search is performed in

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^{*} E-mail address: atlas.publications@cern.ch.

¹ The symbol ℓ stands for electrons or muons.

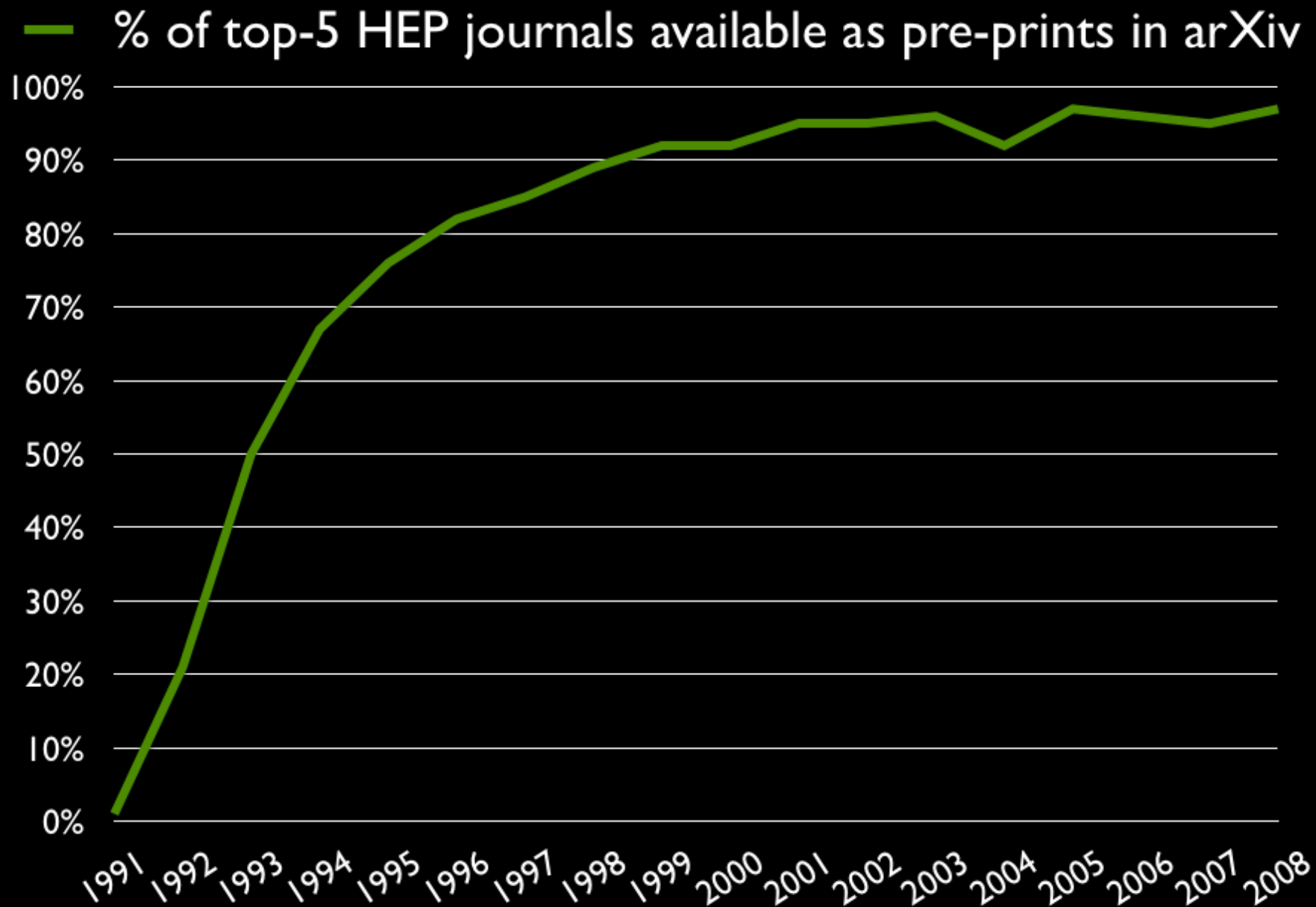
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^{*} E-mail address: cms-publication-committee-chair@cern.ch.

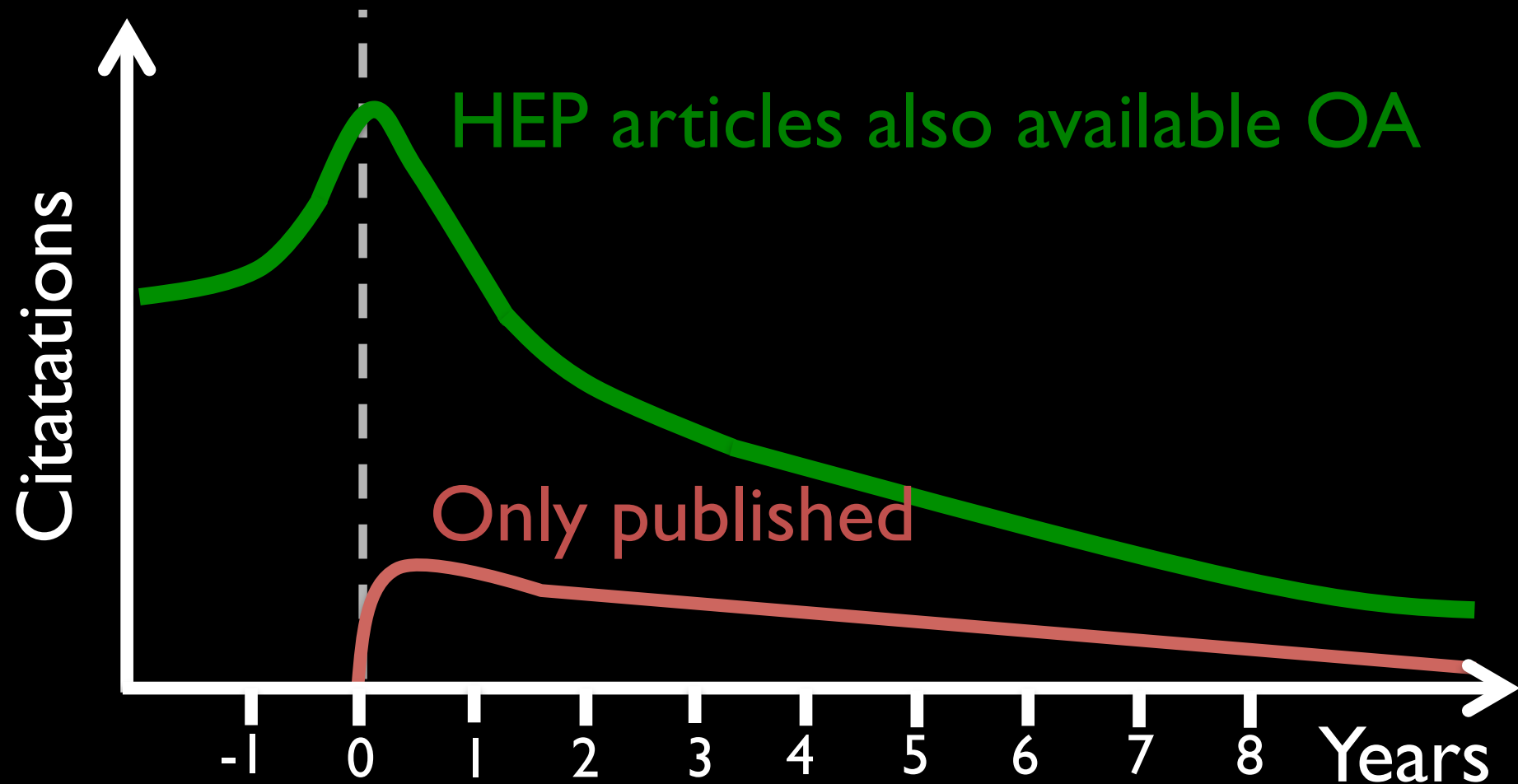


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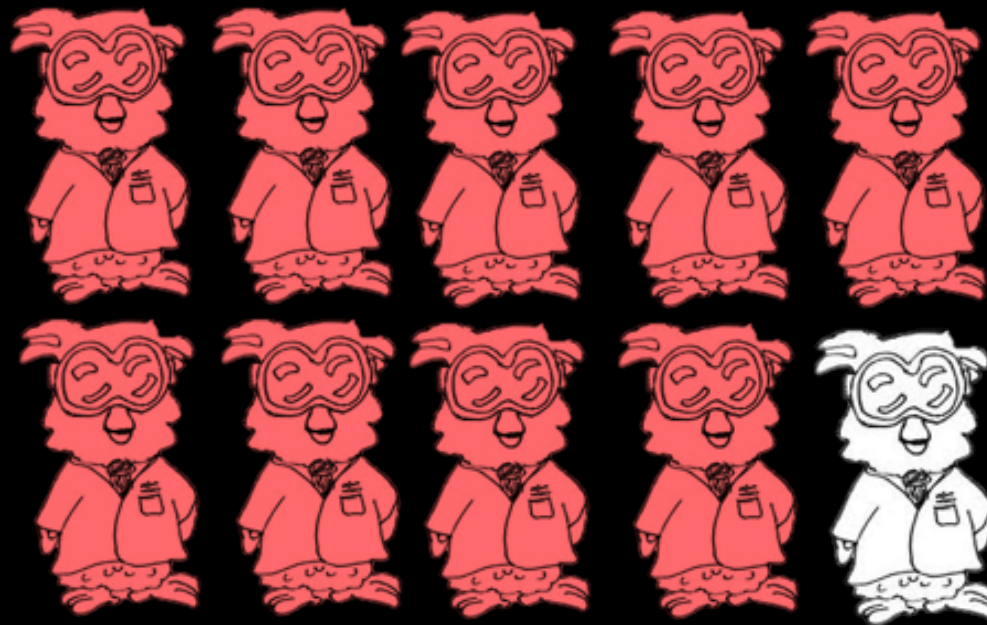


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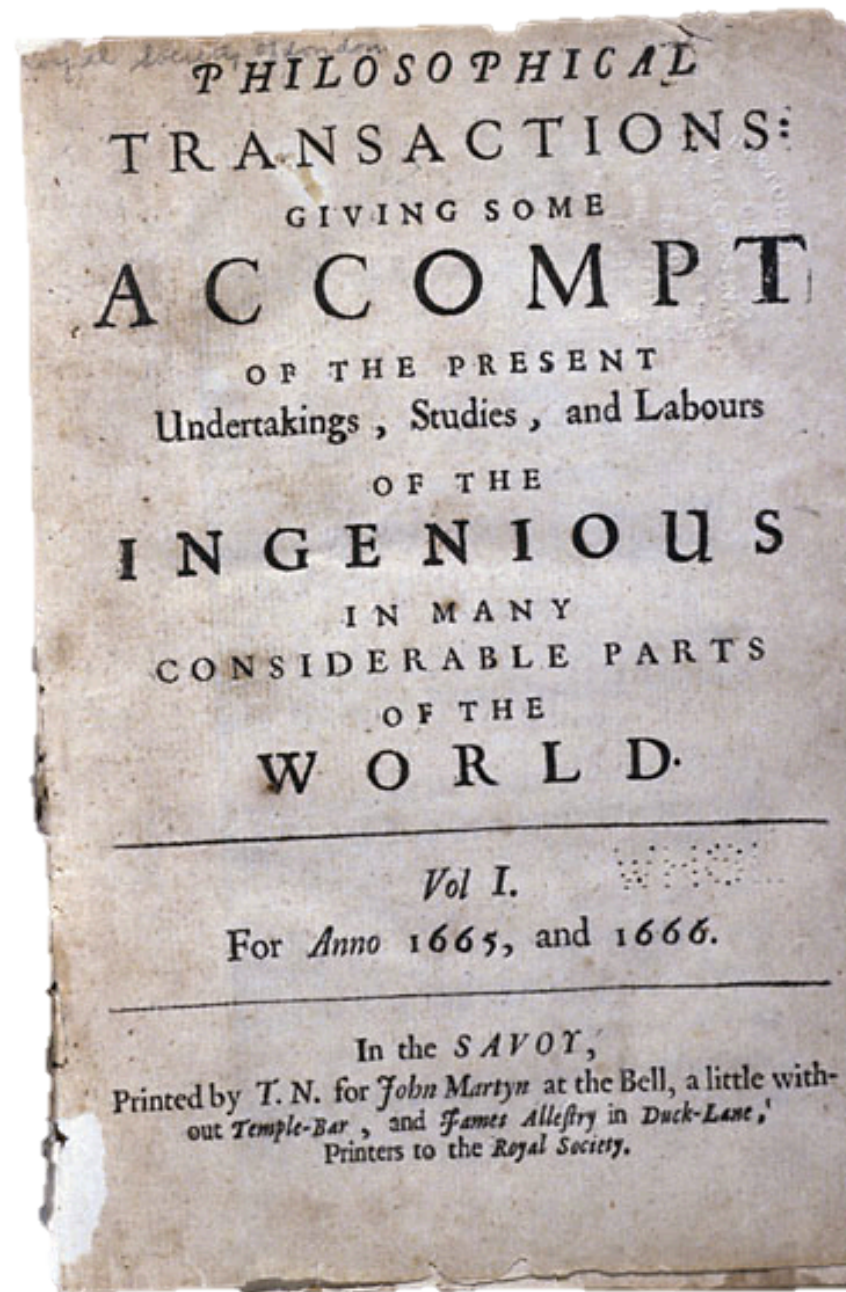


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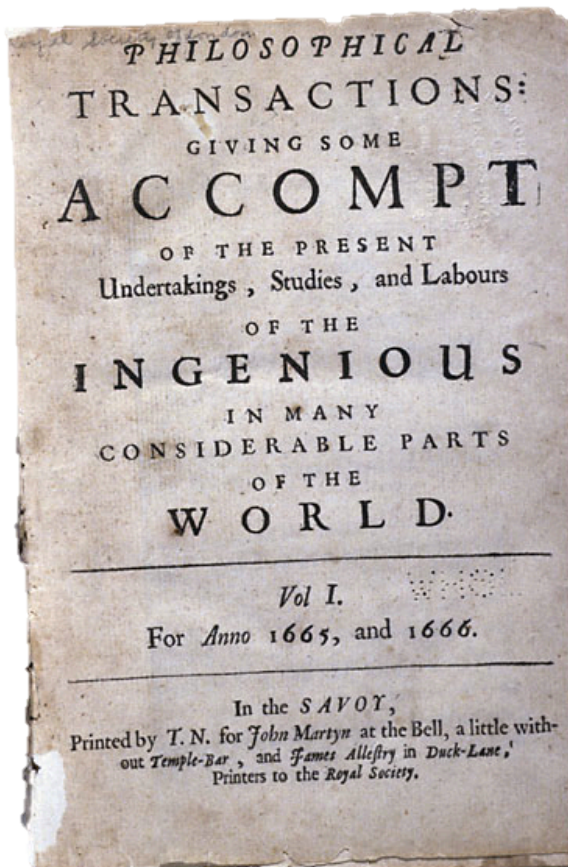
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High Energy Physics - Experiment

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Comments: 24 pages plus author list (38 pages total), 12 figures, 7 tables, revised author list, matches version to appear in Physics Letters B

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Physics Letters B 716 (2012) 1-29

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Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC^{*}

ATLAS Collaboration^{*}

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Both the ATLAS and CMS Collaborations reported excesses of events in their 2011 datasets of proton-proton (pp) collisions at centre-of-mass energy sqrt(s) = 7 TeV at the LHC, which were compatible with SM Higgs boson production and decay in the mass region 124-126 GeV, with significances of 2.9 and 3.1 standard deviations (sigma), respectively [17,18]. The CD0 and D0 experiments at the Tevatron have also recently reported a broad excess in the mass region 120-135 GeV, using the existing LHC constraints, the observed local significances for m_H = 125 GeV are 2.7sigma for CD0 [14], 1.1sigma for D0 [15] and 2.8sigma for their combination [16].

The previous ATLAS searches in 4.6-4.8 fb⁻¹ of data at sqrt(s) = 7 TeV are combined here with new searches for H -> ZZ(*) -> 4l, H -> gamma gamma and H -> WW(*) -> e nu mu nu in the 5.8-5.9 fb⁻¹ of pp collision data taken at sqrt(s) = 8 TeV between April and June 2012.

The data were recorded with instantaneous luminosities up to 6.8 x 10³¹ cm⁻²s⁻¹; they are therefore affected by multiple pp collisions occurring in the same or neighbouring bunch crossings (pile-up). In the 7 TeV data, the average number of interactions per bunch crossing was approximately 10; the average increased to approximately 20 in the 8 TeV data. The reconstruction, identification and isolation criteria used for electrons and photons in the 8 TeV data are improved, making the H -> ZZ(*) -> 4l and H -> gamma gamma searches more robust against the increased pile-up. These analyses were re-optimised with simulation and frozen before looking at the 8 TeV data.

In the H -> WW(*) -> e nu mu nu channel, the increased pile-up deteriorates the event missing transverse momentum, E_T^{miss}, resolution, which results in significantly larger Drell-Yan background in the same-flavour final states. Since the eta eta channel provides most of the sensitivity of the search, only this final state is used in the analysis of the 8 TeV data. The kinematic region in which a SM Higgs boson with a mass between 110 GeV and 140 GeV is

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[†] The symbol sigma stands for electron or muon.

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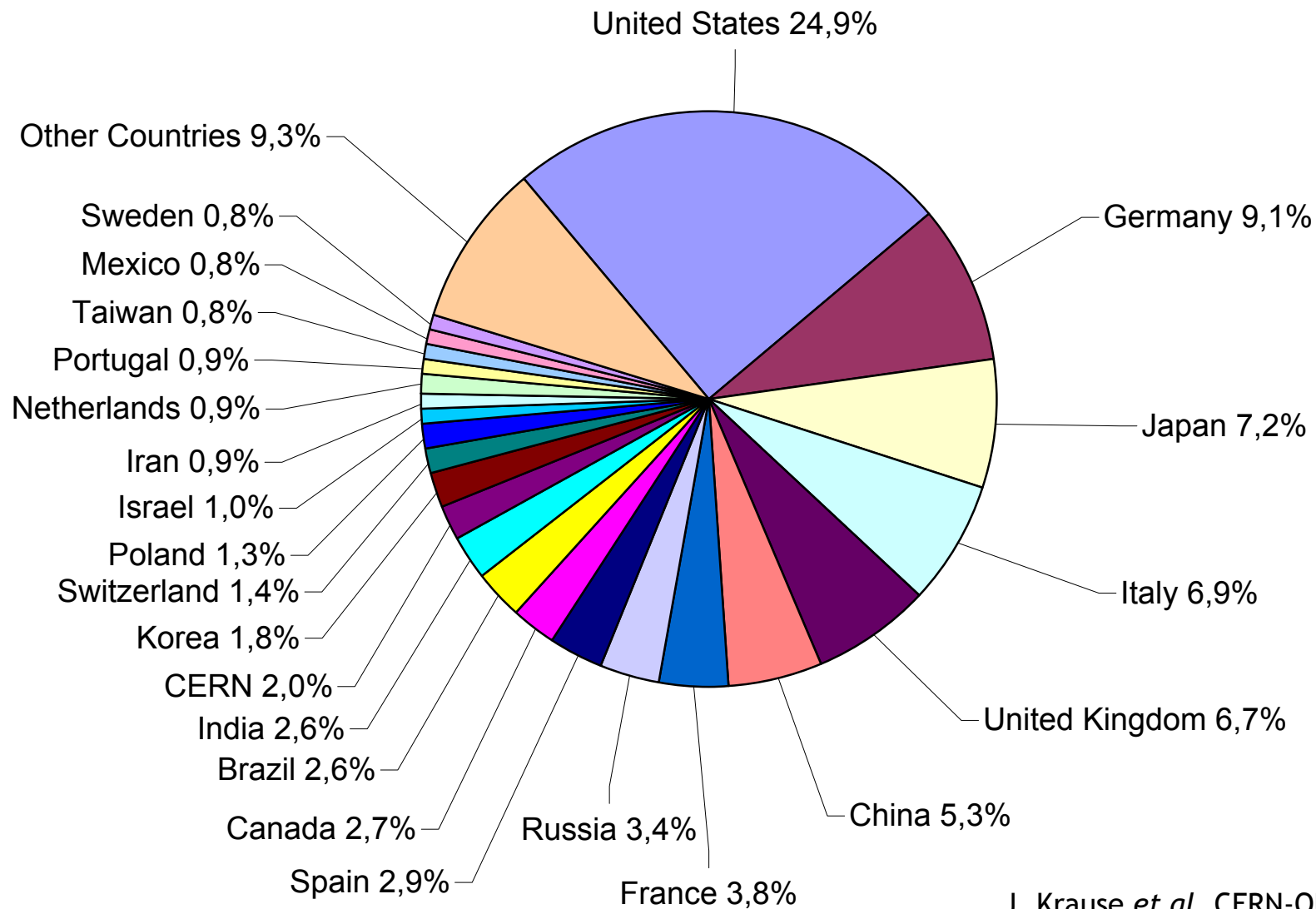
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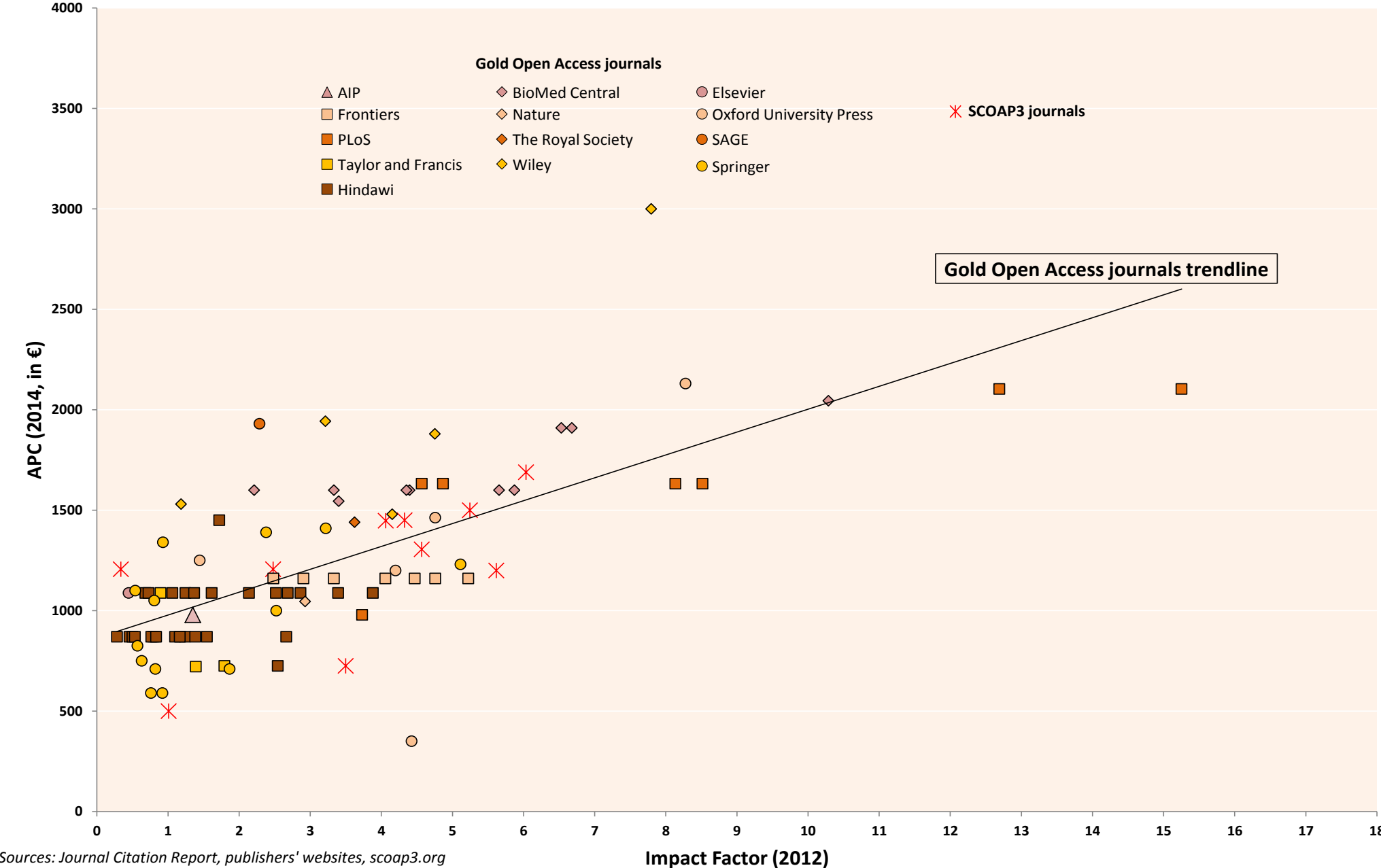
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2500+ libraries (being) credited millions €

1110€ average projected 2014 APC

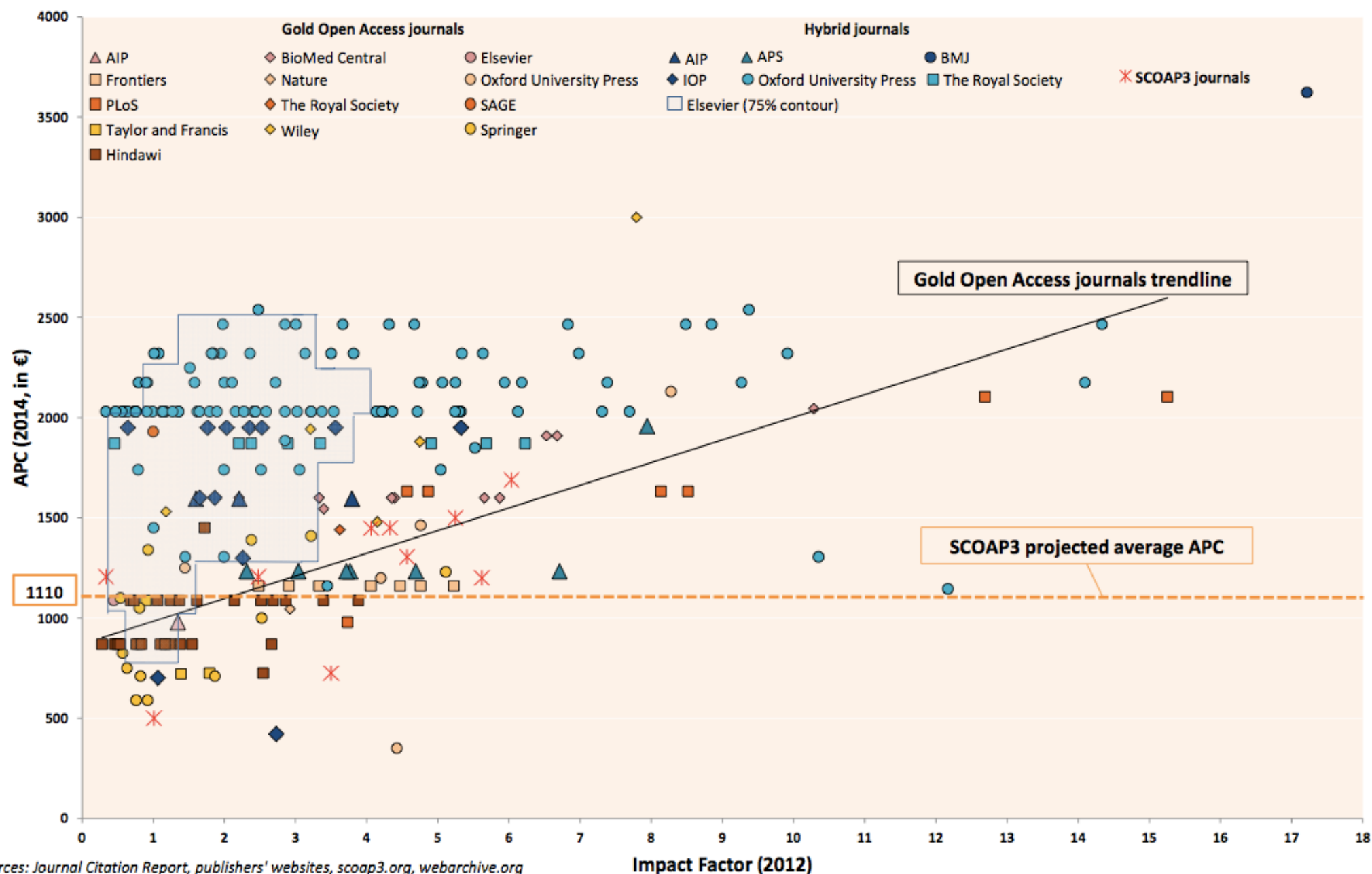
SCOAP3 APC compared with Gold Open Access APC/Impact Factor



SCOAP3 APC compared with Hybrid Open Access APC/Impact Factor



SCOAP3 APC compared with OA Gold/Hybrid journals/Impact factors



3627 articles since Jan 1st 2014

423 articles: at least 1 Japanese author

41 partners in **42** countries

82 countries with authors benefiting

2500+ libraries (being) credited millions €

1110€ average projected 2014 APC

ありがとう



scoap3.org

Salvatore.Mele@cern.ch