Is the Current Process to Select Big Projects Appropriate?

Hitoshi Murayama (UC Berkeley, Kavli IPMU Tokyo)

SCJ Symposium “Exploring new horizon in Astronomy & Astrophysics”

Different Systems

US, Europe, Japan

Disclaimer: vastly oversimplified
based on my impressions

US system

US system

- Massive battles among proponents
- choose three ground-based, three space projects as the highest priorities
- typically only 1~2 funded in the end
- but the community stands behind the priorities
- losers wait out till the next decadal survey
- interesting “forced marriages” among projects from different subfields
  - WFIRST: dark energy, exoplanets, infrared astrophysics
- Report to the funding agencies
- yet funding not guaranteed, subject to Congress
- approved projects may be killed later

European system

メッテルニヒ

ウィーン会議の風刺画「会議は踊る」 1814年9月から，フランス革命とナポレオン戦争後のヨーロッパの秩序を再建するためにウィーン会議が開かれた。議長はオーストリア外相(のちの首相)メッテルニヒ。列強の利害が錯綜(さくそう)する一方，舞踏会や宴会にあけくれたので，**「会議は踊る，されど進まず」**と皮肉(ひにく)られた。メッテルニヒは1848年の二月革命で失脚するまでヨーロッパの保守反動体制の中心人物であった。

European system

- can achieve big projects because of contributions of many countries
- consensus based decisions
- funding agencies from all participating countries must agree
- all scientists must agree on the management model
- a lot of diplomatic skills needed, takes time
- difficult to take risks?
- Report to the funding agencies
- funding pretty much guaranteed if approved

Japanese system

Japanese system

- Guerrilla war
- not massive projects like US, Europe
- find niche with good nose
- sometimes risky, sometimes fails
- very small teams working incredibly hard
- yet often good payoff
- SCJ Master Plan does not report to funding agencies, a self-defined process
  - no analysis of costs and funding profile
  - no prioritization among projects on the master plan
- Yet followed by MEXT roadmap study
- no guarantee for funding
- funding levels “stable”

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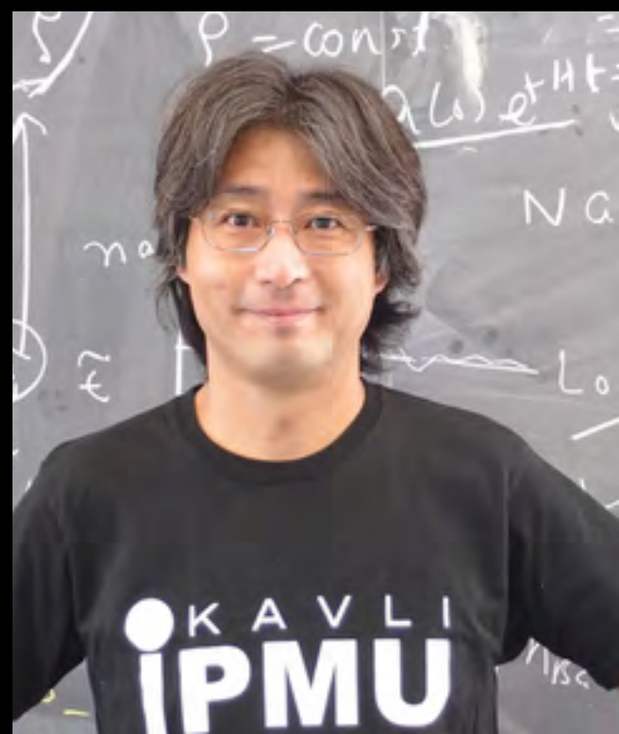
No! It’s broke.

Evidence #1

WPI

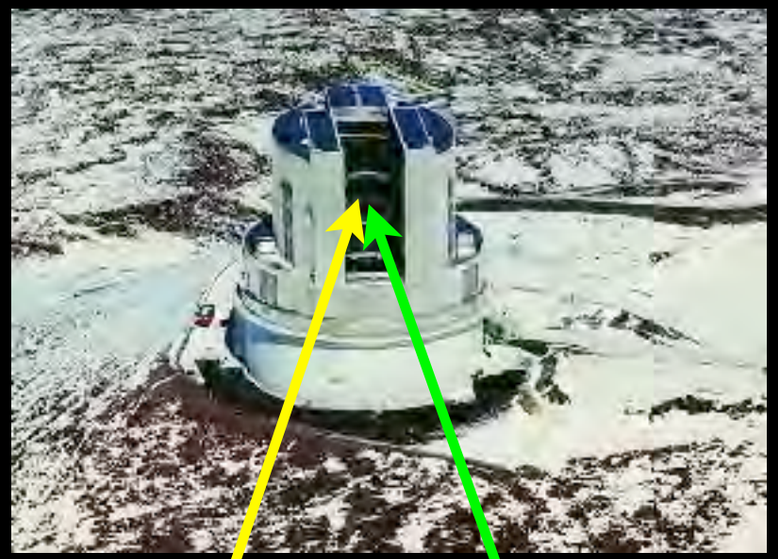
- Government solicited proposals to fund ~¥130okuyen over 10 years to create new international research institutes
- 33 proposals in 2007
- 5 chosen
- One of them was awarded to somebody with
  - no management experience
  - no working experience in Japan
  - completely useless research
  - at the age of 42
- and he didn't want to do it



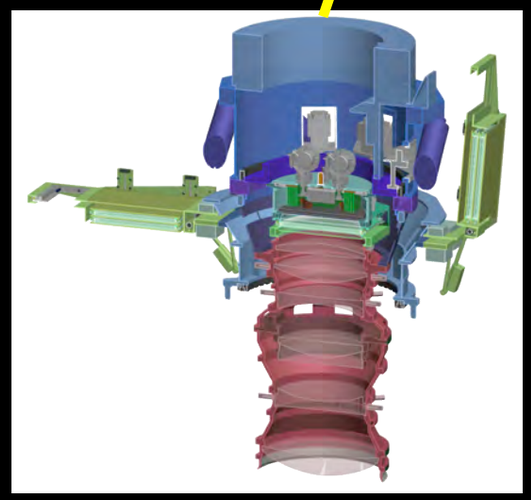
Evidence #2

SuMIRe

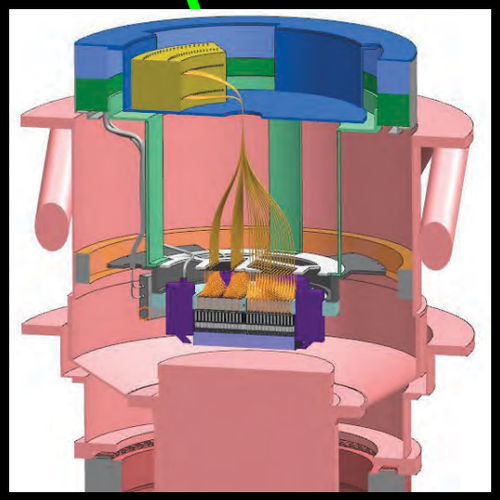
- a 5+5 year survey program
- exploiting FOV ~1.5° of 8.2m Subaru
- Imaging with Hyper-SuprimeCam (HSC)
  - 870M pixels
  - ~20M galaxy images, 1400 sq. deg.
  - 2014–2019, 300 nights
- spectroscopy with PrimeFocusSpectrograph (PFS) ≠ PSF
  - 2400 optical fibers
  - ~4M redshifts
  - 2020–2025? 300 nights?
- *like SDSS on 8.2m telescope!*



Subaru



HSC



PFS

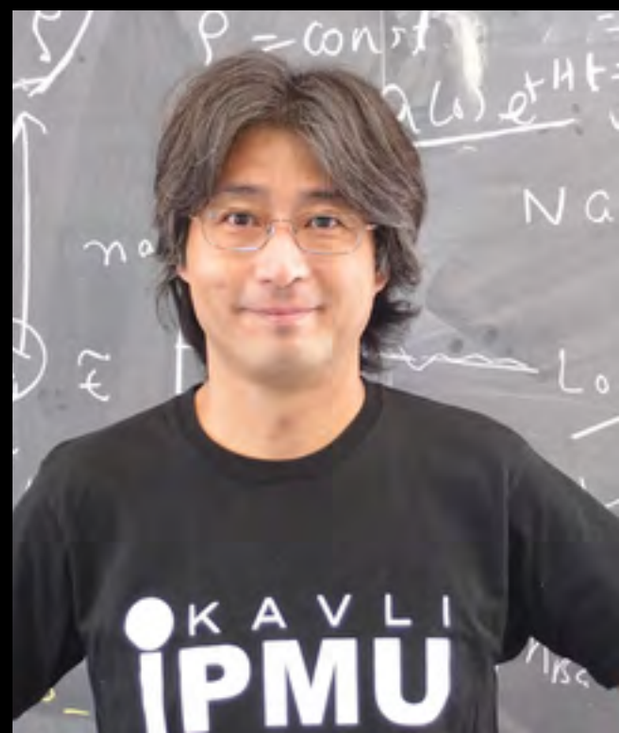
Not on Master Plan

- SCJ didn’t create Master Plans before 2010
- It was discussed by Subaru Advisory Committee, Subaru Users Meeting, and also graded as one of “medium-size projects” by the SCJ astrophysics and astronomy group
- No formal approval process within the community

FIRST

FIRST PROGRAM 最先端研究開発支援プログラム
Funding Program for World-Leading Innovative R&D on Science and Technology

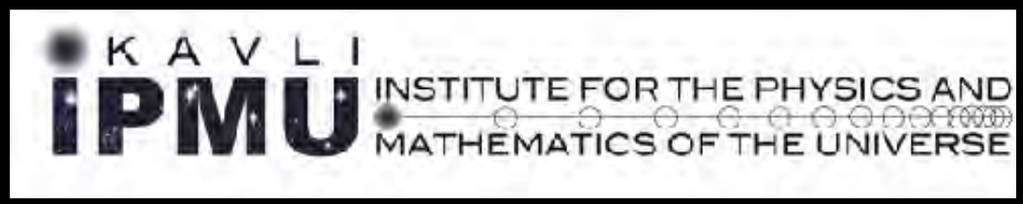
- Economic Stimulus Package after Lehman shock
- ¥3000 okuyen to 30 scientists
- 565 proposals in July 2019
- 90 chosen for presentation in August 2019
- SuMIRe 5th from the bottom
- Awarded to somebody
  - not an astronomer
  - no project management experience
  - only a half time in Japan
- And he didn’t want to do it



funding

- 9/5/2009: approved
- 9/16/2009: Hatoyama cabinet
- 10/17/2009: massive cuts
- 3/29/2010: 32 okuyen award
- 6/1/2010: 2 okuyen “boost”
- divide up
  - HSC 12 okuyen
  - PFS 22 okuyen
- cf. PFS turned out to be about 80 okuyen

HSC collaboration



PFS collaboration

PFS collaboration

Caltech

NASA Jet Propulsion Laboratory
California Institute of Technology

国立天文台 NAOJ

ACADEMIA SINICA 中央研究院 1928

PRINCETON UNIVERSITY

Max-Planck-Institut
für Astrophysik

KAVLI IPMU INSTITUTE FOR THE PHYSICS AND MATHEMATICS OF THE UNIVERSE

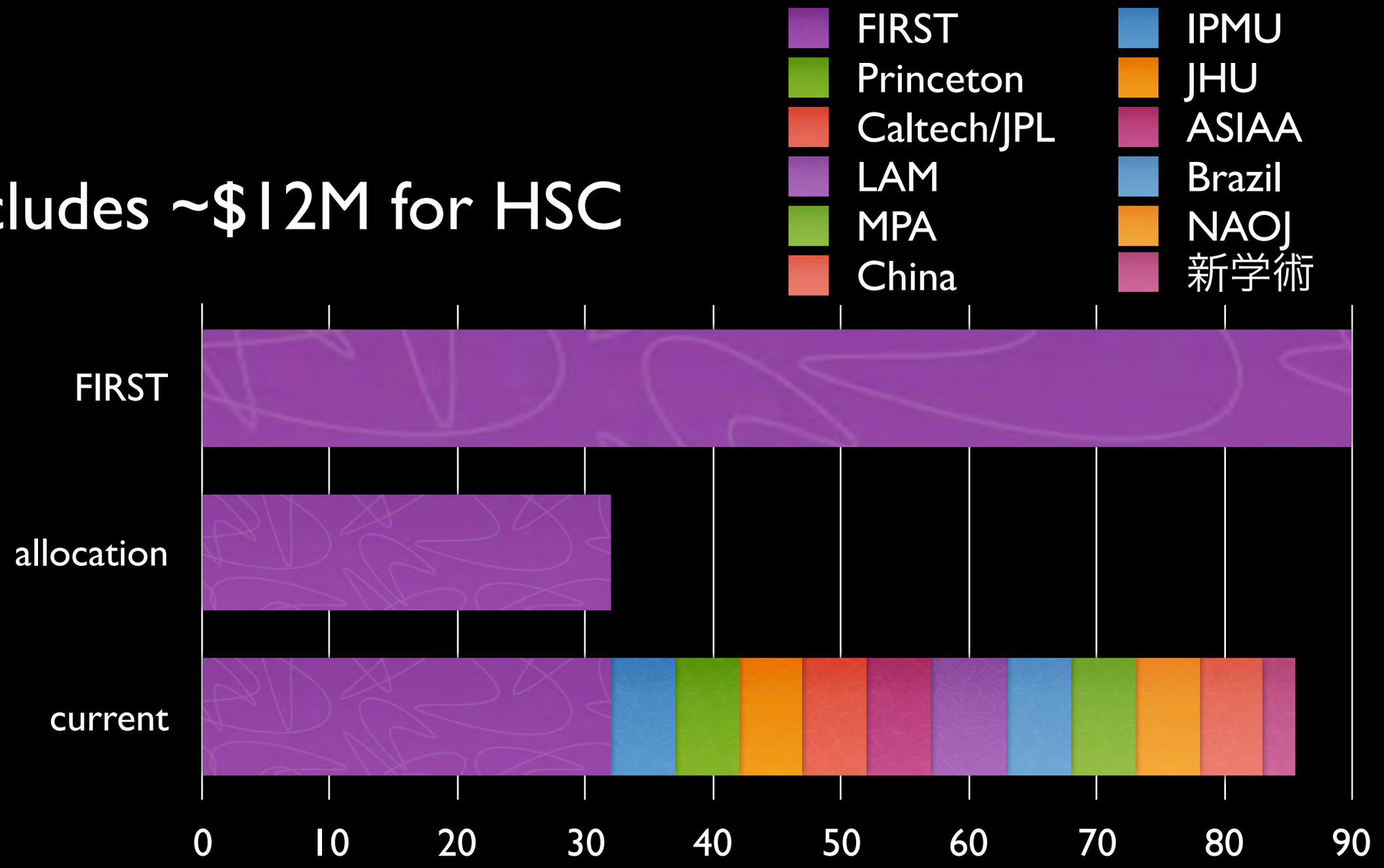
LNA LABORATÓRIO NACIONAL DE ASTROFÍSICA

LAM
LABORATOIRE D'ASTROPHYSIQUE DE MARSEILLE

JOHNS HOPKINS UNIVERSITY

budget recovery

includes ~$12M for HSC



Lessons

- Japanese system is not as rigorous as US
  - which may be sometimes good
- proposals are rather sketchy
  - can be adjusted and refined later
- The bigger the proposal, the less expertise on selection committee
  - easy-to-understand presentation is the key
- Sometimes decision seems somewhat random
- decision process may not look transparent
- It also means opportunities
- decisions can be quick in some cases
- need to be ready to grab opportunities

Falling into cracks?

- Traditional wavelength-based contingents
  - can diminish creativity
  - not suitable for multi-messenger science
- Current groups:
  - 宇宙電波懇談会
  - 光学赤外線天文連絡会
  - 宇宙線研究者会議
  - 高エネルギー宇宙物理連絡会
  - 太陽研究者連絡会
  - 理論懇談会
- demolish them? (Kaifu)
- Perhaps add 「その他懇」？

Big vs Small

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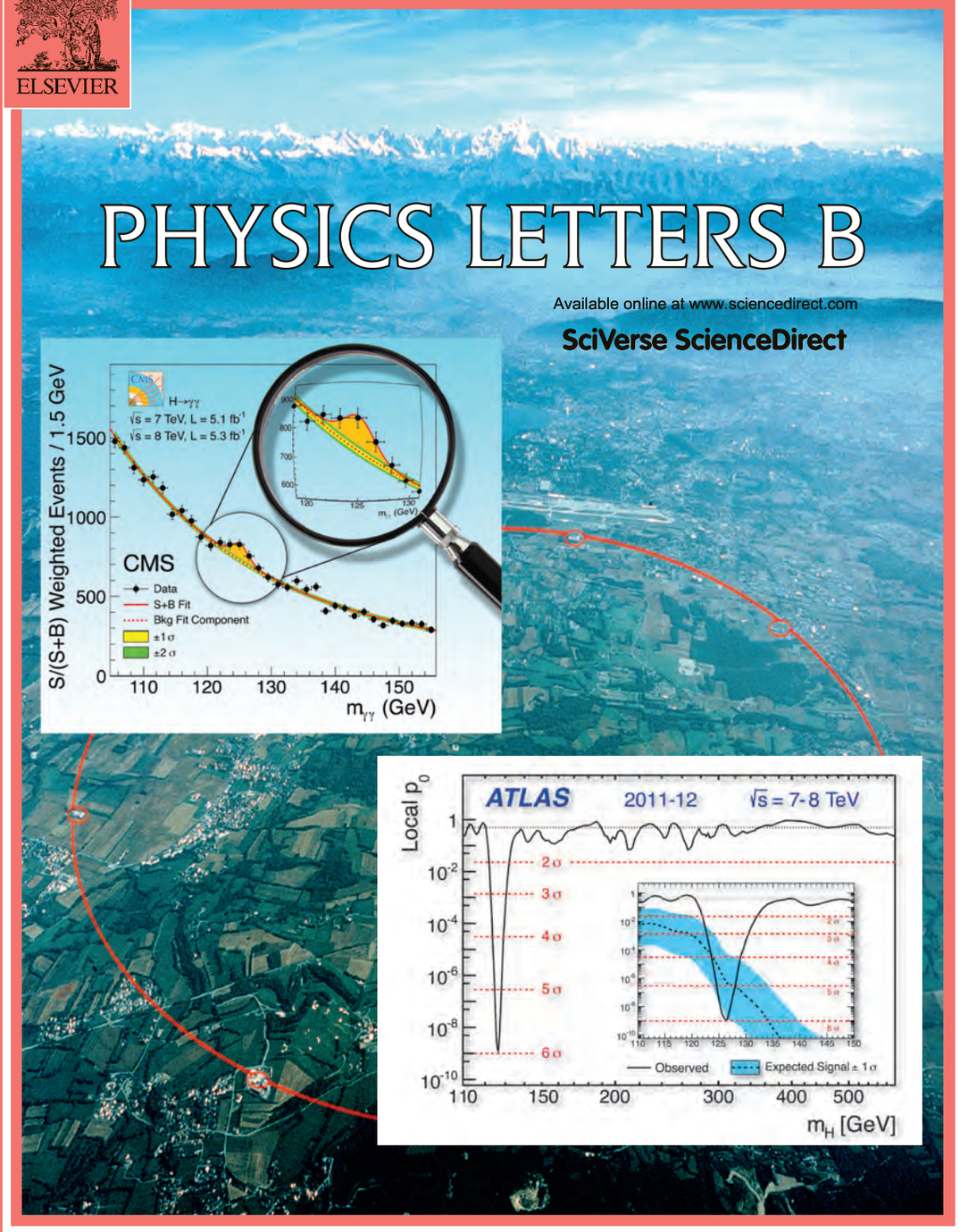

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Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC ☆

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.

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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 $\sqrt{s} = 7$ TeV in 2011 and 5.8 fb^{-1} at $\sqrt{s} = 8$ TeV in 2012. Individual searches in the channels $H \to ZZ^{(*)} \to 4\ell$, $H \to \gamma\gamma$ and $H \to WW^{(*)} \to e\nu\mu\nu$ in the 8 TeV data are combined with previously published results of searches for $H \to ZZ^{(*)}$, $WW^{(*)}$, $b\bar{b}$ and $\tau^+\tau^-$ in the 7 TeV data and results from improved analyses of the $H \to ZZ^{(*)} \to 4\ell$ and $H \to \gamma\gamma$ 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 (sys) 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.

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 $m_H < 158$ 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 $\sqrt{s} = 7$ 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 $m_H = 125$ GeV are 2.7σ for CDF [14], 1.1σ for DØ [15] and 2.8σ for their combination [16].

The previous ATLAS searches in 4.6–4.8 fb^{-1} of data at $\sqrt{s} = 7$ TeV are combined here with new searches for $H \to ZZ^{(*)} \to 4\ell$,[1] $H \to \gamma\gamma$ and $H \to WW^{(*)} \to e\nu\mu\nu$ 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 6.8×10^{33} cm^{-2} 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 $H \to ZZ^{(*)} \to 4\ell$ and $H \to \gamma\gamma$ 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 $H \to WW^{(*)} \to \ell\nu\ell\nu$ channel, the increased pile-up deteriorates the event missing transverse momentum, $E_{\mathrm{T}}^{\mathrm{miss}}$, 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

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[1] The symbol ℓ stands for electron or muon.

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Big Projects

- HSC ~150
- LIGO ~1000
- LHC ~4000
- Can young people shine in big groups?
- Too long lead time for graduate students?
- Yet most research done by small teams 3~10
- young people do find their own topics once vast shared data obtained
- Need *staggered* projects, combination of big and small

Fixed Budget

Fixed Budget

Small Projects

Big Projects

- No bigger projects possible?
- end of small projects?

Fixed Budget

Small Projects

Big Projects

- No bigger projects possible?
- end of small projects?

Comments

- Yes, big projects are squeezing small ones
- Yes, big projects are getting more expensive
- Yet people can always find their own space
- Japanese guerrilla war system seems to have advantages for small and medium size projects
- big ones can come smaller with technology

Consensus?

- Need a good balance between big and small
- make sure to avoid favoritism to “establishment”
  - but exploit input of “wise men/women”
- need more transparency
  - yet avoid bureaucratic overhead, heavy reviews
- need clear priorities
- don’t keep changing funding programs
  - need stability to have long-term view
- Don’t fight with other fields over funding
  - keep arguing for boosting whole science
  - education & outreach crucial for basic science

Never stop dreaming!