KAVLI IPMU INSTITUTE FOR THE PHYSICS AND MATHEMATICS OF THE UNIVERSE

東京大学 THE UNIVERSITY OF TOKYO

Kavli IPMU

Hitoshi Murayama

NNN2013 @ Kavli IPMU

KAVLI IPMU

Oct 2007

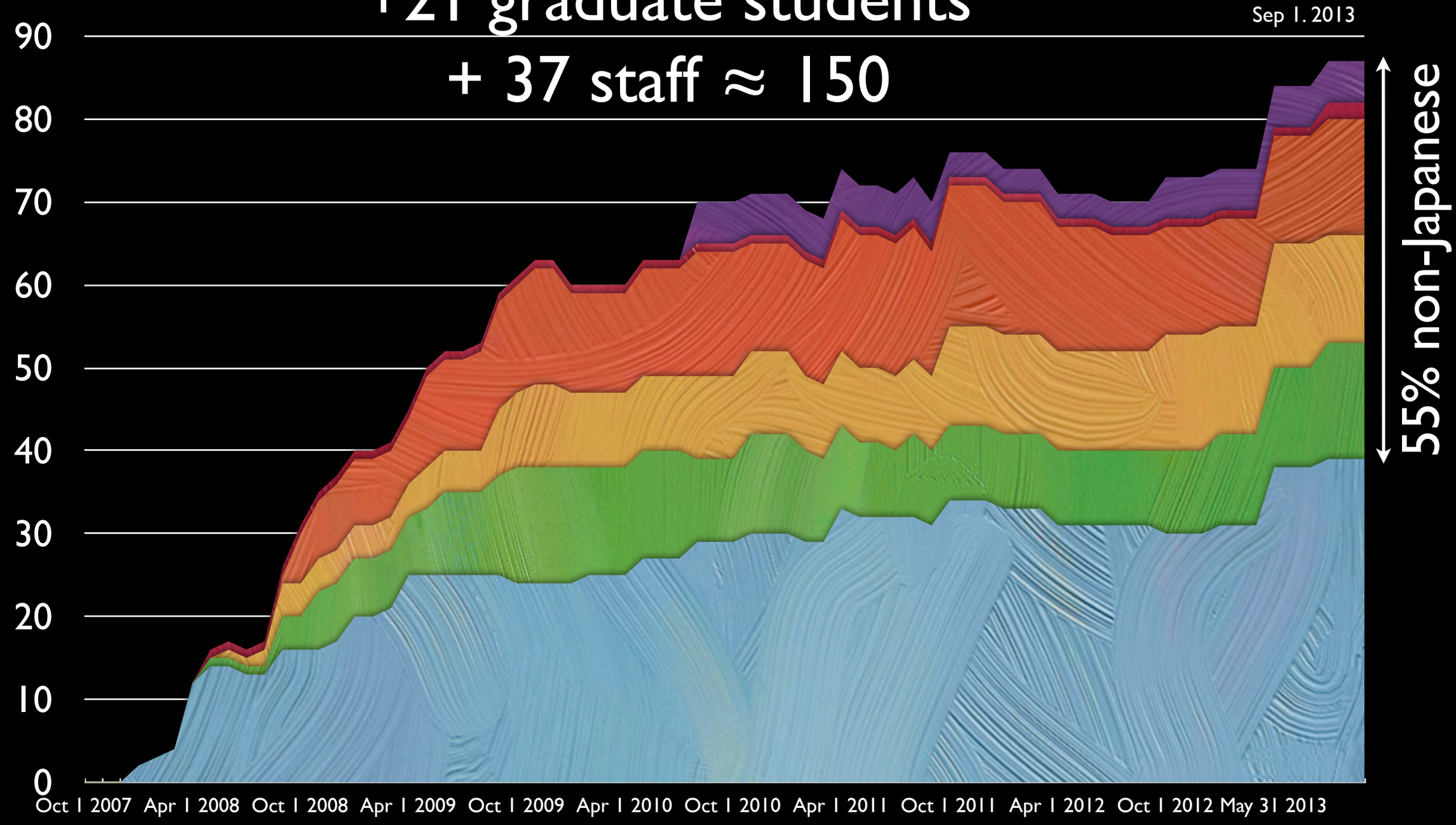
Oct 2013

KAVLI IPMU

Full-time Scientists paid by IPMU

+21 graduate students

+ 37 staff ≈ 150



*Argentina, Canada, Chile

new assistant profs

Alexie Leauthaud (lensing & cosmology), Feb 1
from Berkeley, *competed against Portsmouth*
first female faculty member

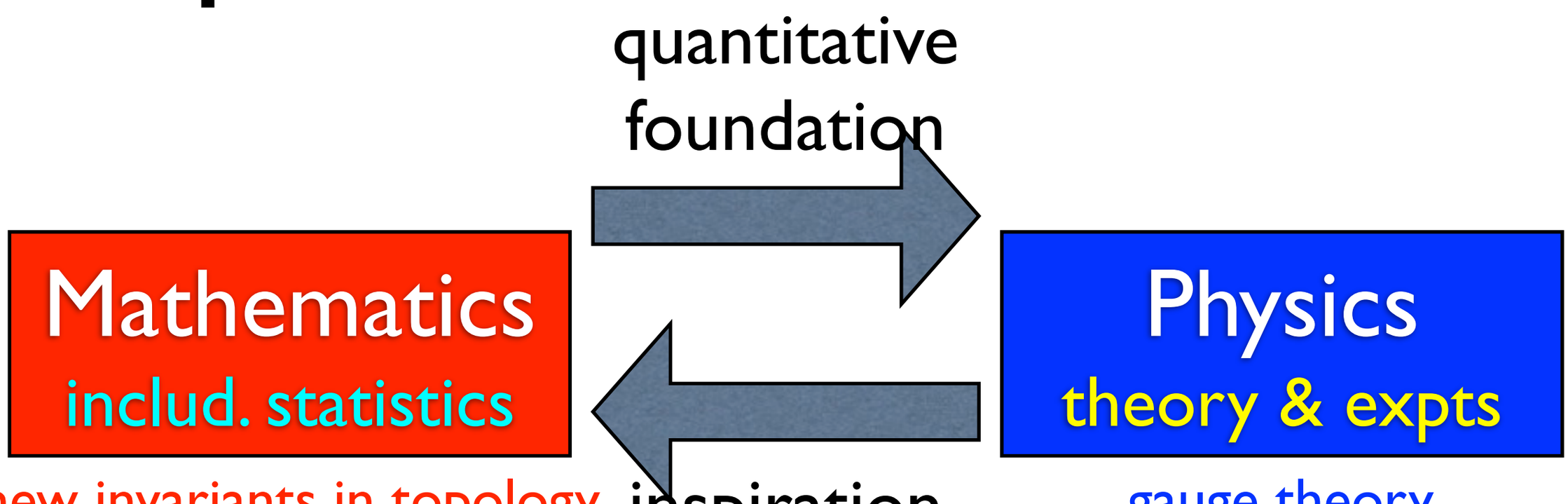
Masahito Yamazaki (string theory), Jun 1
from Princeton

Mark Hartz (neutrino experiment), Jun 15
from Toronto, *competed against Fermilab*
joint tenure track with TRIUMF, Canada

Nao Suzuki (supernova & Lyα cosmology), Sep 1
from Berkeley

We attract first-rate faculty!

Mathematics and Physics promote each other



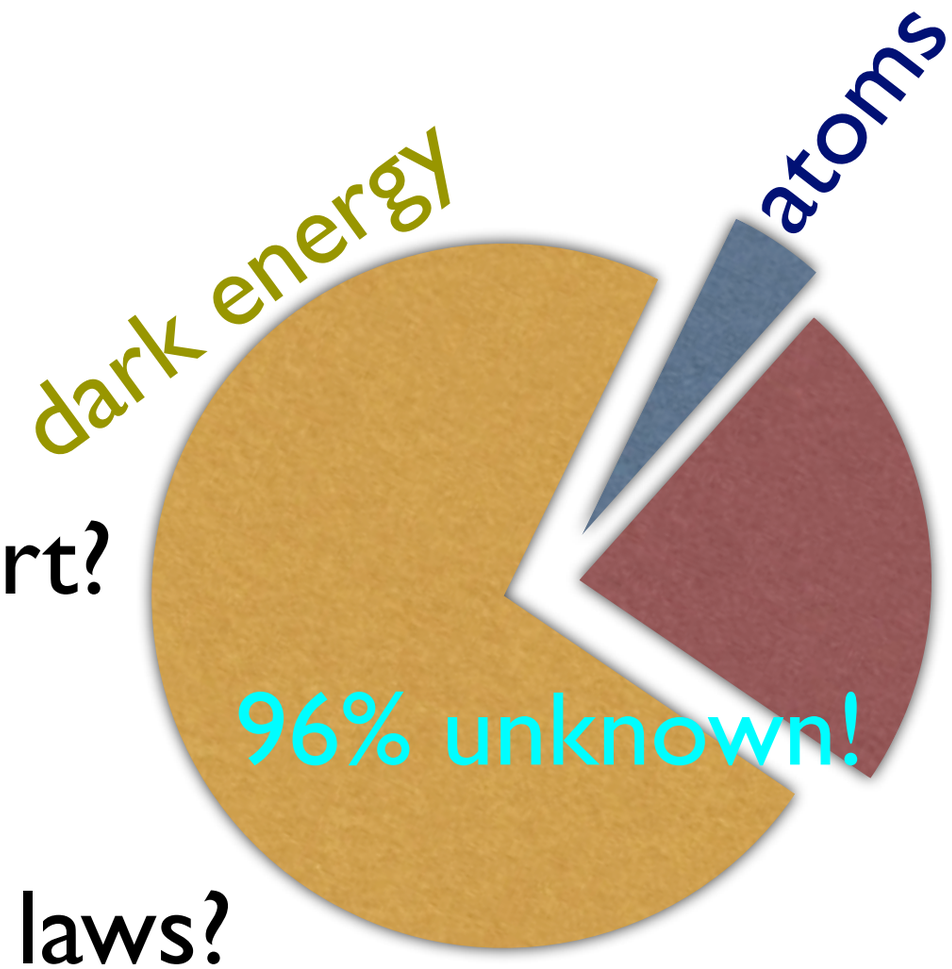
7 out of 18 Fields Medals since 1990 were inspired by particle physics

growing field!

Nobel prizes in 1999, 2002, 2004, 2006

The Science

- How did the Universe start?
- What is it made of?
- What is its fate?
- What are its fundamental laws?
- Why do we exist?

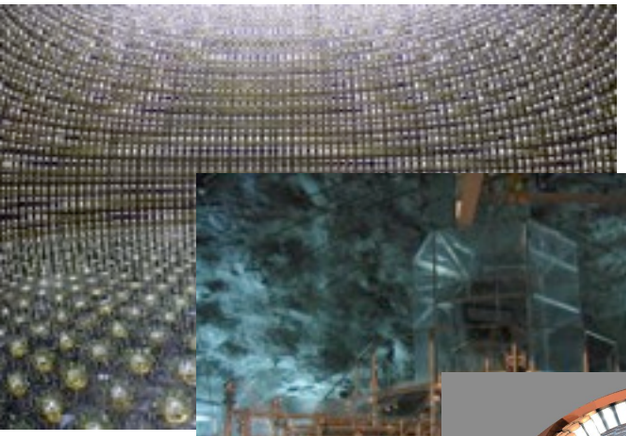


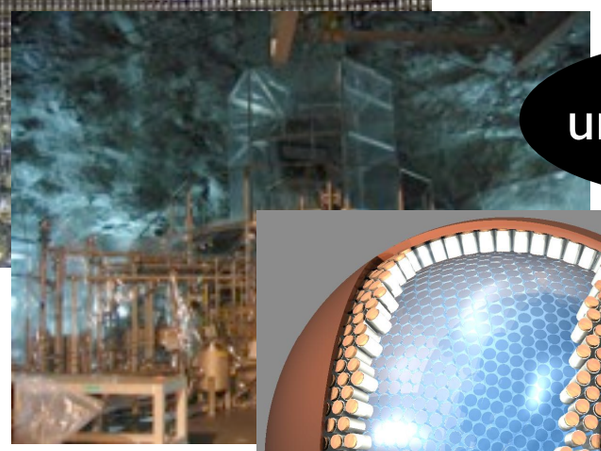
We need new data to address them

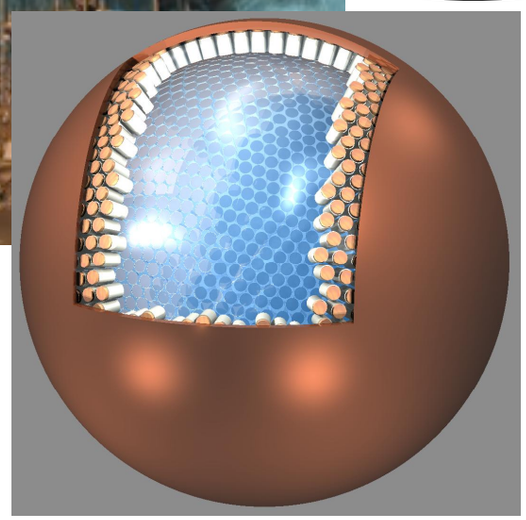
We need both new mathematics and new physics to describe them

Multi-faceted attack on the universe

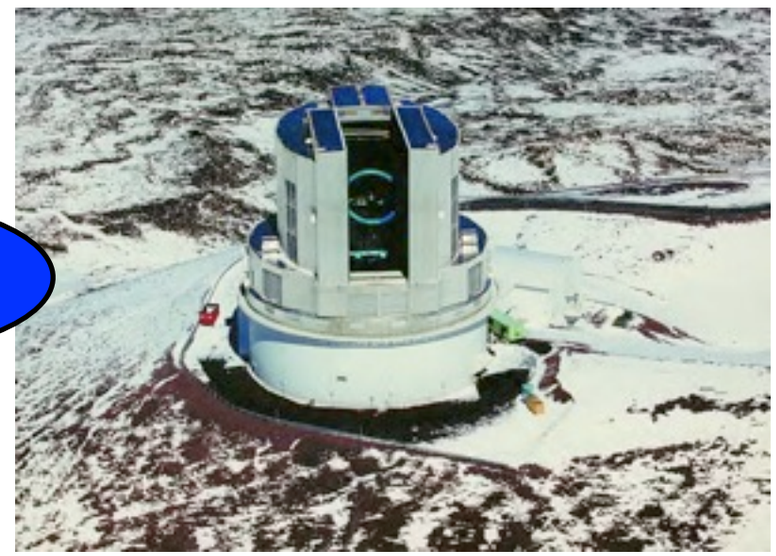
Together with math and theory, *unique* combination in the world!



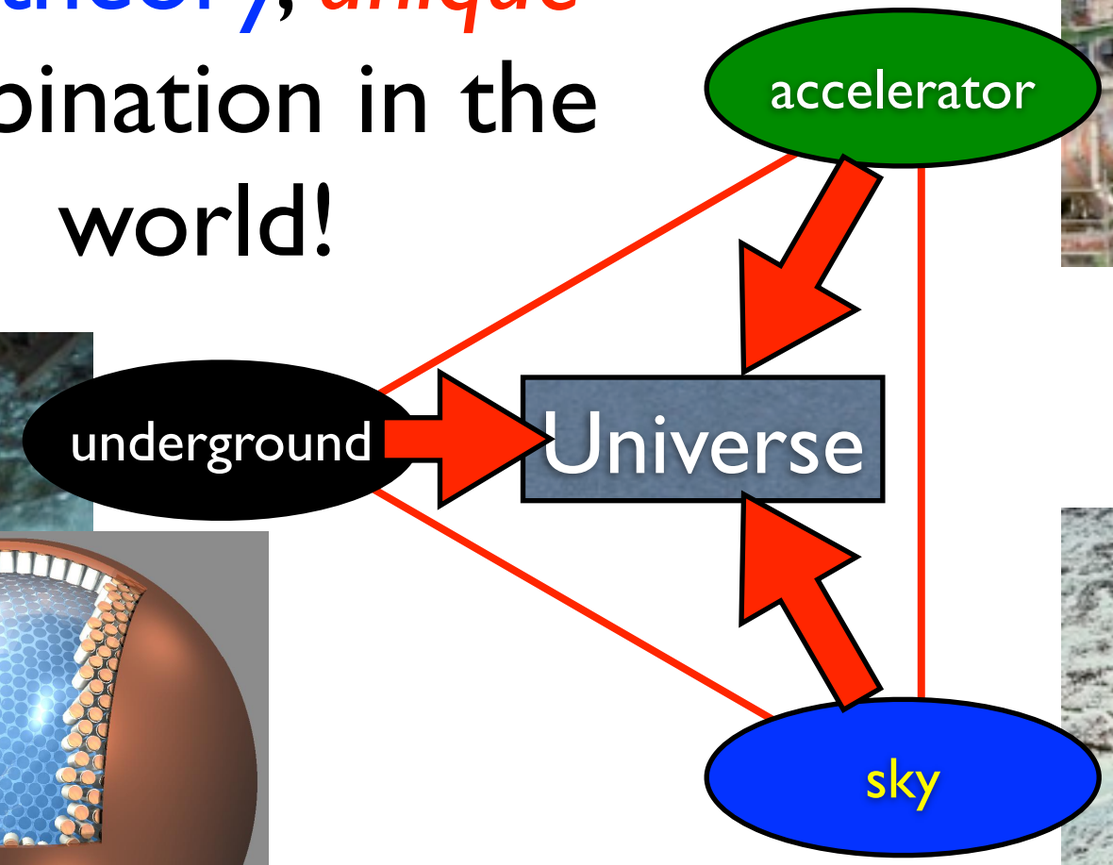




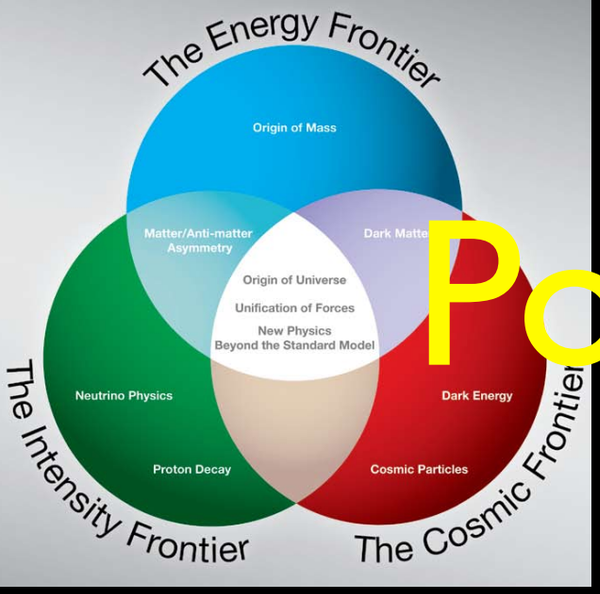
LHC (CERN)



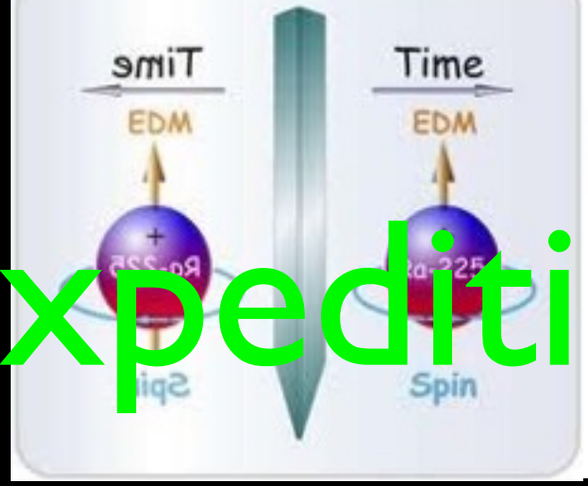
Subaru (NAOJ)

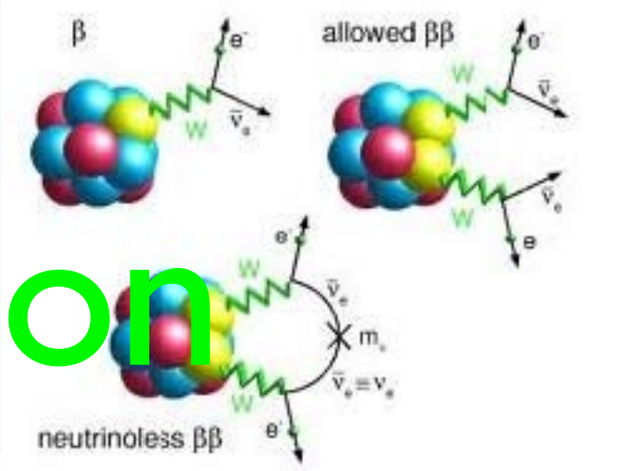


ICRR/Tohoku



Power of Expedition





proton deay

neutrino

lepton flavor

quark flavor

EDM

dark matter

LHC

Unified Theories

10^2 10^4 10^6 10^8 10^{10} 10^{12} 10^{14} 10^{16} 10^{18}

experimental reach [GeV]

(with significant simplifying assumptions)

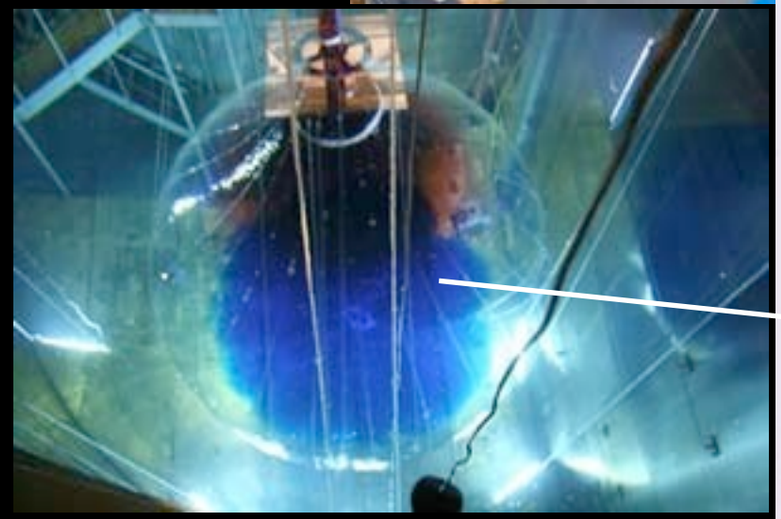
KamLAND control room

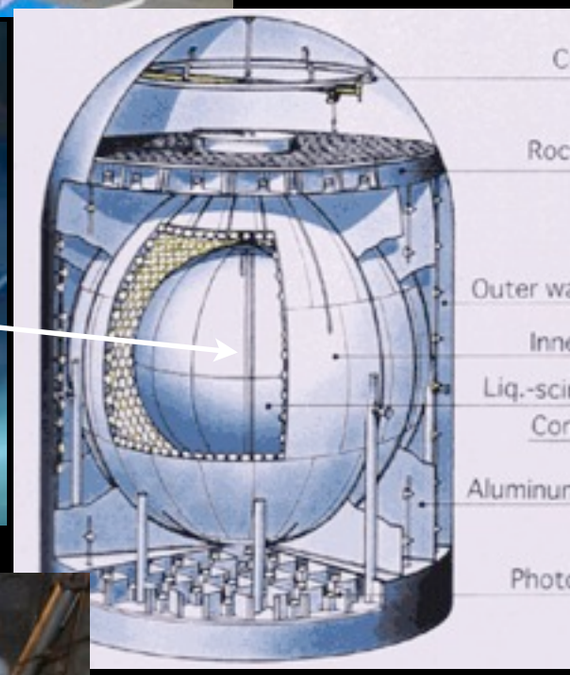
Clear leadership roles

- Vagins pioneered the concept to detect supernova relic neutrinos with Gd in SK

- Kozlov developed the concept to dissolve Xenon gas into KamLAND for 0νββ

- Suzuki proposed XMASS dark matter expt with single-phase scalable LXe detector

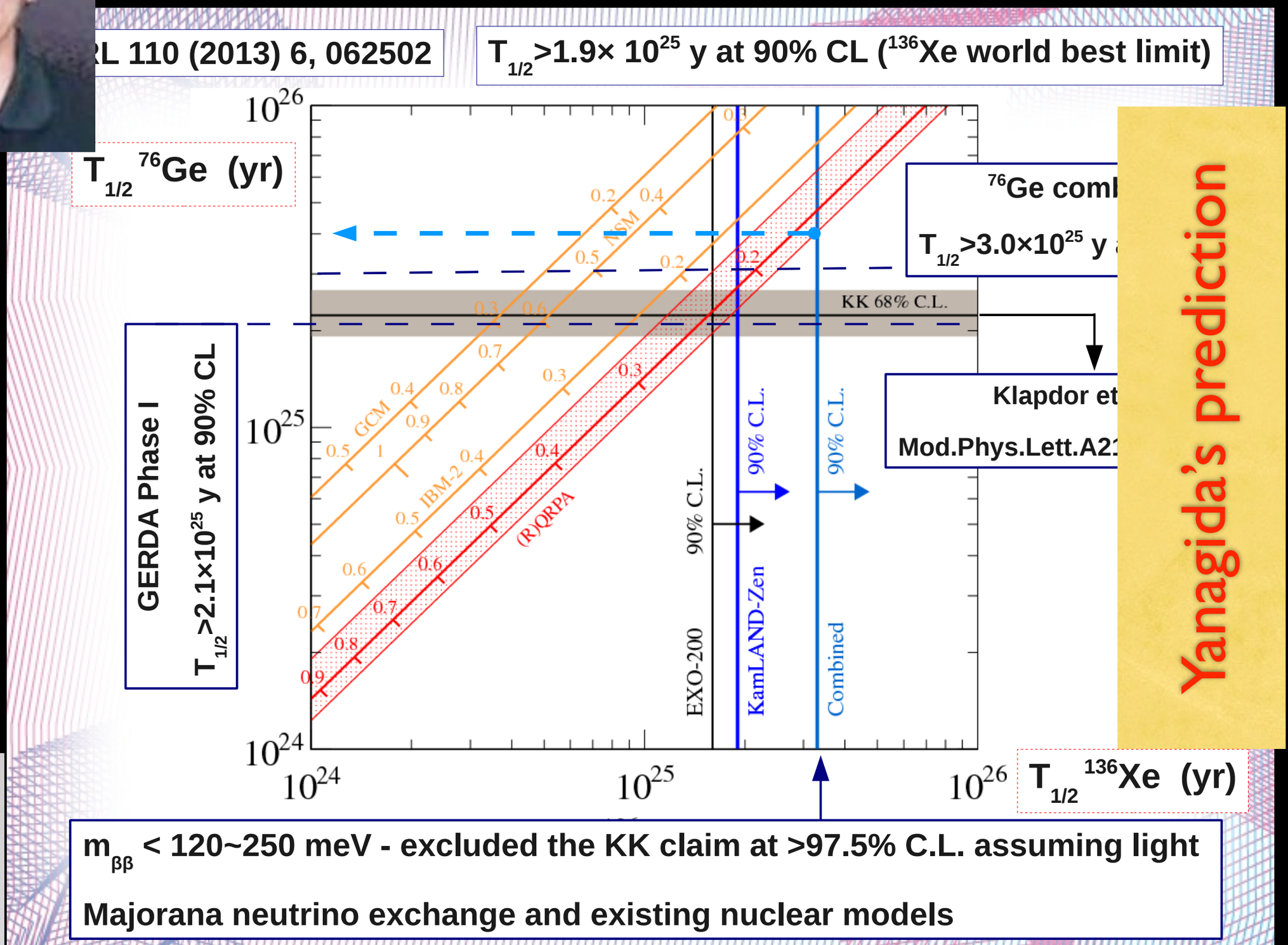




World's best limit

RL 110 (2013) 6, 062502

$T_{1/2}$>1.9× 10^{25} y at 90% CL (^{136}Xe world best limit)



$m_{\beta\beta}$ < 120~250 meV - excluded the KK claim at >97.5% C.L. assuming light Majorana neutrino exchange and existing nuclear models

Alexander Kozlov (KamLAND-ZEN experiment)

2007
2012
2017
2022
2027

HSC
XMASS
GAZOOKS!
ZEN
PolarBear1+2
PFS
Belle2
ZEN
XMASS
PolarBear1+2
HSC
XMASS1.5
GAZOOKS!
Belle2
PFS
LiteBIRD
HyperK/T2HK
ILC

How did it begin?
What is it made of?
What is its fate?
What are its laws?
Why do we exist?

Have a safe trip home!