Welcome
어서오세요
欢迎 欢迎

理研仁科加速器研究中心

— 8000 tons of Joyful Burden —

延與 秀人
Hideto En'yo
Director

オソオセヨ
ホオアン イィン

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RIKEN Nishina Center for Accelerator-based Science

— RI Beam Factory (RIBF) —

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Welcome
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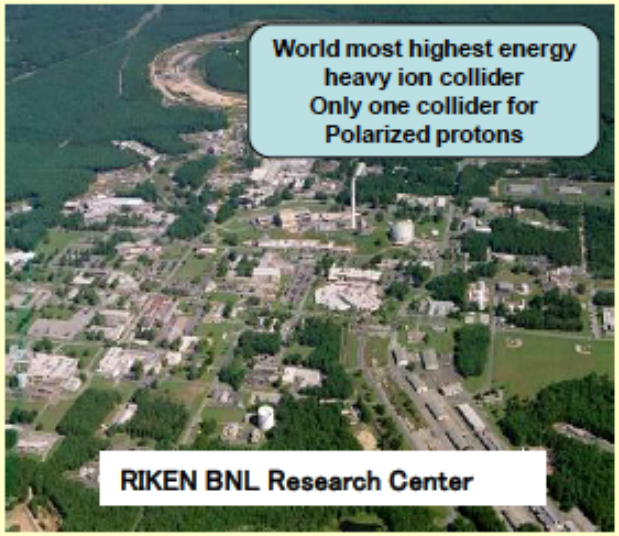
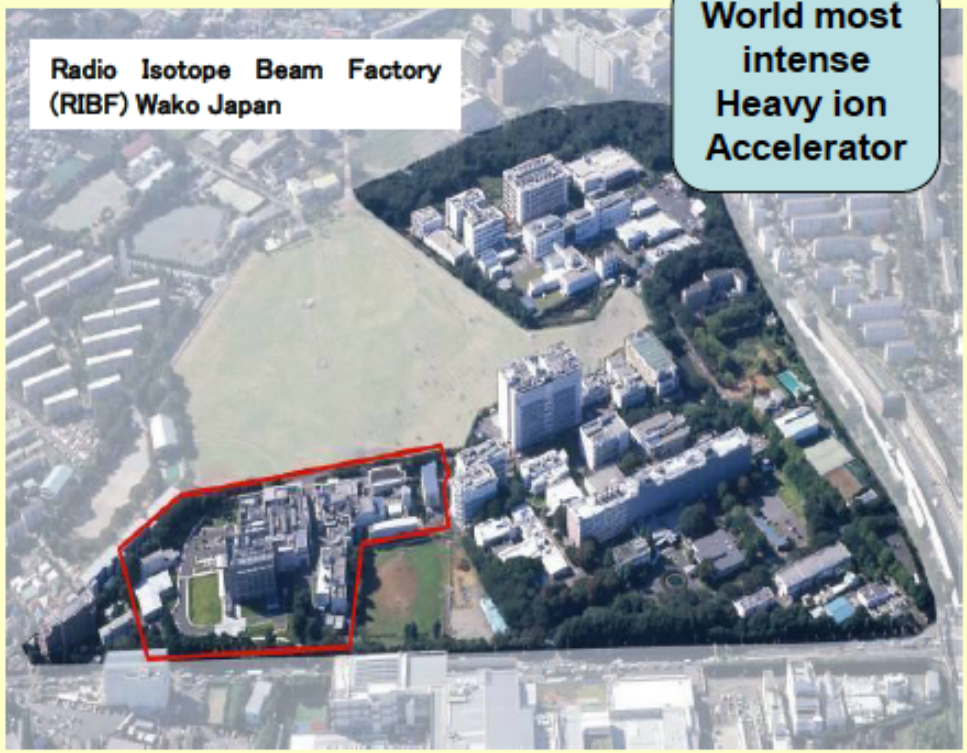
欢迎 欢迎
RIKEN Nishina Center for Accelerator-based Science
RI Beam Factory (RIBF)
RNC and RIBF
Tohru Motobayashi
オソオセヨ
ホオアン イィン

RIKEN Nishina Center for Accelerator-Based Science

理研仁科加速器研究センター



Three Major Research Facilities of Nishina Center



RIKEN's No. 2 Cyclotron (1943)

Dr. Yoshio Nishina **(1890-1951)**

"The Father of Nuclear Science in Japan"

Theorist
(Klein-Nishina Formula)

Experimentalist
*(Particle, Nuclear Physics
Cosmic-ray Physics)*

Accelerator Builder
(CW, Cyclotrons 1937, 1943)

Promoter of Applications
(RI production. Radiobiology)


S.Tomonag
(1906-1979
1965 Nobel P


H. Yukawa
(1907-1981)
1949 Nobel Priz

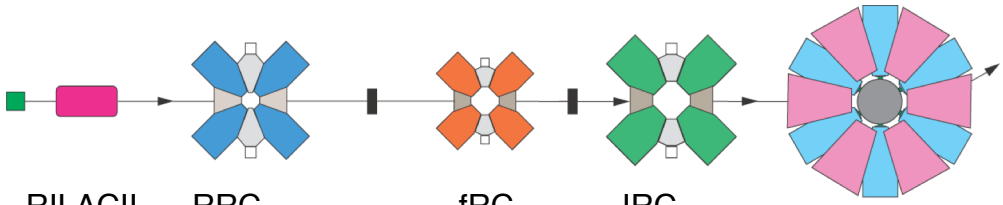

M. Kobayashi


H. Maskawa

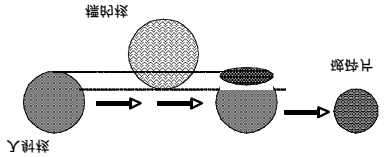

Y.Nambu

From "Profile" by Ken Domon

RIKEN RIBF (RI Beam Factory) -- -- radioactive isotope beams (new generation)

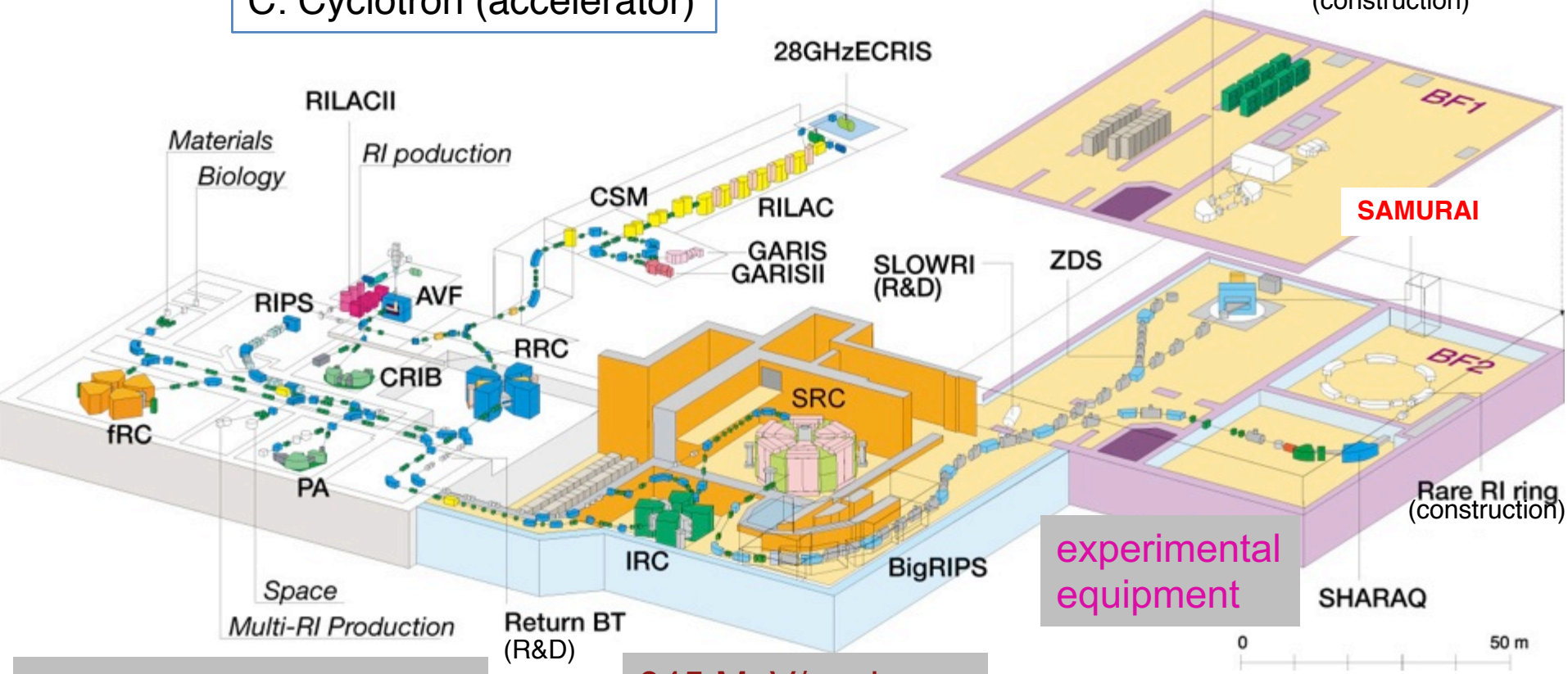


C: Cyclotron (accelerator)



projectile fragmentation

e-RI scattering with SCRIT (construction)

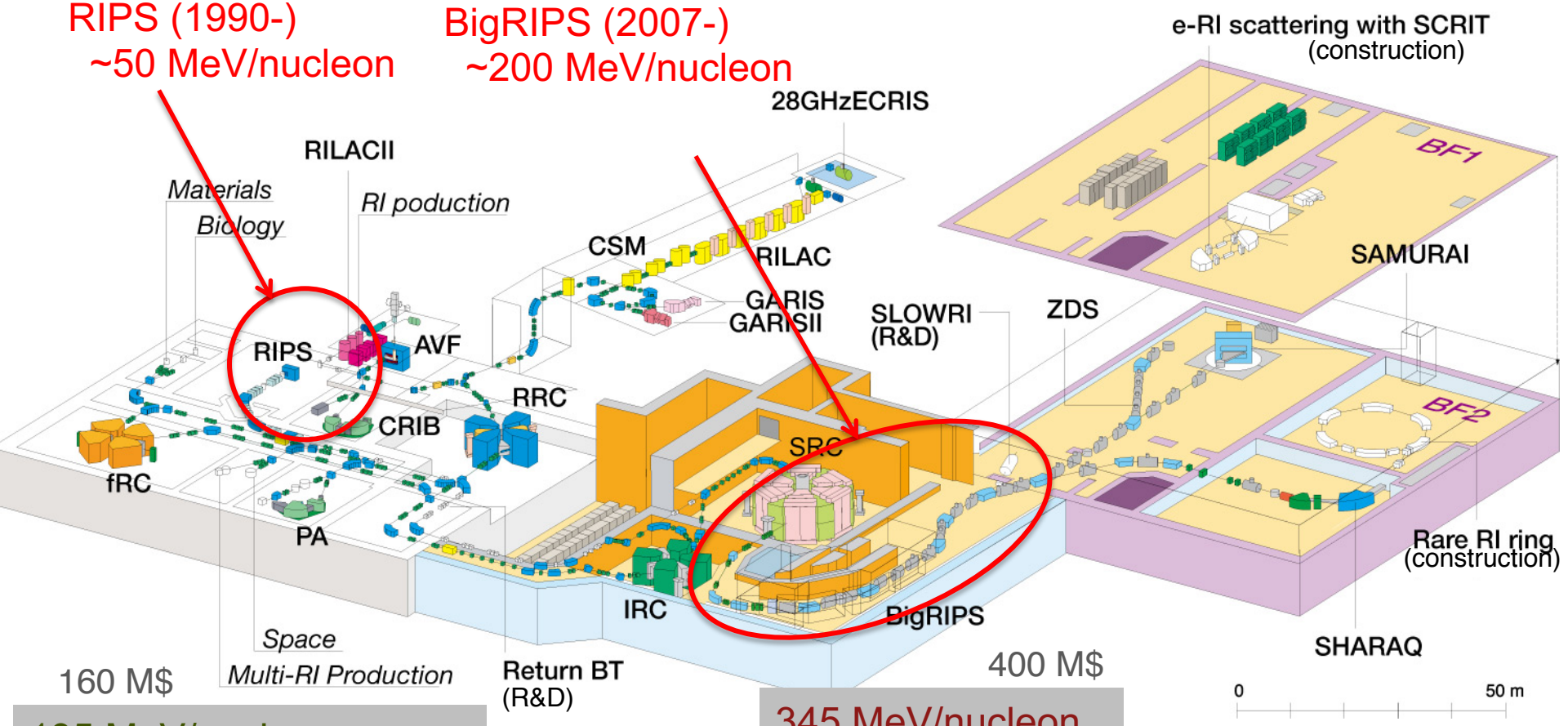


experimental equipment

135 MeV/nucleon
for light nuclei (1986-)

345 MeV/nucleon
up to U (2006-)

a new generation RIB facility in operation
with **world highest capability of providing beams of unstable nuclei**



160 M$

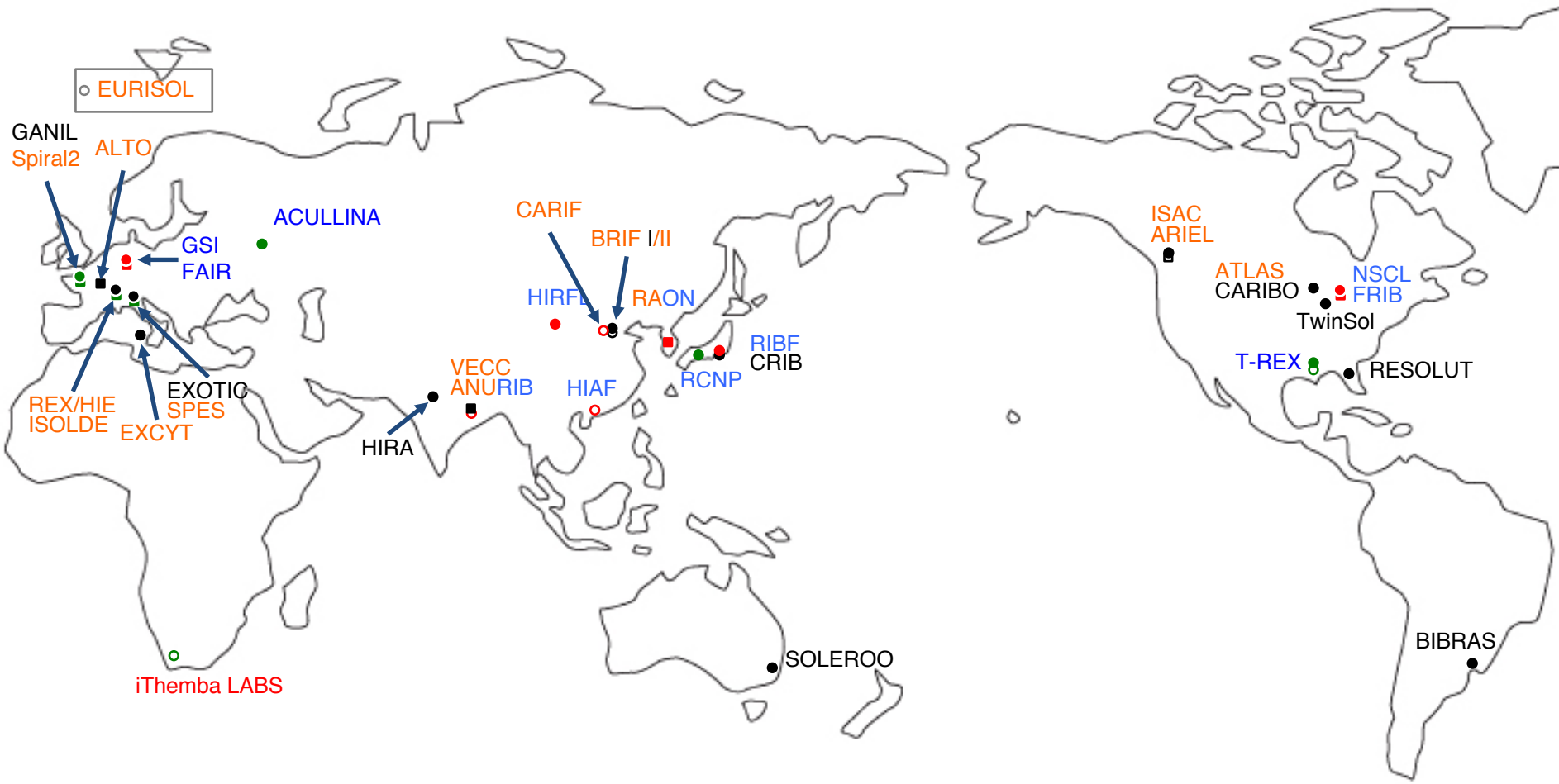
135 MeV/nucleon
for light nuclei (1986-)

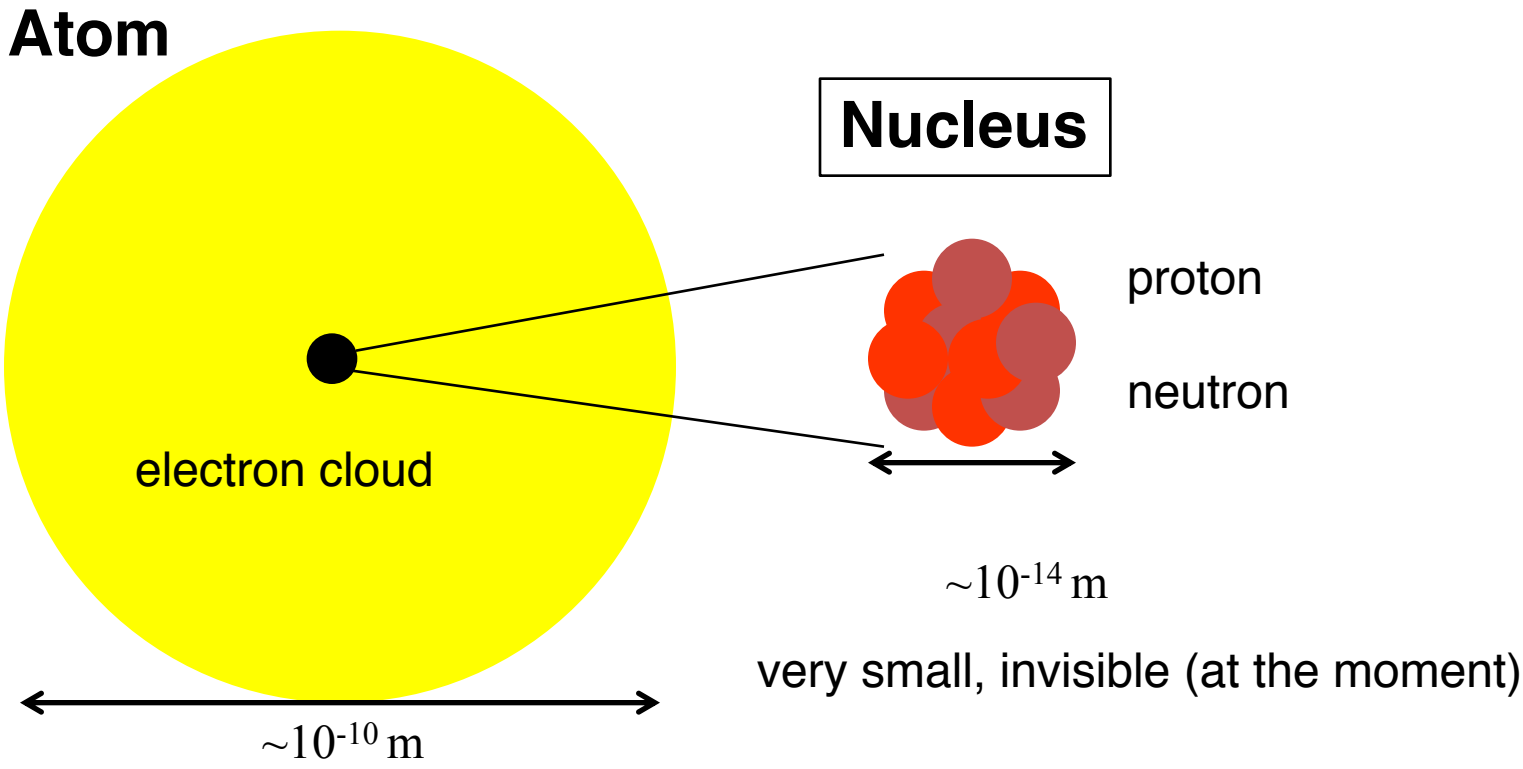
400 M$

345 MeV/nucleon
up to U (2006-)

experimental
equipment

accelerator facilities in the world with similar purposes



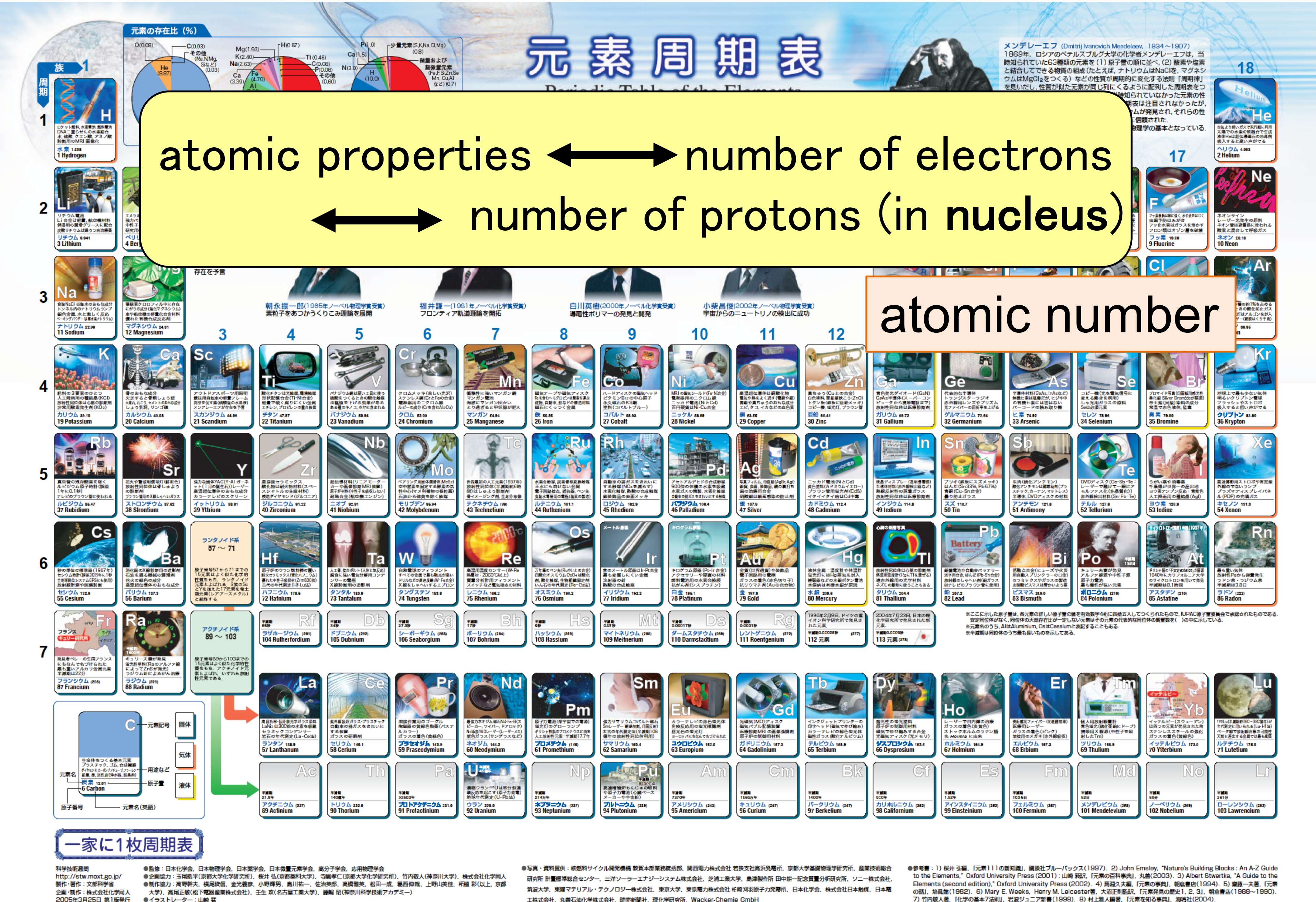


proton (neutron) : ~2000 times heavier than atom

mass of matter ~ mass of nuclei

→ mass of the universe? No!

Periodic table of the chemical elements



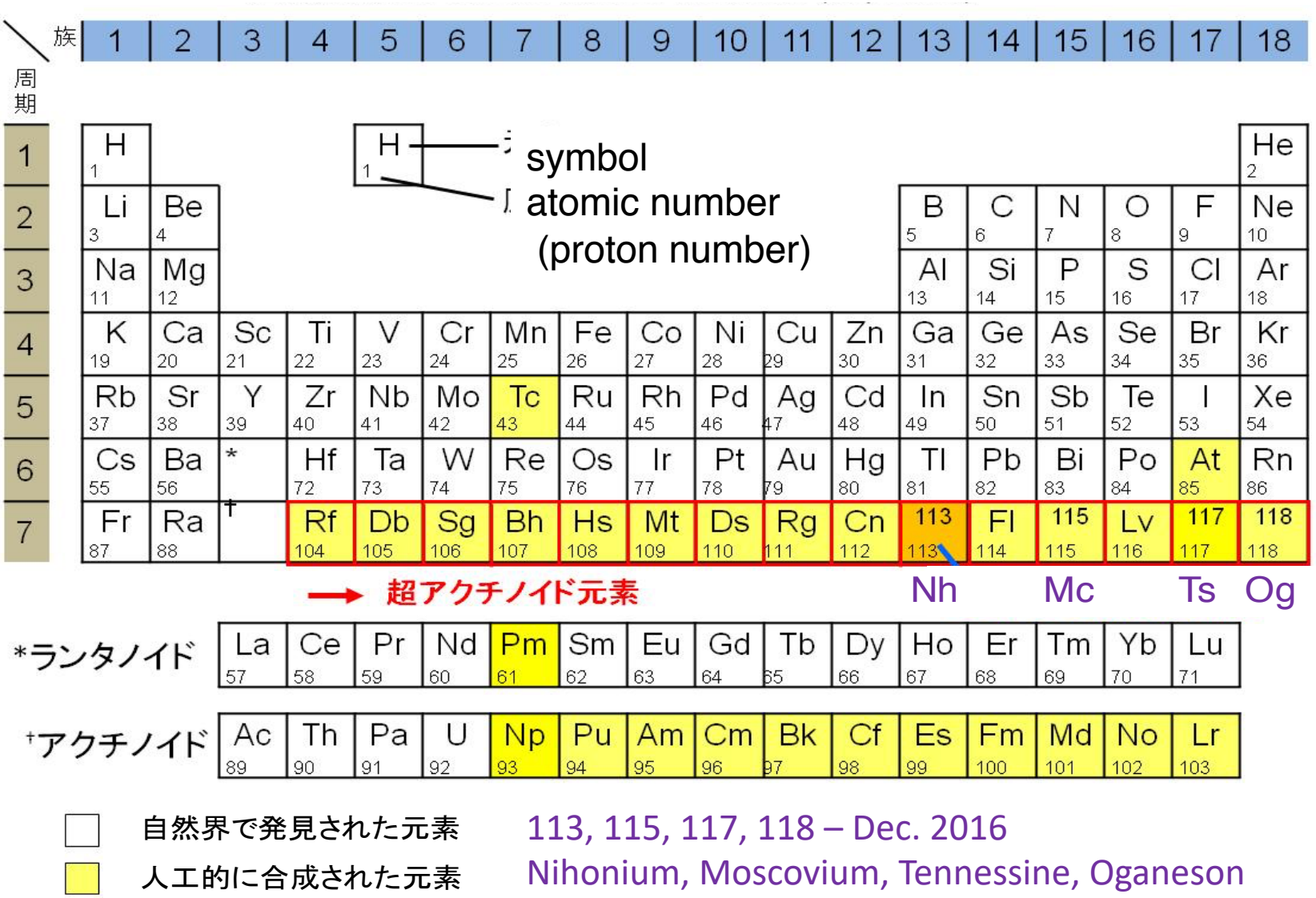
atomic properties ⟷ number of electrons

⟷ number of protons (in **nucleus**)

atomic number

Nihonium, the 113th element

Press conference on the name of 113th, December 1st, 2016


族
周期
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
H 1
He 2
Li 3 Be 4
B 5 C 6 N 7 O 8 F 9 Ne 10
Na 11 Mg 12
Al 13 Si 14 P 15 S 16 Cl 17 Ar 18
K 19 Ca 20 Sc 21 Ti 22 V 23 Cr 24 Mn 25 Fe 26 Co 27 Ni 28 Cu 29 Zn 30 Ga 31 Ge 32 As 33 Se 34 Br 35 Kr 36
Rb 37 Sr 38 Y 39 Zr 40 Nb 41 Mo 42 Tc 43 Ru 44 Rh 45 Pd 46 Ag 47 Cd 48 In 49 Sn 50 Sb 51 Te 52 I 53 Xe 54
Cs 55 Ba 56 * Hf 72 Ta 73 W 74 Re 75 Os 76 Ir 77 Pt 78 Au 79 Hg 80 Tl 81 Pb 82 Bi 83 Po 84 At 85 Rn 86
Fr 87 Ra 88 † Rf 104 Db 105 Sg 106 Bh 107 Hs 108 Mt 109 Ds 110 Rg 111 Cn 112 113 113 Fl 114 115 115 Lv 116 117 117 118 118
H 1
symbol
atomic number
(proton number)
超アクチノイド元素
Nh Mc Ts Og
*ランタノイド
La 57 Ce 58 Pr 59 Nd 60 Pm 61 Sm 62 Eu 63 Gd 64 Tb 65 Dy 66 Ho 67 Er 68 Tm 69 Yb 70 Lu 71
†アクチノイド
Ac 89 Th 90 Pa 91 U 92 Np 93 Pu 94 Am 95 Cm 96 Bk 97 Cf 98 Es 99 Fm 100 Md 101 No 102 Lr 103
自然界で発見された元素
人工的に合成された元素
113, 115, 117, 118 – Dec. 2016
Nihonium, Moscovium, Tennessine, Oganeson

族	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
周期 1	H 1																	He 2
2	Li 3	Be 4											B 5	C 6	N 7	O 8	F 9	Ne 10
3	Na 11	Mg 12											Al 13	Si 14	P 15	S 16	Cl 17	Ar 18
4	K 19	Ca 20	Sc 21	Ti 22								Zn	Ga 31	Ge 32	As 33	Se 34	Br 35	Kr 36
5	Rb 37	Sr 38	Y 39	Zr 40								Cd	In 49	Sn 50	Sb 51	Te 52	I 53	Xe 54
6	Cs 55	Ba 56	*	Hf 72								Hg	Tl 81	Pb 82	Bi 83	Po 84	At 85	Rn 86
7	Fr 87	Ra 88	†	Rf 104								Cn 112	113 113	Fl 114	115 115	Lv 116	117 117	118 118
													Nh		Mc		Ts	Og
*ランタノイド			La 57	Ce 58										Ho 67	Er 68	Tm 69	Yb 70	Lu 71
†アクチノイド			Ac 89	Th 90	91	92	93	94	95	96	97	98	Cf	Es 99	Fm 100	Md 101	No 102	Lr 103

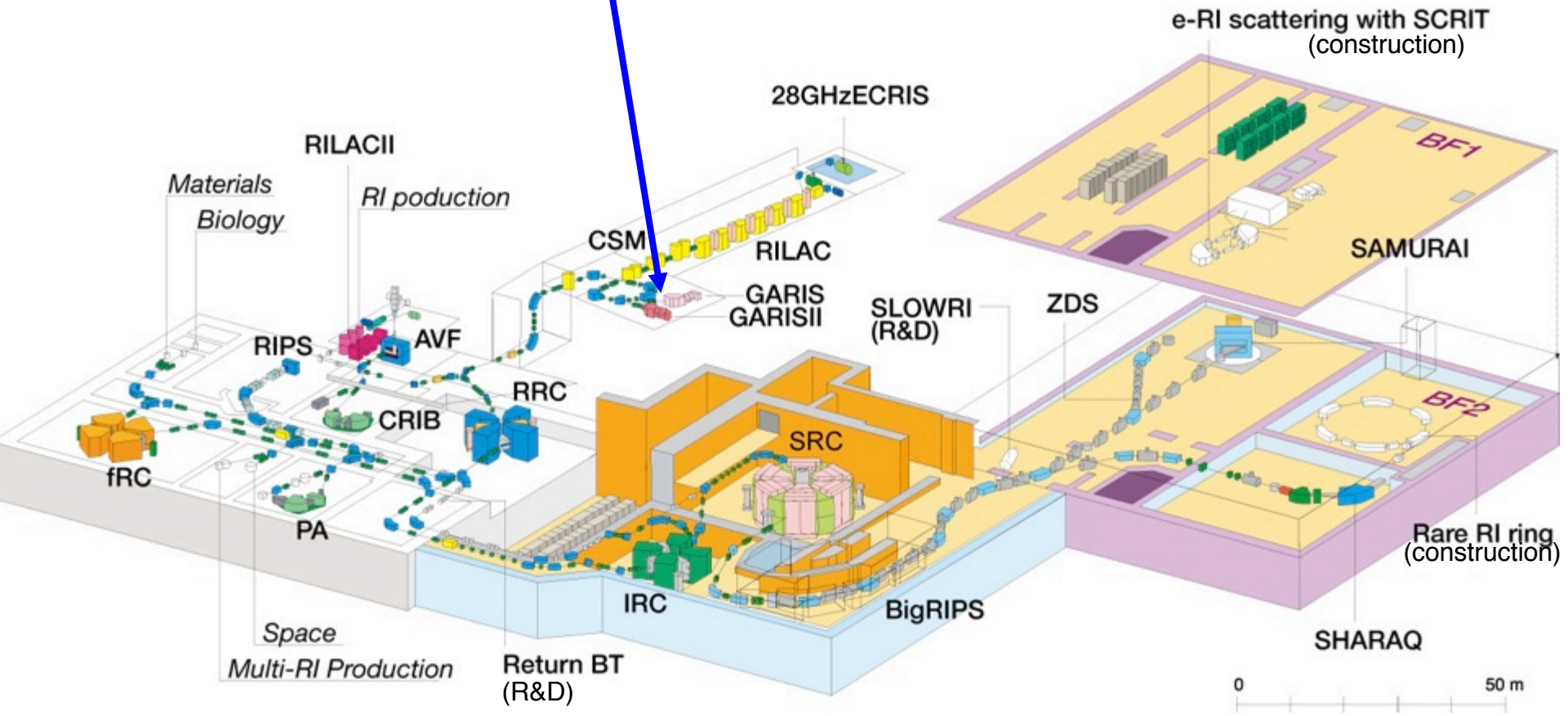
□ 自然界で発見された元素

■ 人工的に合成された元素

113, 115, 117, 118 – Dec. 2016

Nihonium, Moscovium, Tennesin, Oganeson

element *Z*=113 Nihonium (Nh)
-- produced by ^{70}Zn+^{209}Bi fusion at ~5MeV/nucleon



Synthesis of Nihonium ← creation of nuclei of 113 protons
by nuclear reactions

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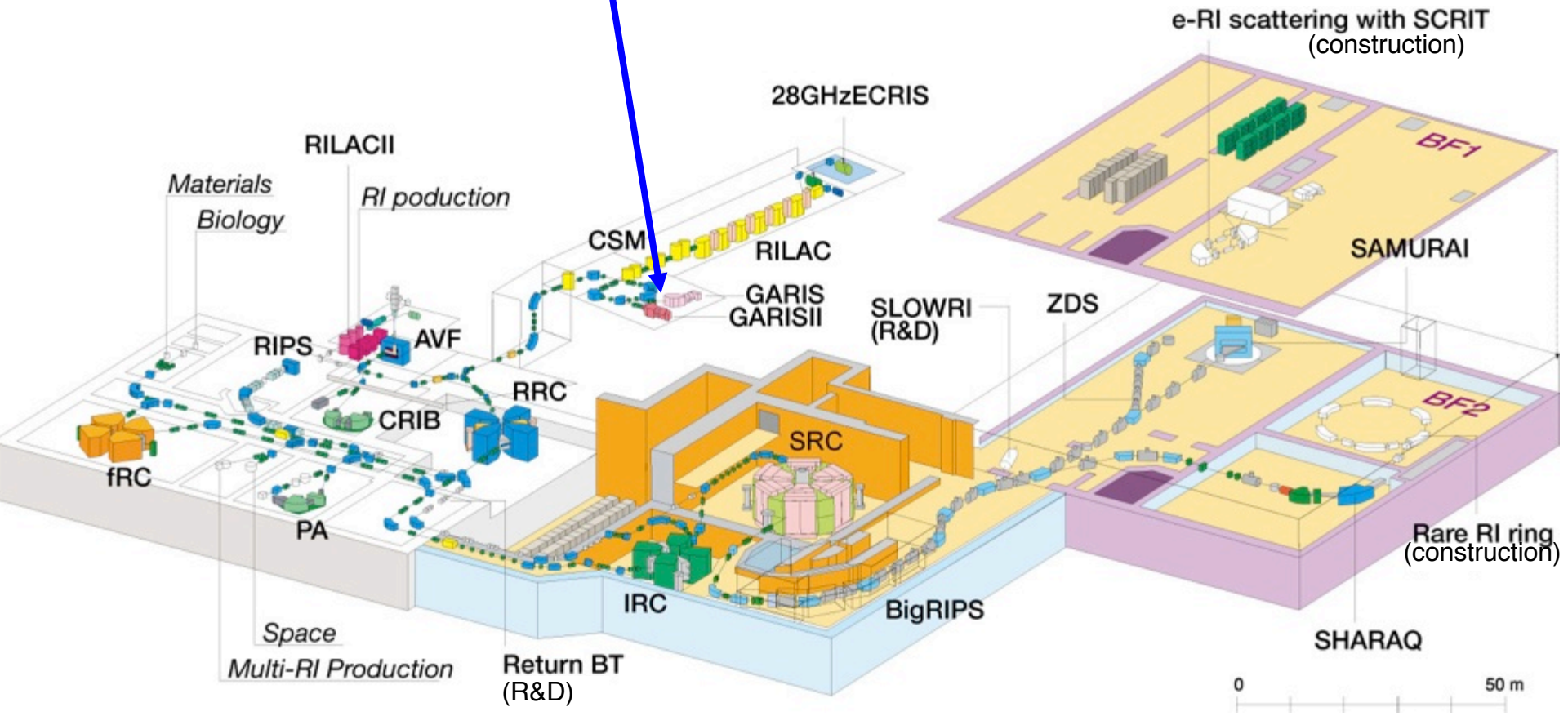


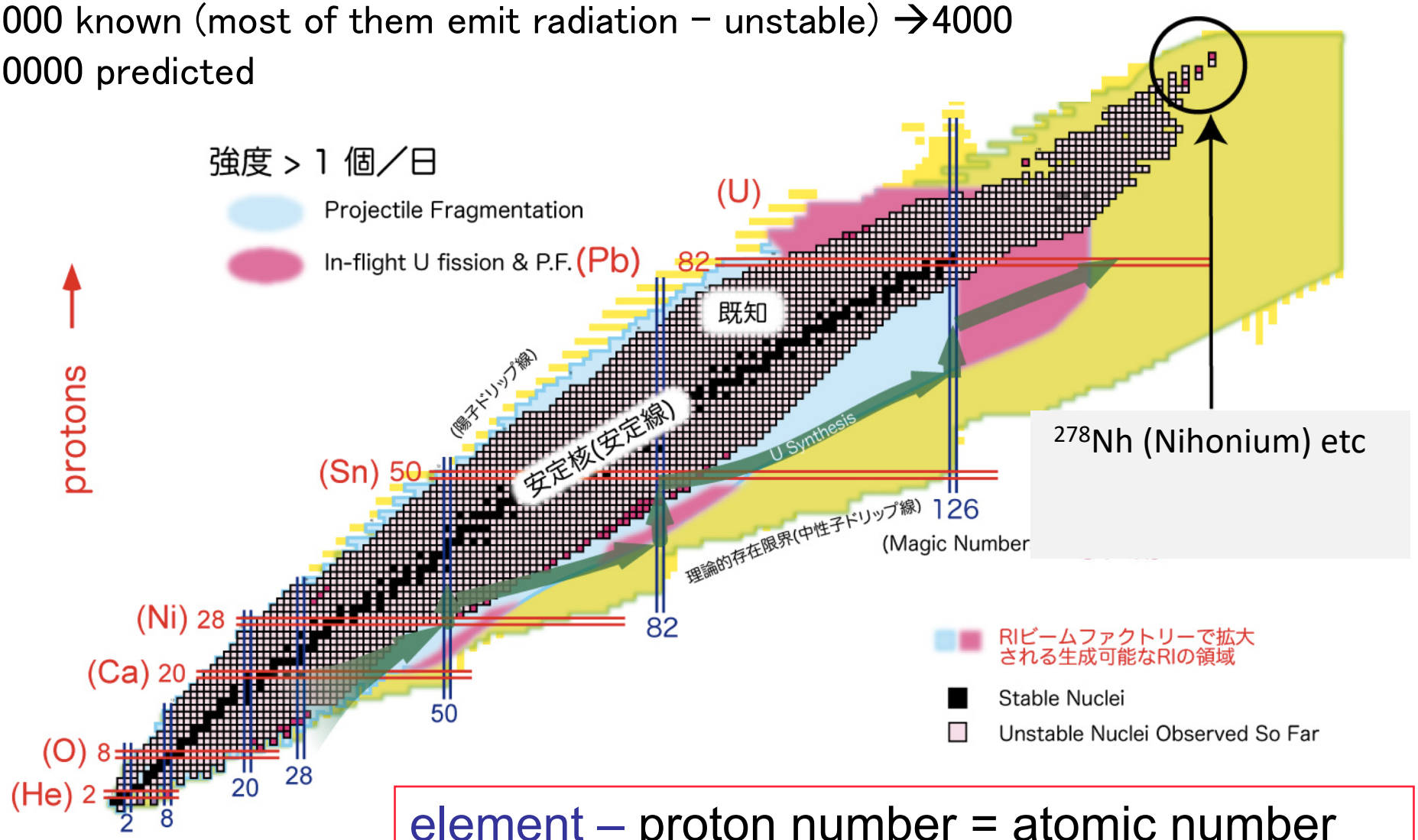
Synthesis of Nihonium ← creation of nuclei of 113 protons
by nuclear reactions -- school program

Nuclear chart – nuclear periodic table

300 stable nuclei,

3000 known (most of them emit radiation – unstable) →4000

10000 predicted



element – proton number = atomic number

nucleus – proton & neutron number (isotope)

Two fundamental questions of Nuclear Physics

(Fundamental many body system)

Why we (universe, life) can ever exist ?

-- origin of elements

Why we are heavy?

-- origin of mass

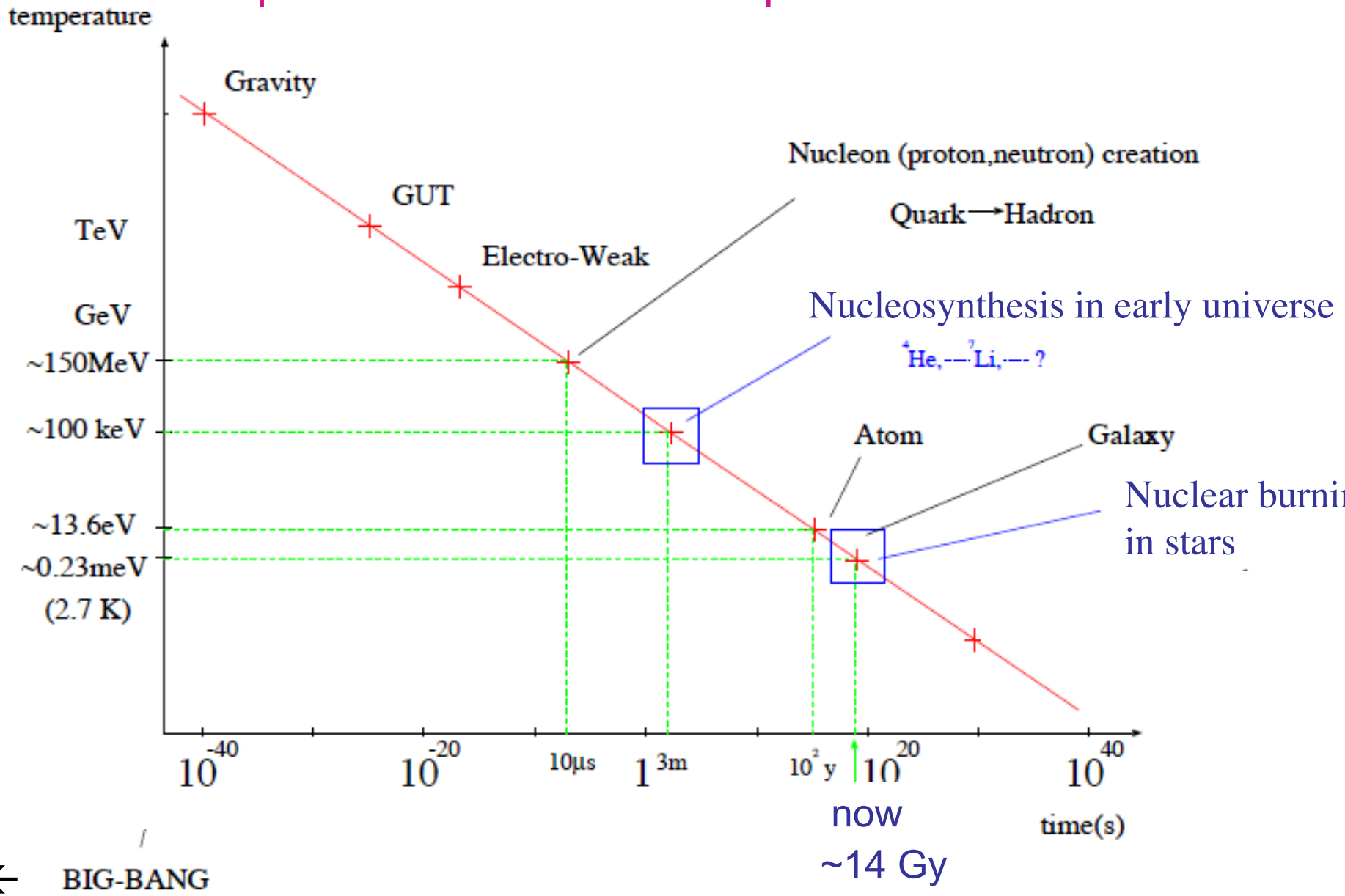
Ate too much?

Not only so

Nambu found it

History of the universe in one page -- average temperature

Temperature decrease as expansion of the universe

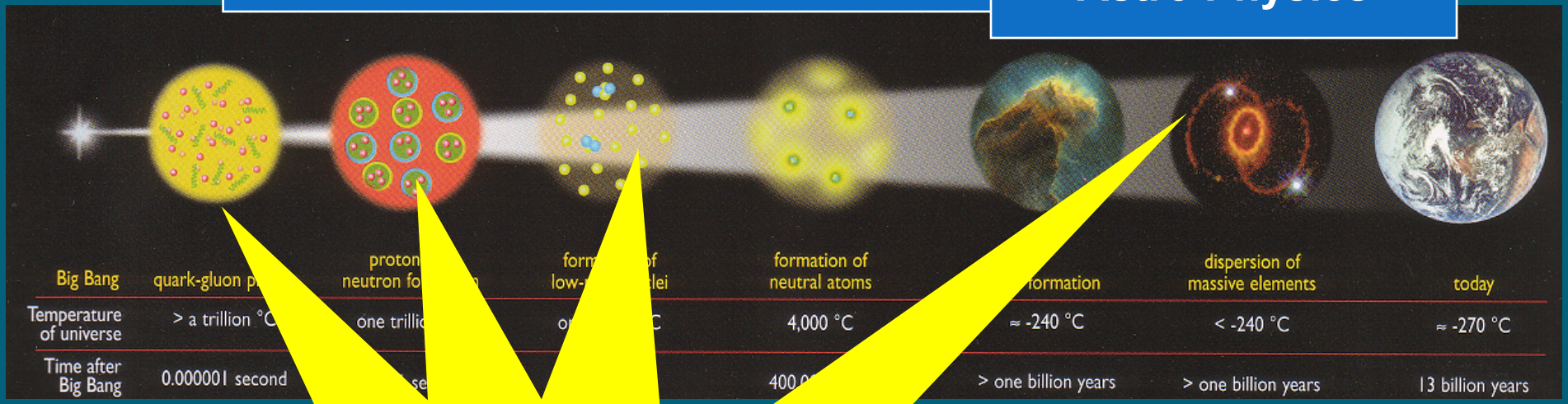


Particle Physics

What We learn ?

Nuclear Physics

Astro Physics



Super Nova Explosion
to create
Heavy (>Iron) Nucleaus

or ....

What is research ?

Physics start from your own subjective thinking

The process make it objective is called research

Novelty	must contain something new
Effectiveness	obtain something new ,conclusively…
Feasibility	Idea alone doesn't count

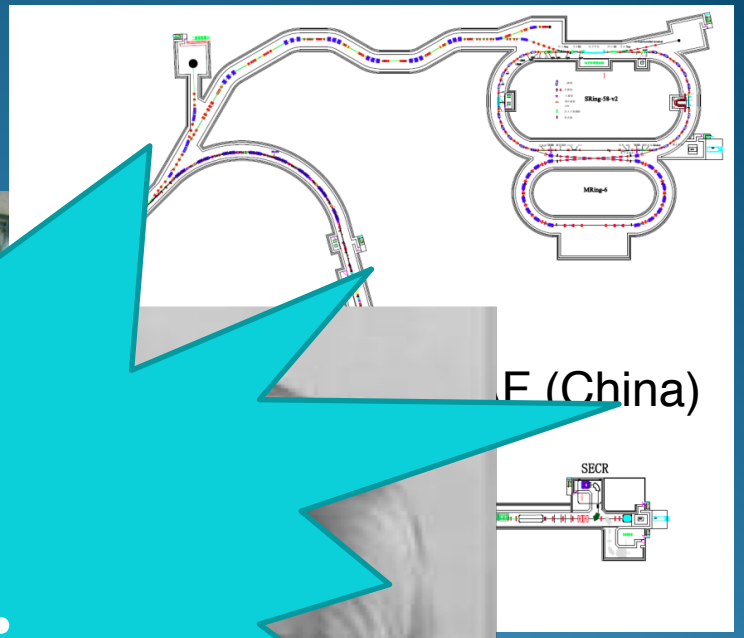
Be professional

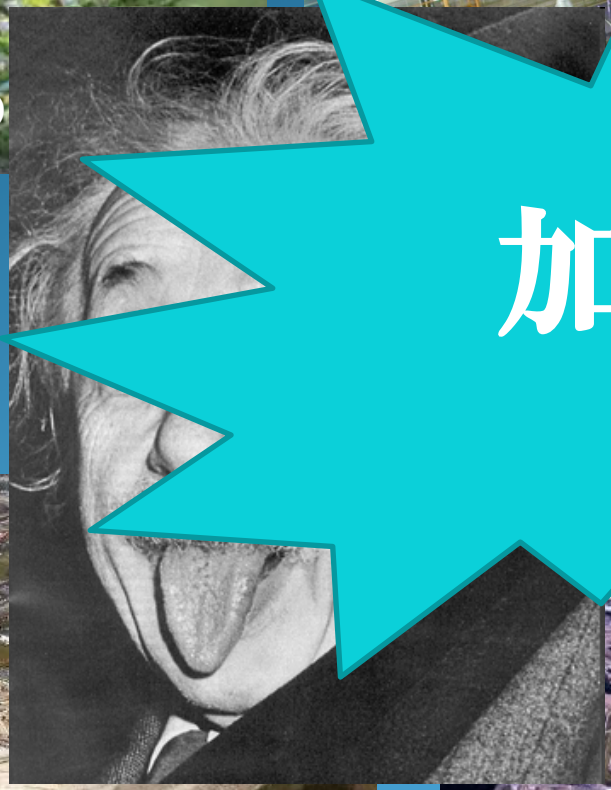
1）Do what others cannot do

2）Do what others doesn't do

3）Do what others are doing

Your future is full of glory.
A lot to discover.





加油…

RIKEN RAL Branch

J-PARC

RIKEN BNL Research Center