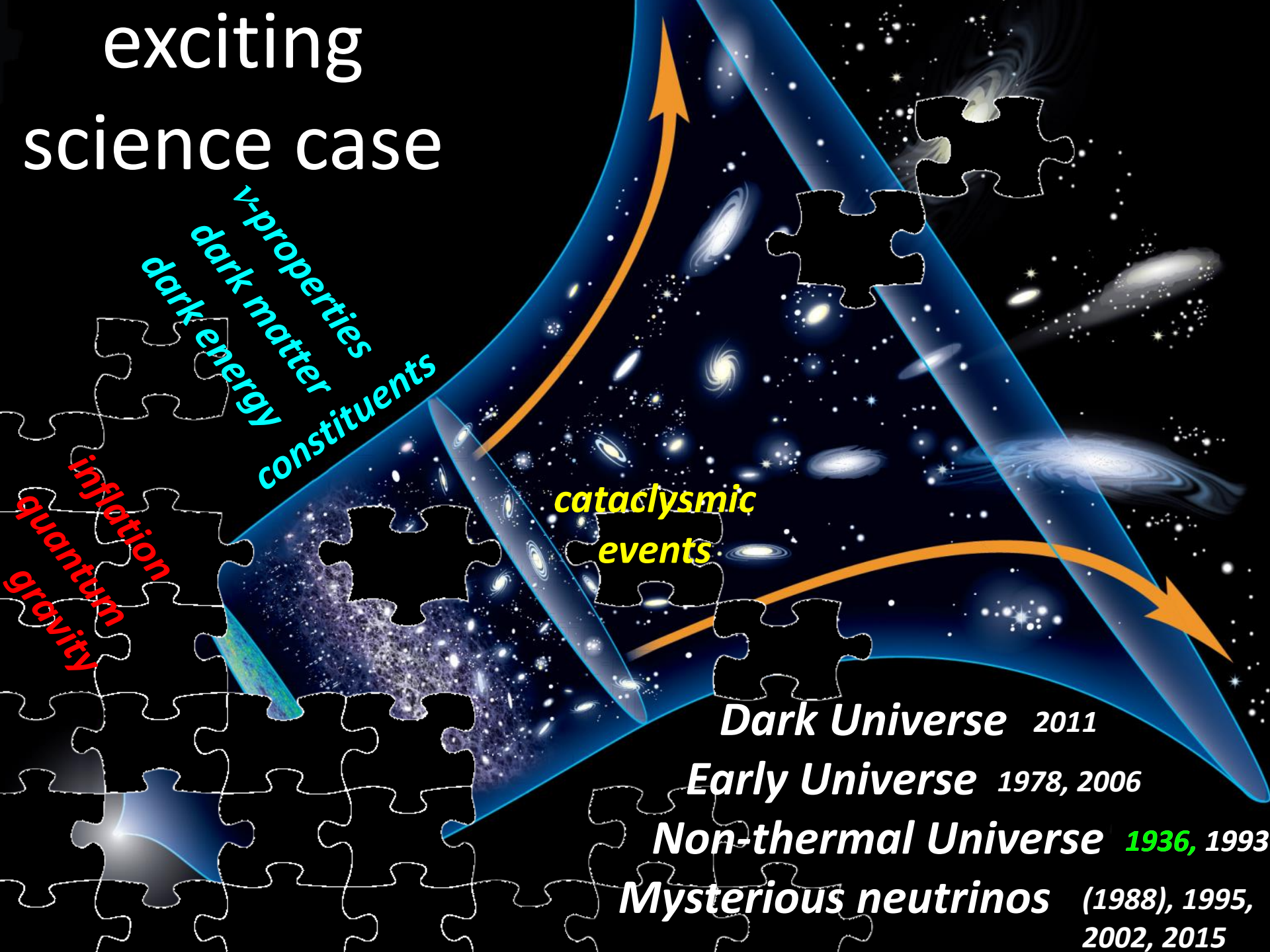
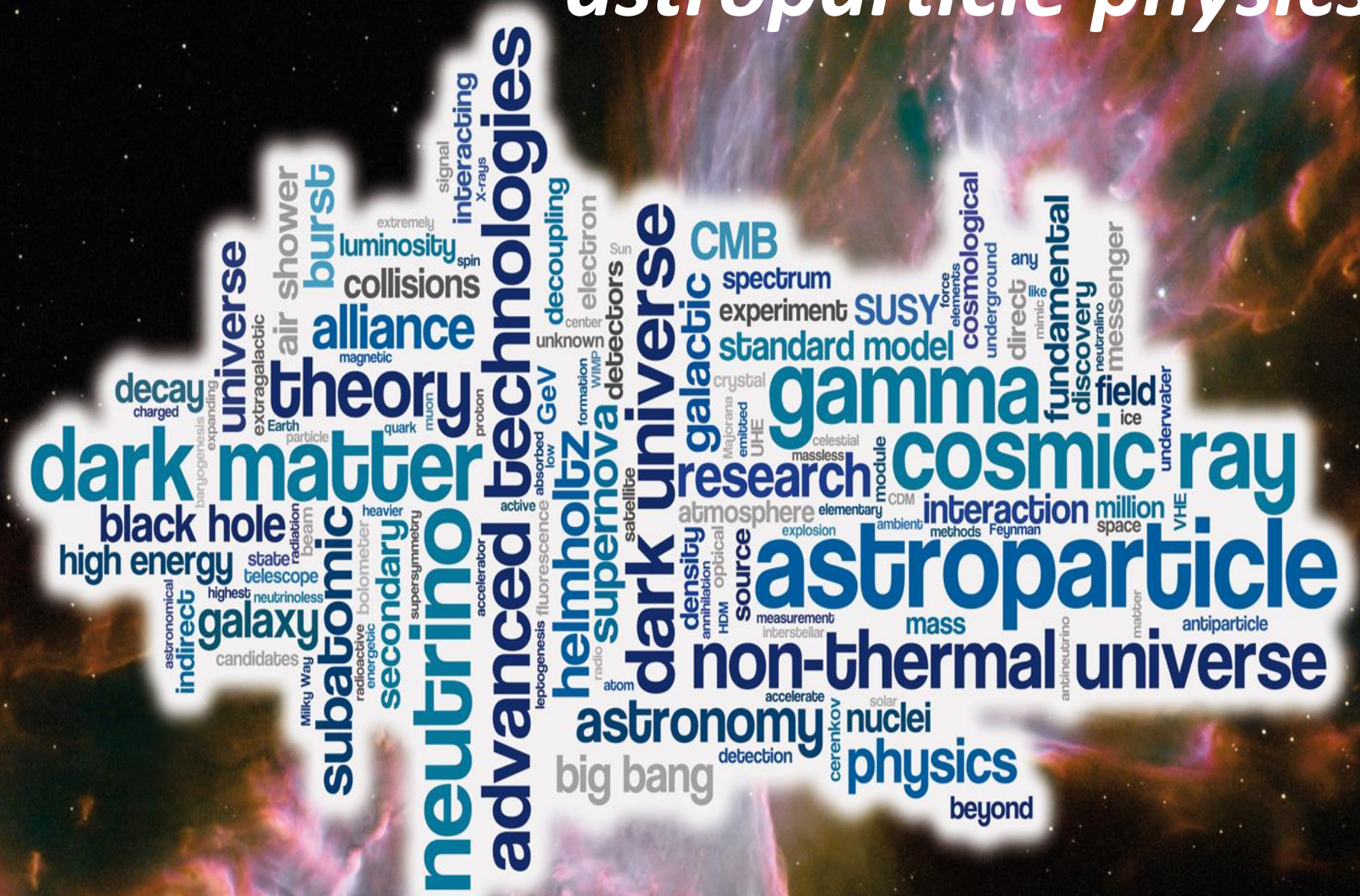
APPEC roadmap 2016 – Town Meeting

Paris, April 6-7

exciting science case



astroparticle physics



No €'s, no management = ideal world?

APPEC *organisation – expanding*

AstroParticle Physics European Consortium

cash budget: ~80 k€ /year …
(members invest a lot more!)

APPEC
functional centers

STFC – Swindon/UK
Outreach

DESY - Hamburg/D
Management, Computing & Industry

APC - Paris/F
Roadmapping, Common Calls, Interdisciplinary

LSC - Canfranc/S
Web pages

LNGS - L'Aquila/I
Networking, Theory, Graduate Schools

Links to CERN, ESO, ESA, …

APPEC observers: CERN & ESO

CERN: European Particle Physics Strategy 2006:

7. *A range of very important non-accelerator experiments take place at the overlap between particle & astroparticle physics ….*
   Council will seek to work with APPEC to develop a coordinated strategy in these areas of mutual interest.

CERN: European Particle Physics Strategy update 2013:

j. *A range of very important non-accelerator experiments … particle & astroparticle physics, such as searches for proton decay, $0\nu\beta\beta$ decay and dark matter and study of high energy cosmic-rays …*
   In the coming years CERN should seek a closer collaboration with APPEC on detector R&D with a view to maintaining the community's capability for unique projects in this field.

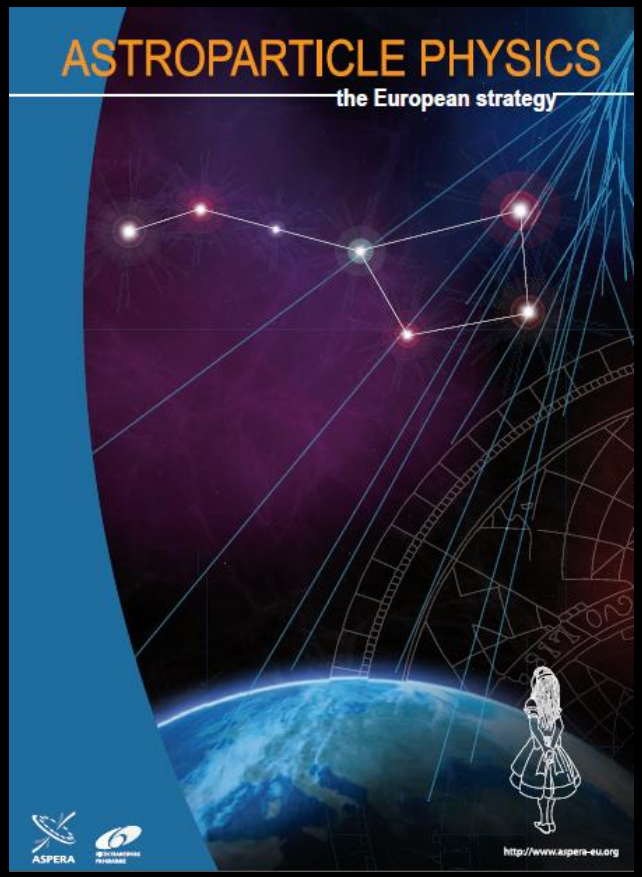
ESA: Euclid, eLISA, CORE+, …

ESO: negotiating with CTA as Southern hemisphere site

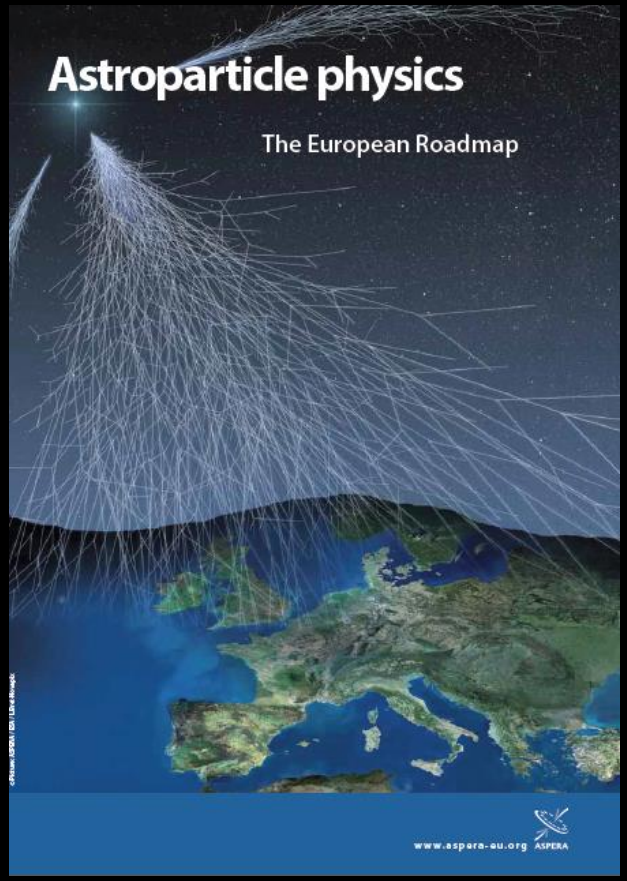
Generally: astroparticle physics = astronomy+particle physics

Roadmapping

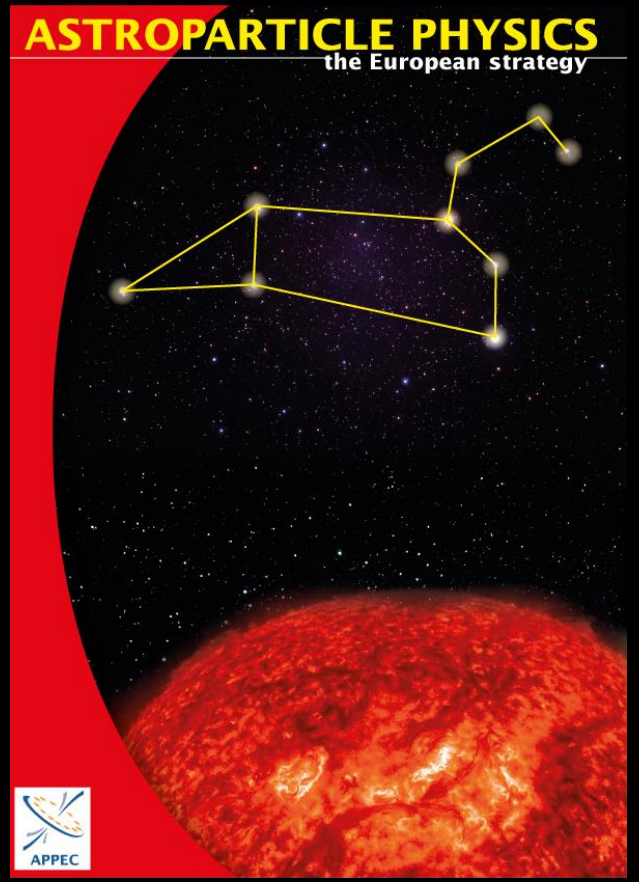
2008



2011



2016



resource aware

Unique & crucial infrastructure

deep-underground
low-background
laboratories

BUL – Boulby/UK
LNGS – Gran-Sasso/I
LSC – Canfranc/ES
LSM – Modane/F
CallioLab – /Pyhäjärvi/SF
LSBB – Rustrel/F

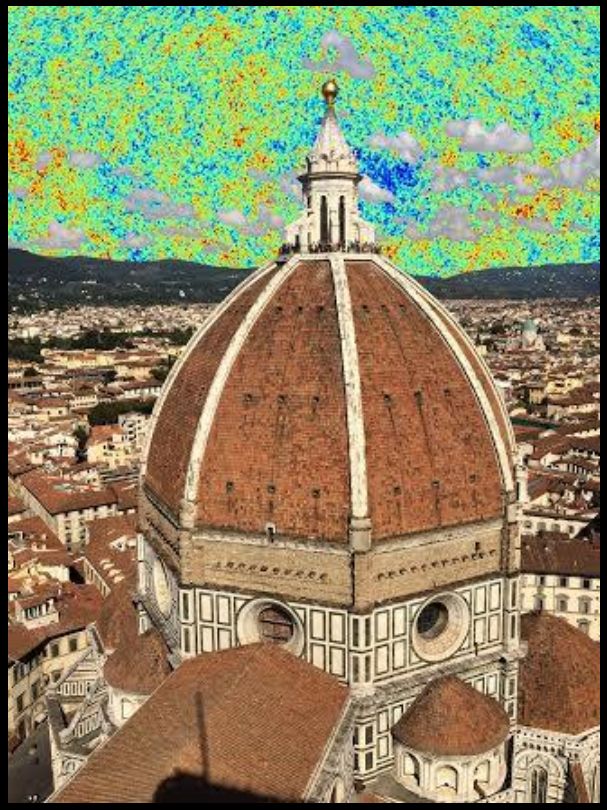
Deep Underground Laboratory Integrated Activity (DULIA)

Challenge: *>20 M€ infrastructures*

In particular those not (largely) 'covered' by ESA, USA, Japan, China, …

International meeting Large ν-infrastructures

Florence CMB workshop

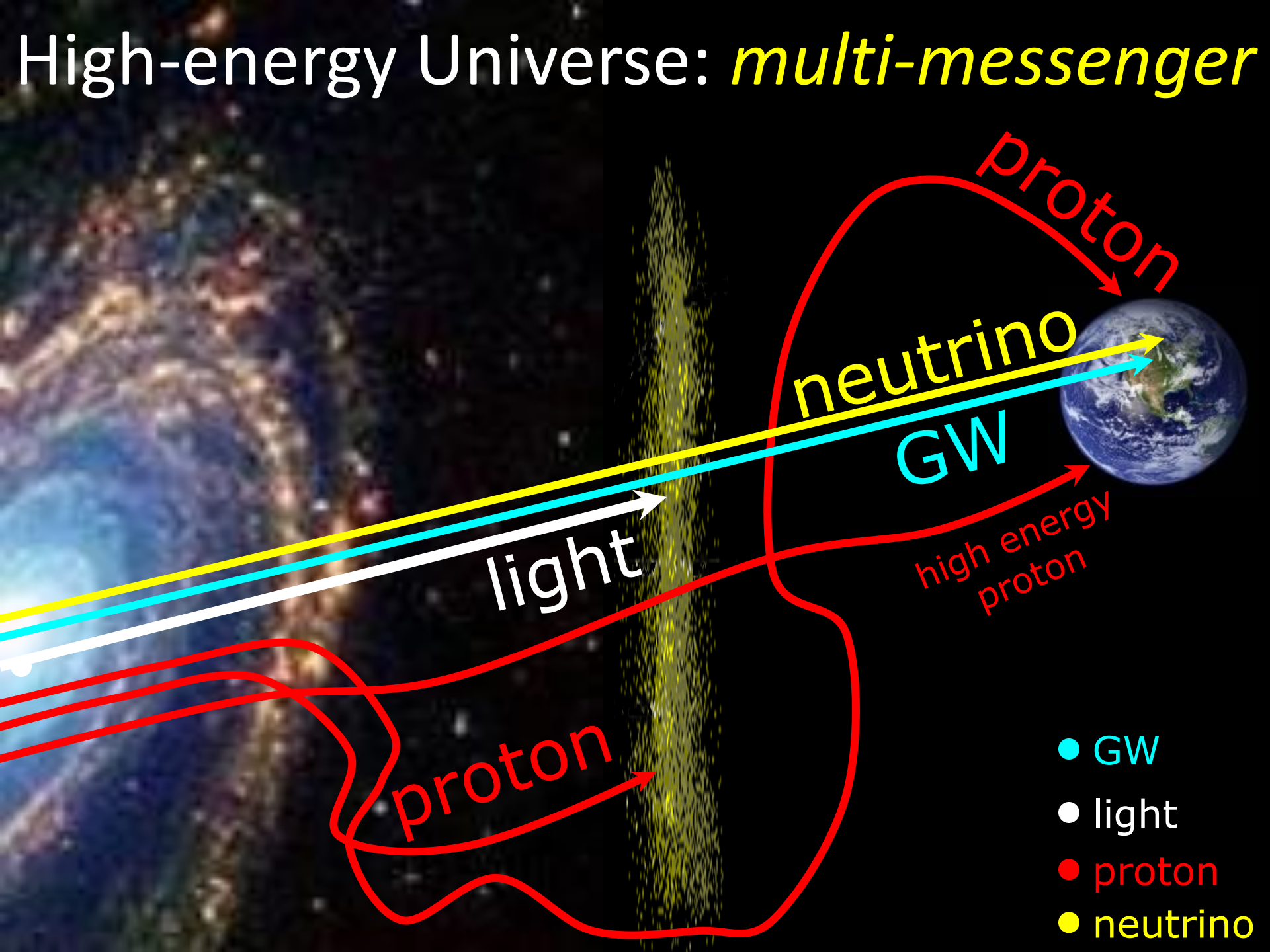


June 2014 (Paris)
April 2015 (Chicago)
30-31 May 2016 (Tokyo)

Asia: JUNO (RENO-50)
→ USA: DUNE
Japan: Hyper-Kamiokande

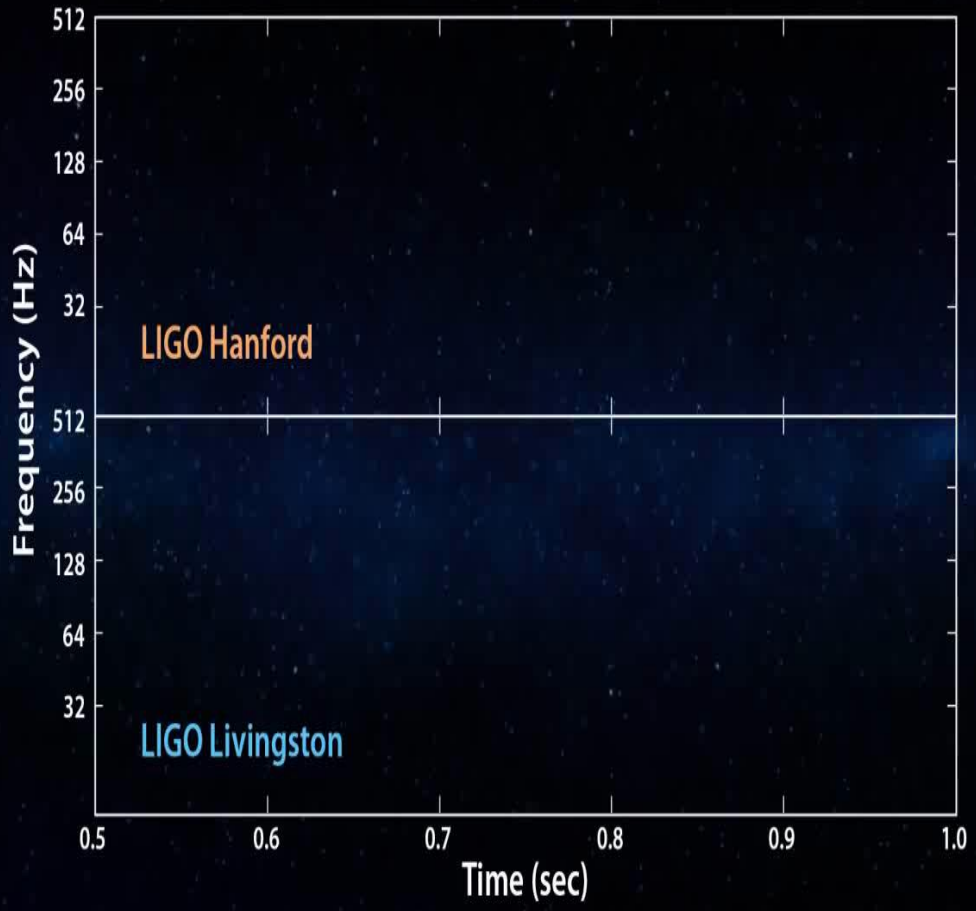
September 2015 (Florence)
September 2016 (Florence)
→ EU ground-based CMB

High-energy Universe: *multi-messenger*

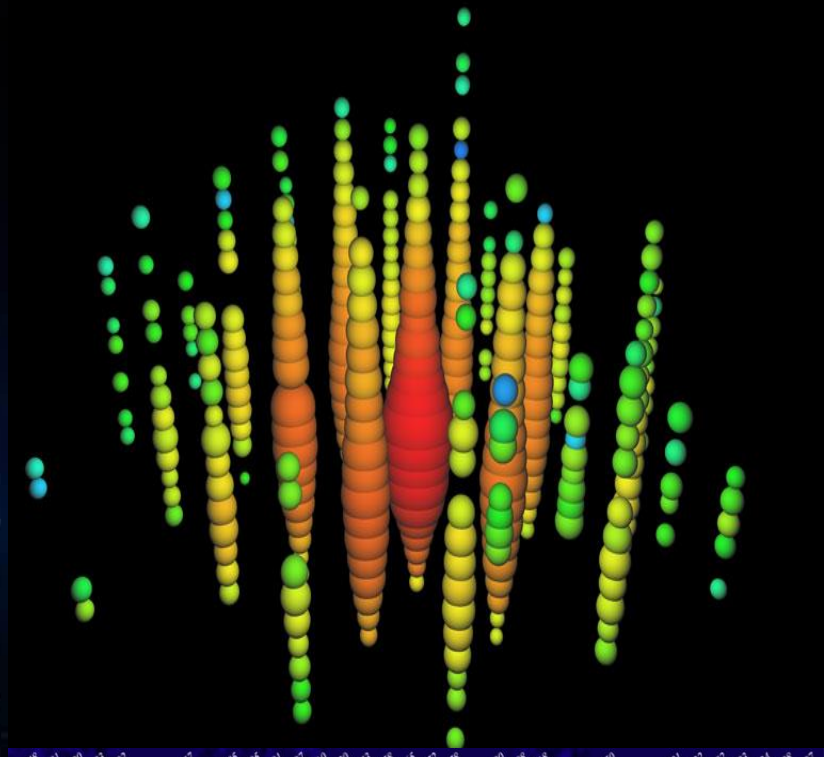


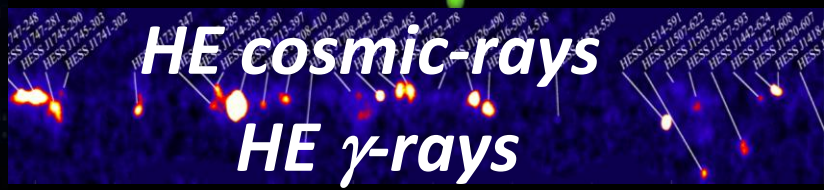
High-energy Universe: *multi-messenger*

GW150914



PeV neutrinos

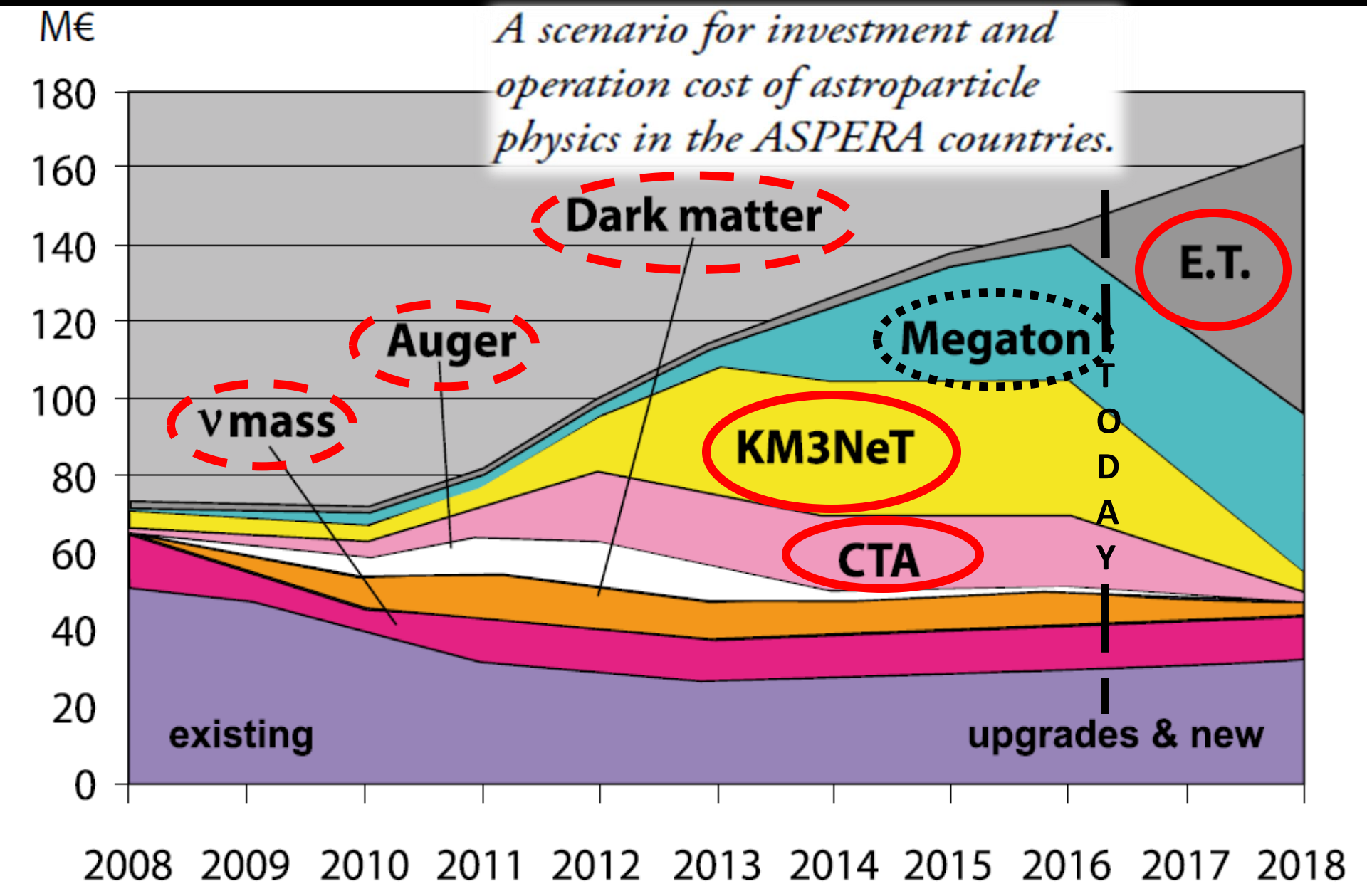




HE cosmic-rays

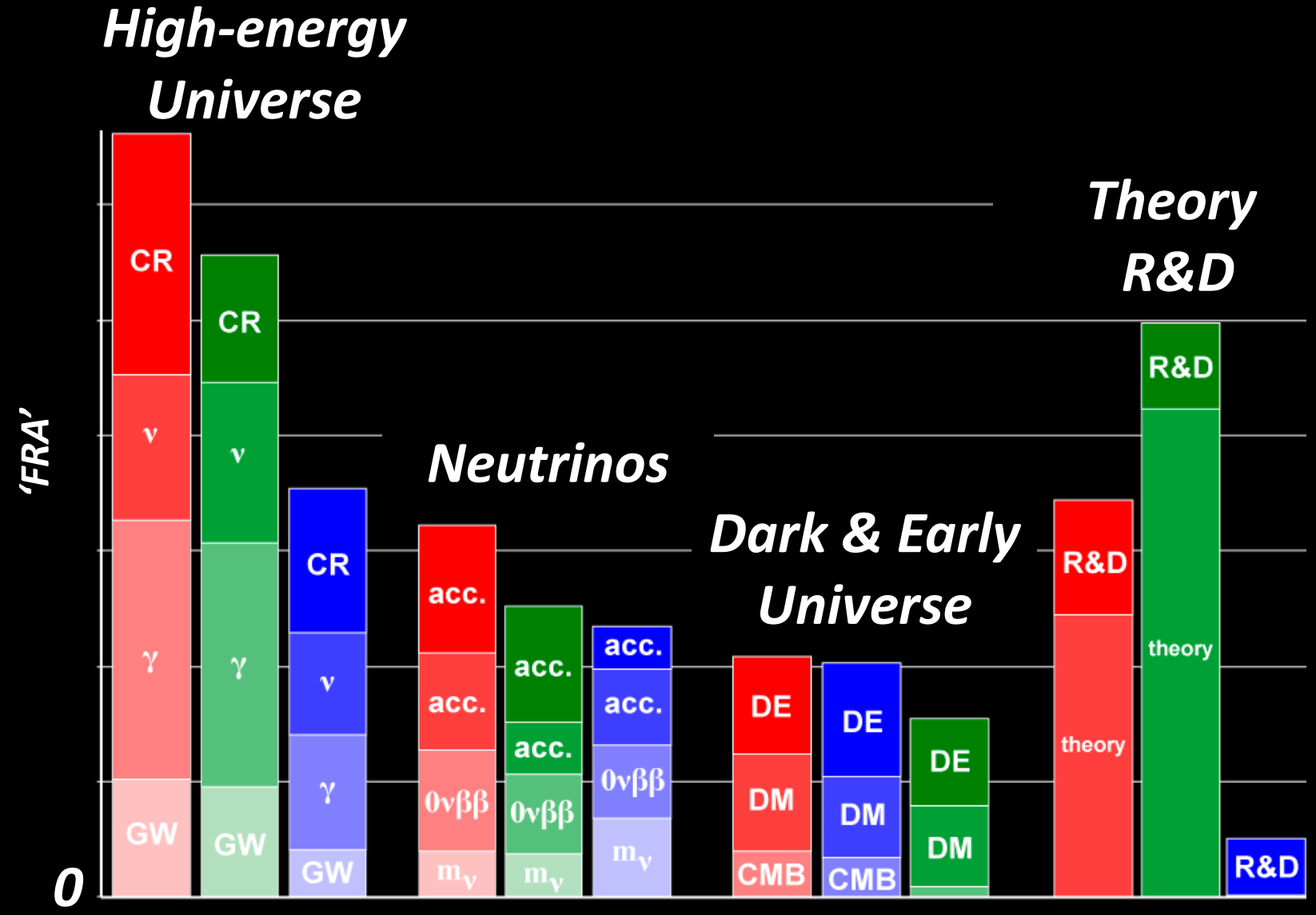
HE γ-rays

Ambitions APPEC's 2008 roadmap …



preliminary

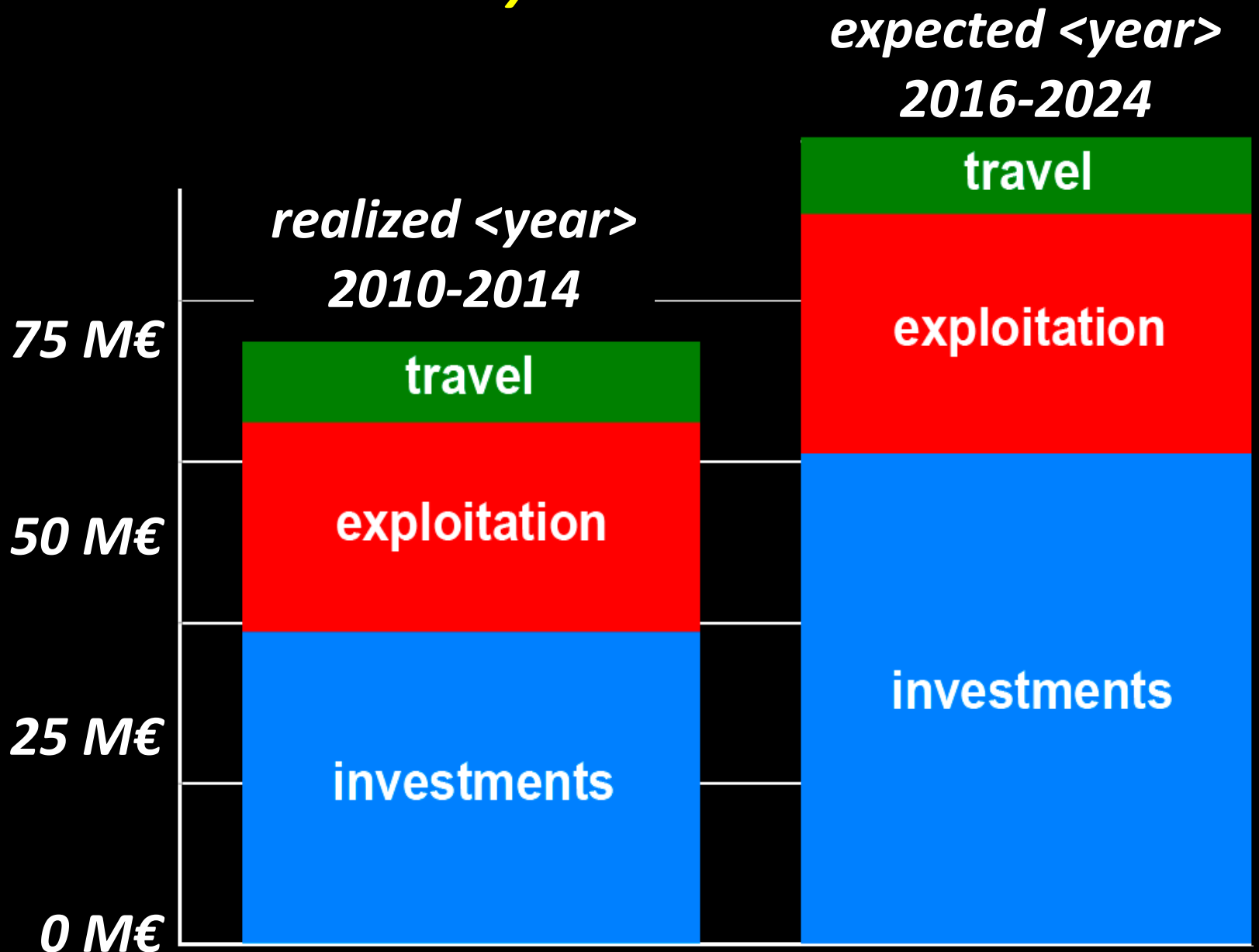
APPEC: *inventory human-resources*



Senior scientists – Junior scientists – Engineers

preliminary

APPEC: *inventory €-resources*

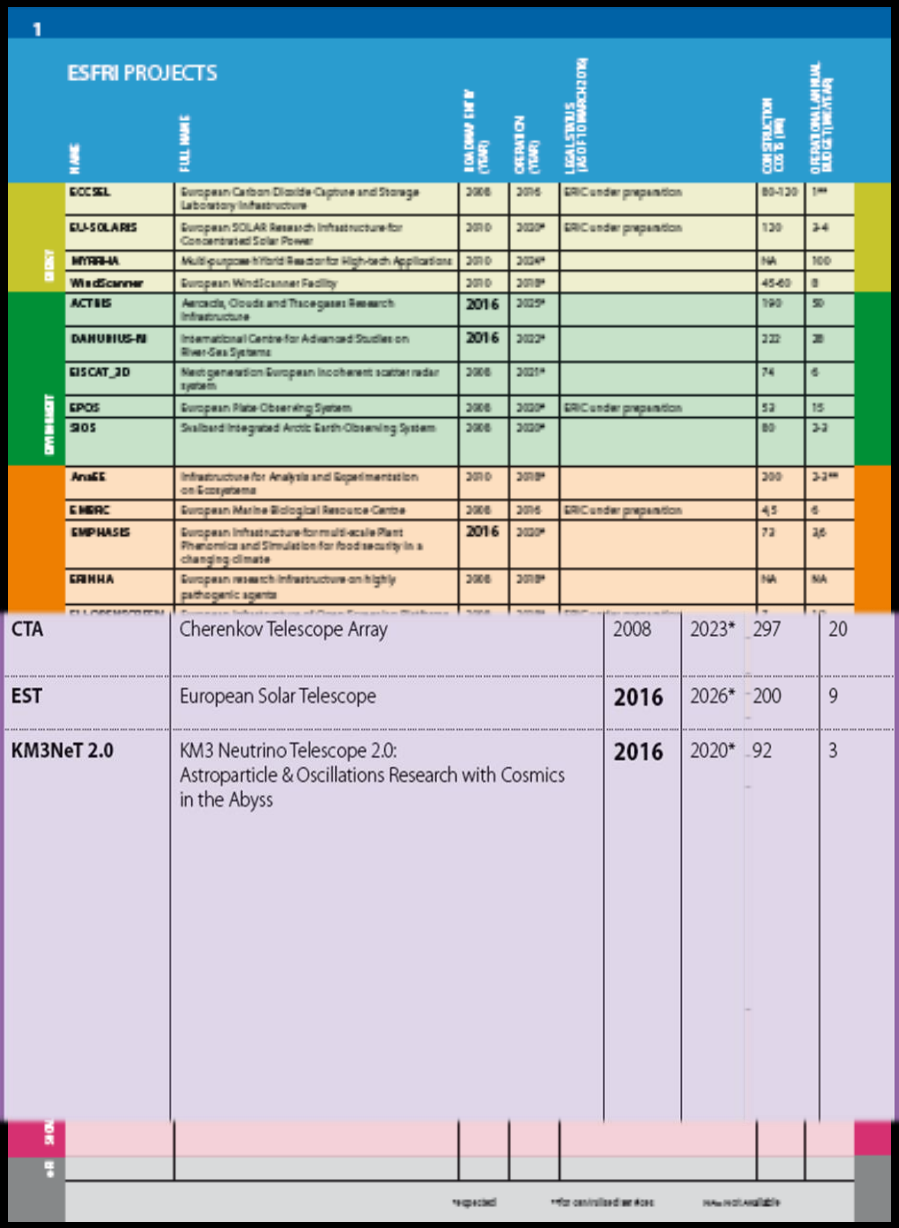


Some countries, EU-regional & -structural & astronomy funding still missing …

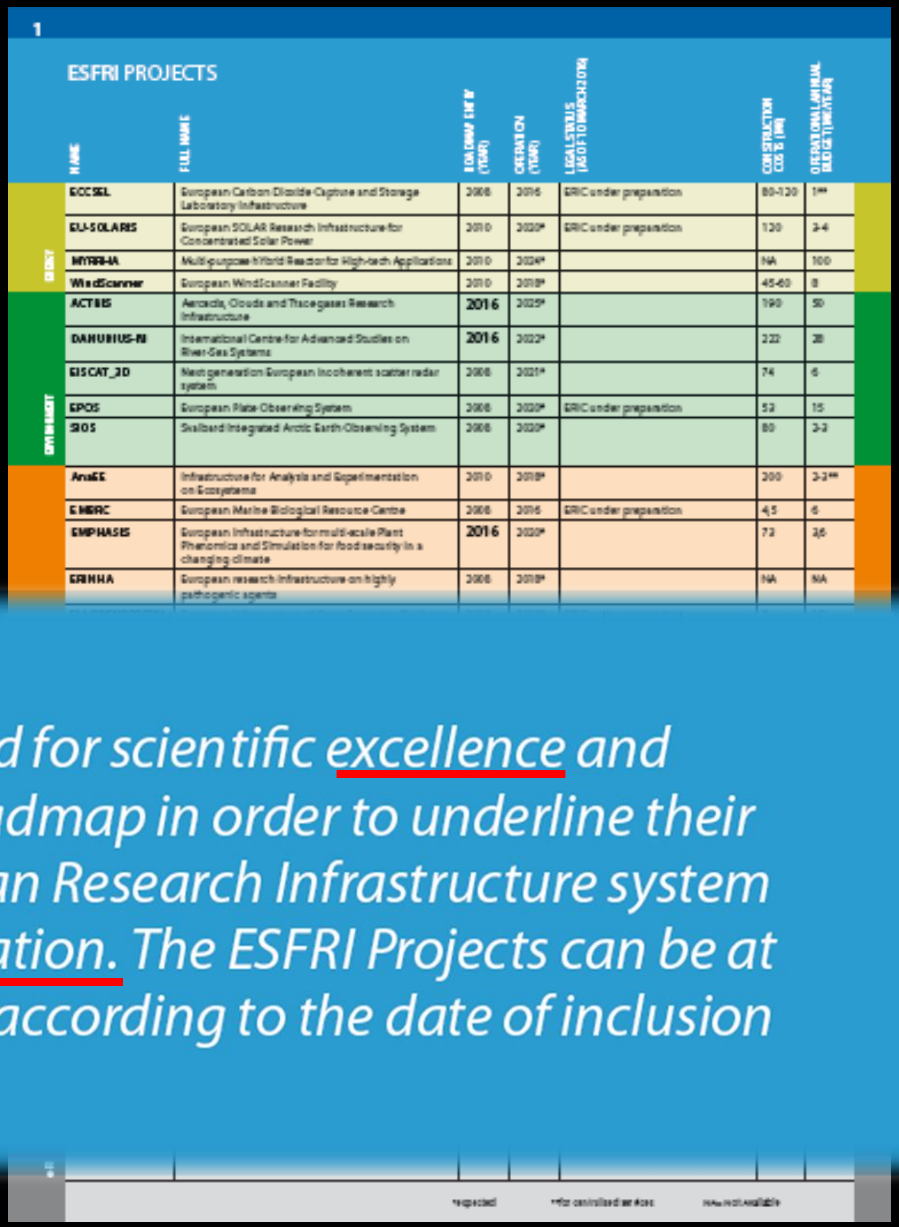
APPEC: *experiment 'fact' sheets*

Science case, investment, exploitation, schedule … help from APPEC!

European roadmap: *ESFRI*



European roadmap: *ESFRI*



ESFRI Projects

The ESFRI Projects have been selected for scientific excellence and maturity and are included in the Roadmap in order to underline their strategic importance for the European Research Infrastructure system and support their timely implementation. The ESFRI Projects can be at different stages of their preparation according to the date of inclusion in the ESFRI Roadmap.

National roadmaps: *APP well represented*

Excellent start of process

Next step:
funding alignment,
cost savings, staging, …

Progress

Both attracting EU/regional funding

KM3NeT

Cost reduction: ***ESFRI 2006 220-250 M€***
ESFRI 2016 125 M€

More science: ***ν-mass hierarchy + PeV ν***

Down side: ***slower than anticipated …***

cta
cherenkov telescope array

Funding: ***excellent prospects in many EU countries***

Legal structure (GmbH/D) established

Prospective sites (Chili & Spain) identified

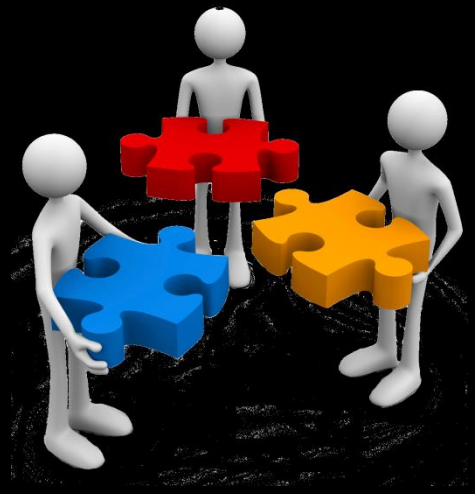
Concern: ***(exploitation) cost***
but: make fair comparison!

Points of attention

+ room for R&D, theory!

coherent program

connected community



alignment of EU national funding …
(harder in EU than in USA, Japan, China)

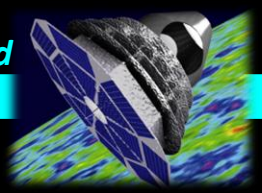
→ *technical readiness/convergence (€'s)*
→ *realistic time schedules*
→ *realistic spending profiles*
→ *exploitation costs*

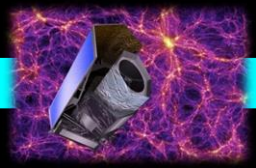
Bottom line: we need to strengthen EU organisation …

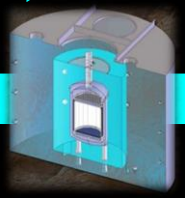
Promising – *very bright* – future ahead!

COSMOLOGY

NEW

PIXIE
COrE+/LiteBIRD
+ ground-based

CMB

DESI, LSST
Euclid

DE

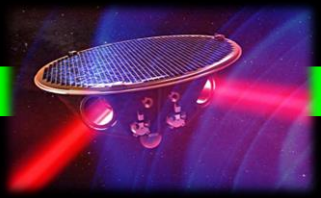
multi-ton
argon/xenon
+ other technologies

DM

2016 2018 2020 2022 2024 2026 2028 2030 2032 2034

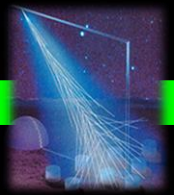
ν

1t 0νββ
JUNO, …
DUNE/HK
+ direct ν-mass …

neutrinos

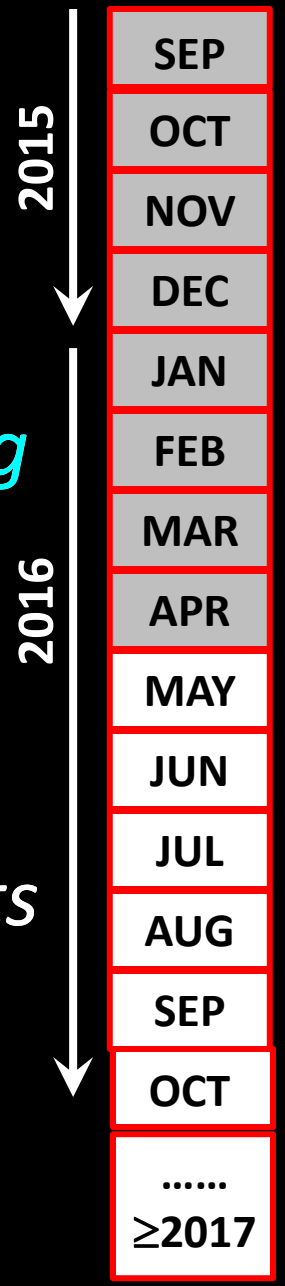
AdvVirgo/LIGO+
ET
eLISA

GWs

HEU

Auger+, TA
CTA
Icecube/KM3NeT, GVD

HE CR-, γ- & ν-observatories

Roadmap process

- *Executive summary*
- *Introduction*
- *Research themes (3)*
- *Theory, R&D, Computing*
- *EU APP community*
- *Global aspects*
- *Societal relevance*
- *Inter-disciplinary aspects*
- *Organizational aspects*
- *Recommendations*



together with you

APPEC GA & SAC

→ draft roadmap

→ considerations

→ town meeting

anyone interested

=you!

→ *15-20* recommendations

→ final roadmap

→ launch event

→ *roadmap implementation!*

Regarding the recommendations

General:

- *Excellent & appealing science program*
- *Dynamic & (too fast?) expanding field*
- *incredible experiments*
  often at 'interesting' locations
  scale/€: small – medium – large – huge
- *Highly distributed community (many labs)*
- *State-of-the-art & crucial detector R&D*
- *'All' encompassing theory!*

R&D and theory activities fundamental and must have high priority (EU-applications, APPEC common calls, work closer with CERN, etc.)

Multi-messenger:

Funding: 100% astroparticle physics
i.e. if APPEC does not do it – it will not happen!
Vice-versa: if it does not happen – APPEC failed

And …: *Same applies to notably* ***DM*** *&* ***0νββ***

but:
- *experiment costs still below 100 M€*
- *we know we need global approach*
- *should maintain strong EU position!*

New APPEC activities CMB & DE:

CMB approach (Florence workshop) as 1st step
Initiate same concept for DE?

Cosmic rays: *<<€*

near future obvious: get Auger+ going

longer term: R&D to collect >> & better statistics

γ-rays: *€€€€: APPEC + EU + astronomy*

CTA! But try to get costs down (technology, size, …)

or secure more alternative funding (EU?) channels

ν-telescopes: *€€€: APPEC + EU + USA*

Icecube, KM3NeT, GVD → global ν-observatory

time-wise: 1st ORCA, sparse=HE array(s) next

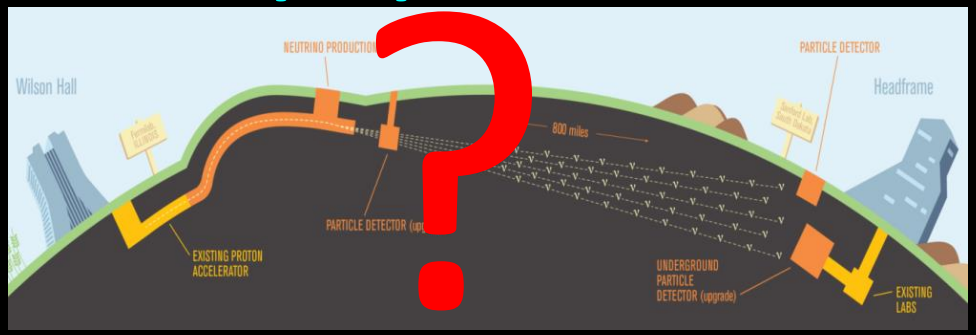
Gravitational waves: *>€€€€€: APPEC + EU + astronomy*

maximize LIGO, Virgo, … output

prepare for ET (APPEC+) & support eLISA (ESA)

DUNE & HK: *in ex clude in our roadmap?*

ν-properties



long-baseline ν-beam

DM search

LHC

2008/2011: 'megaton' detector integral part of roadmap

Deep-underground location = APPEC infrastructure

Addresses core APPEC topics like p-decay, SN-ν, … as well

Astroparticle physics detection technology/concept

Synergies with other ν-experiments *(applies also to DM)*

Community feels itself to belong to astroparticle physics?

APPEC contributed to the convergence (DUNE)

Governance/funding: indeed primarily accelerator labs …


thank you
danke
謝謝
рахмат
ngiyabonga
teşekkür ederim
Баярлалаа
спасибо
mersi
kia ora
barka
welalin
tack
spas
mahalo
tapadh leat
faafetai lava
vinaka
спасибі
blagodaram
dank je
misaotra
matondo
paldies
grazzi
gracias
хвала
kiitos
dankie
nanni
nandri
dhanyavad
mauruuru
köszönöm
aciò
dankon
akun
asante
manana
obrigada
tenki
bedankt
bayarlalaa
gràcie
hvala
enkosi
dziękuję
djiere dieuf
tau
mochchakkeram
murakoze
дякую
mamnun
chokrane
chnorakaloutioun
gratias ago
gràcies
sulpáy
go raibh maith agat
sobodi
děkuji
obrigado
sagolun
sukriya
kop khun krap
taiku
arigatô
takk
dakujem
trugarez
mèsi
didi madloba
najis tuke
ありがとう
tanemirt
grazie
rahmet
terima kasih
kam sah hamnida
rahmat
diolch
dhanyavadagalu
shukriya
mercê
мерси
তোমাকে ধন্যবাদ
감사합니다
xièxie
ευχαριστώ
merci