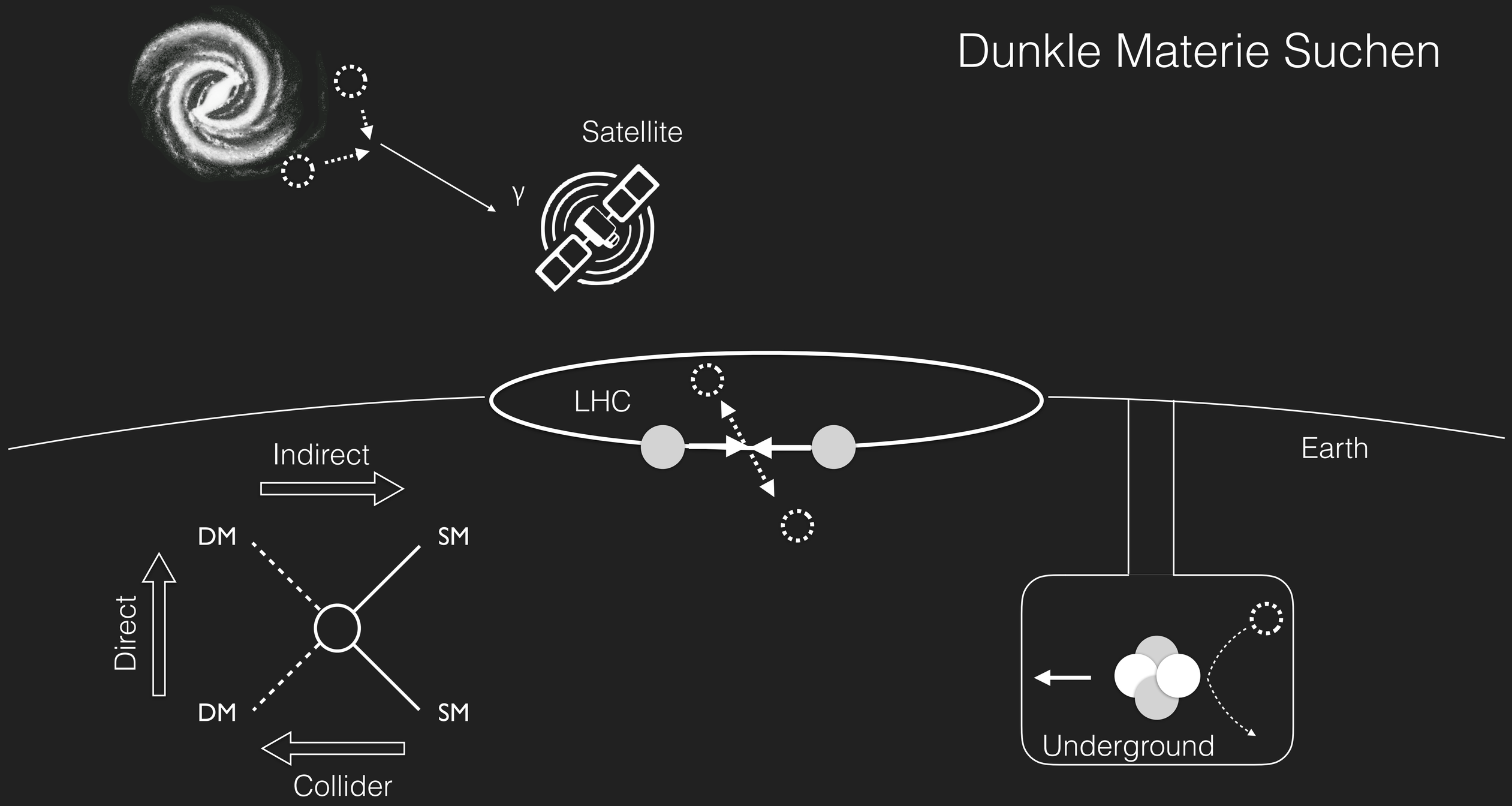
The New York Times

Thursday, July 23, 2020

The Other Half of the Universe Discovered

Geneva, Switzerland

Dunkle Materie Suchen



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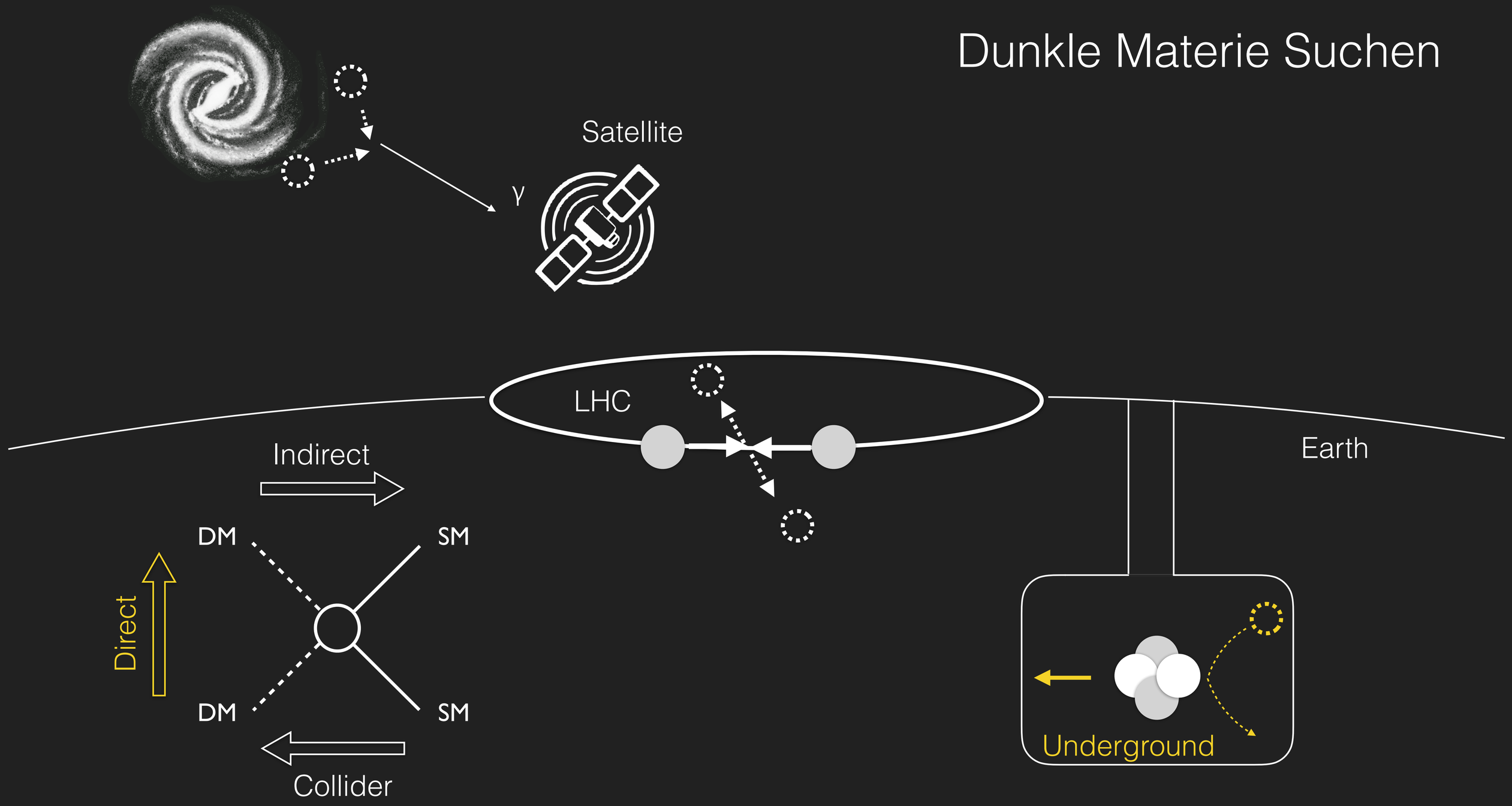

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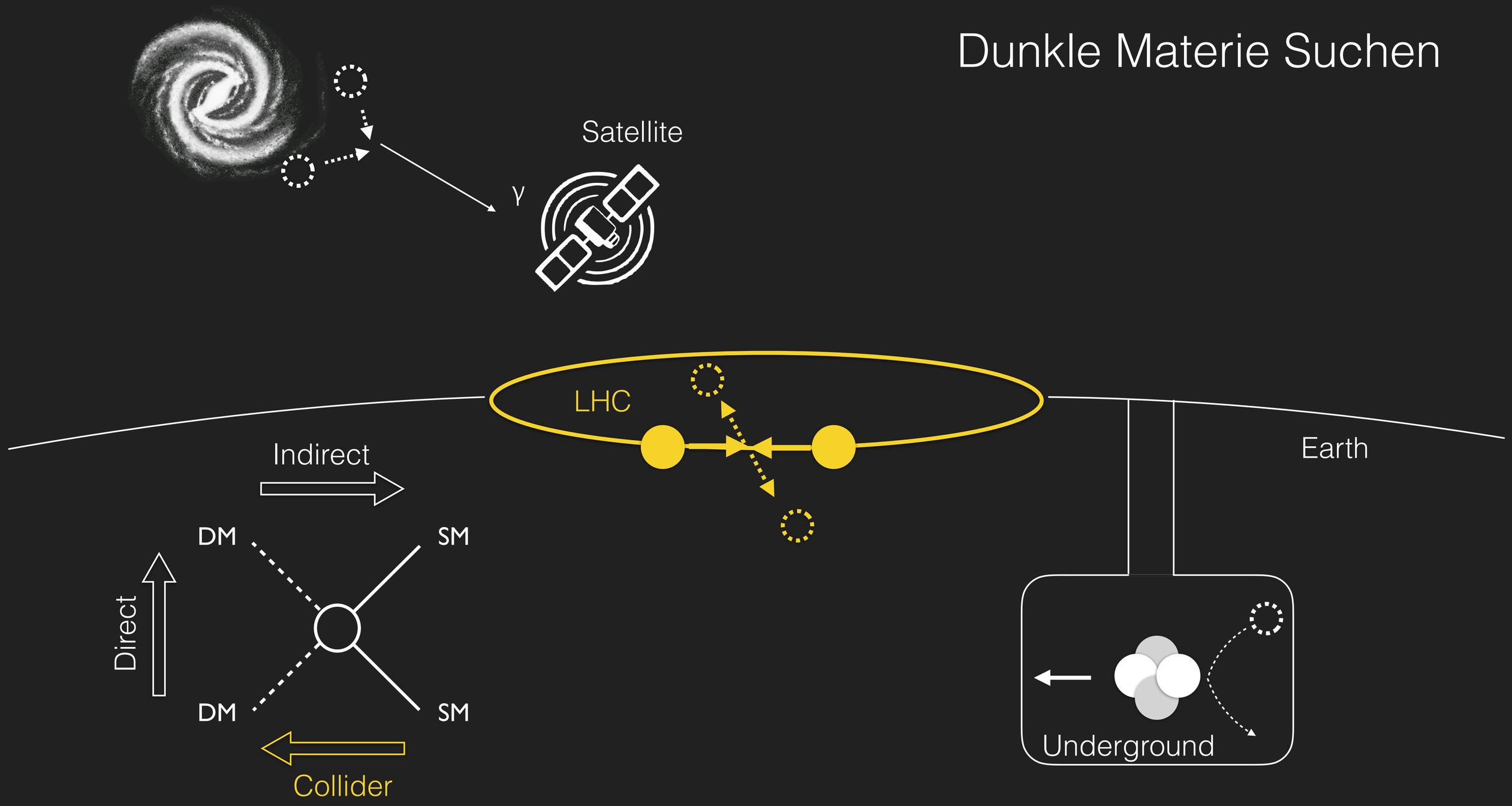

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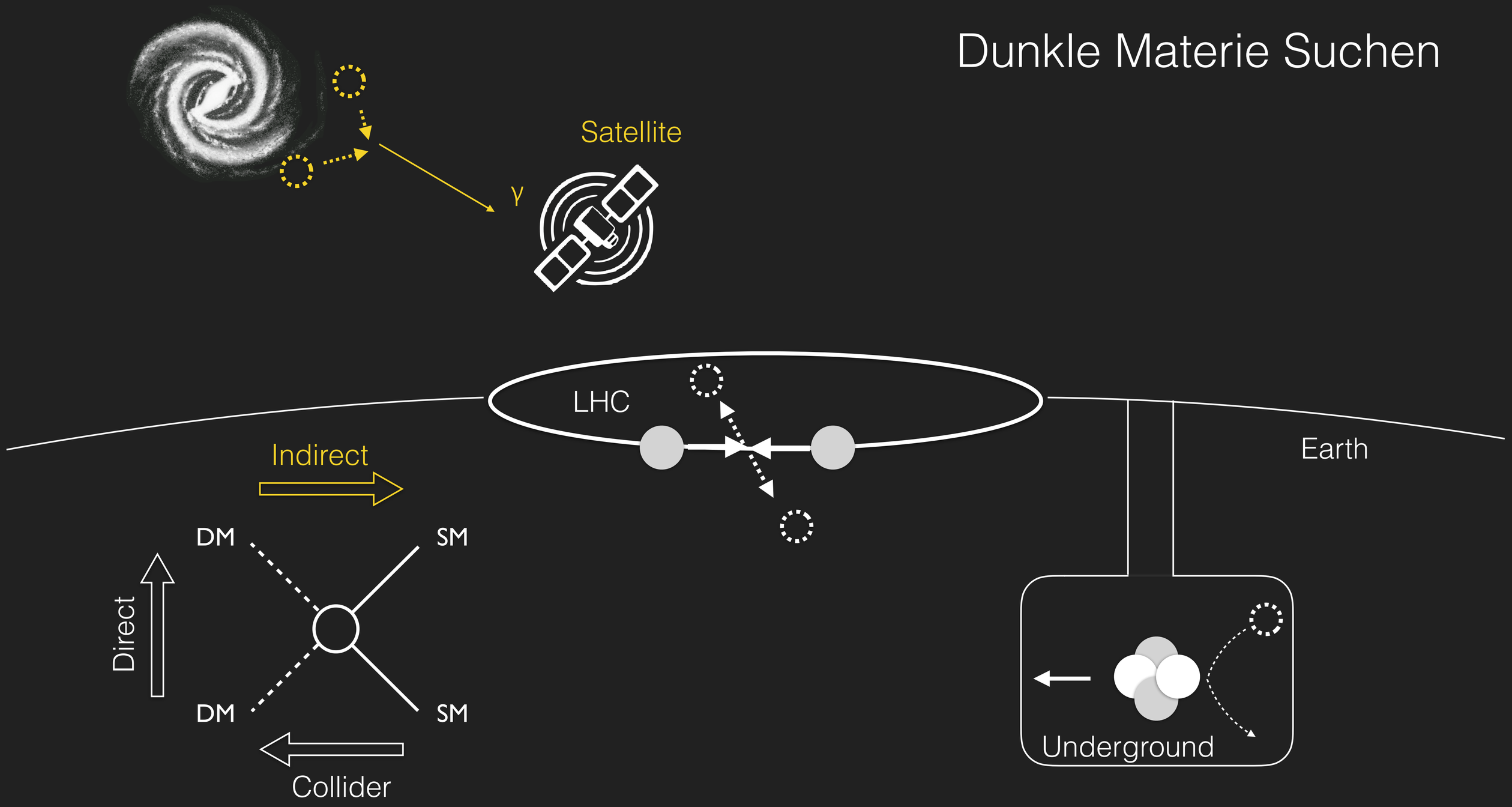
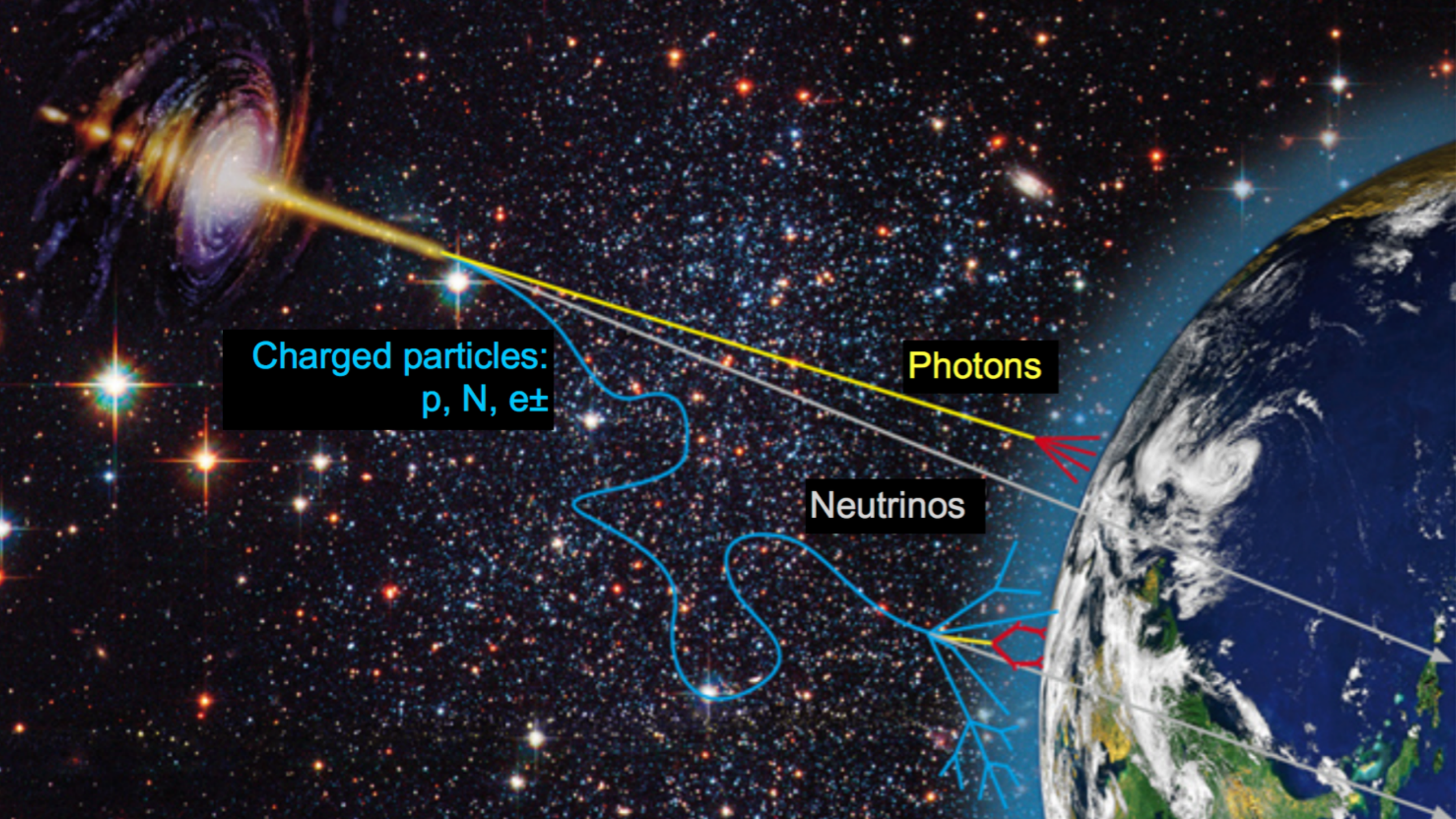
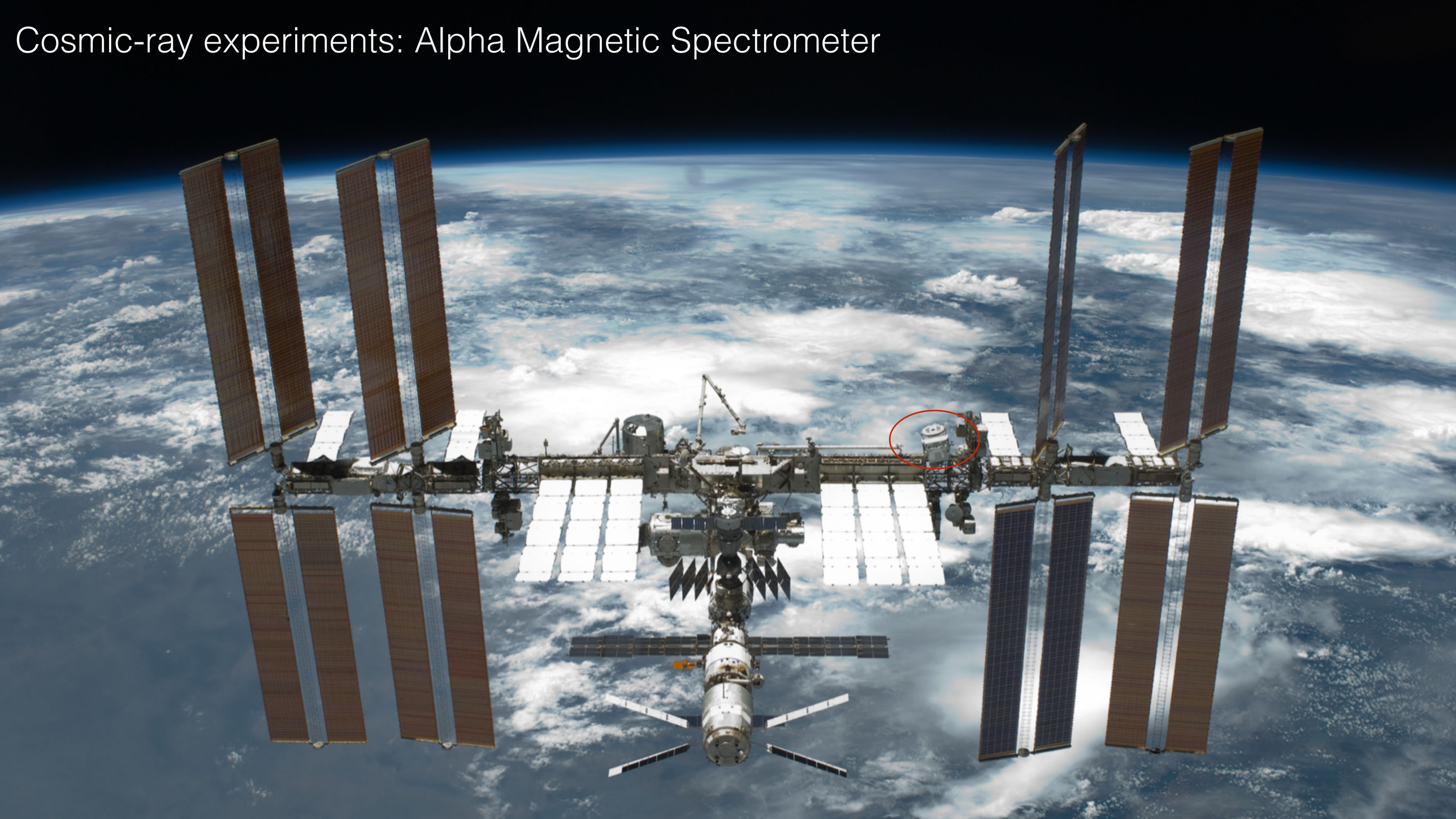
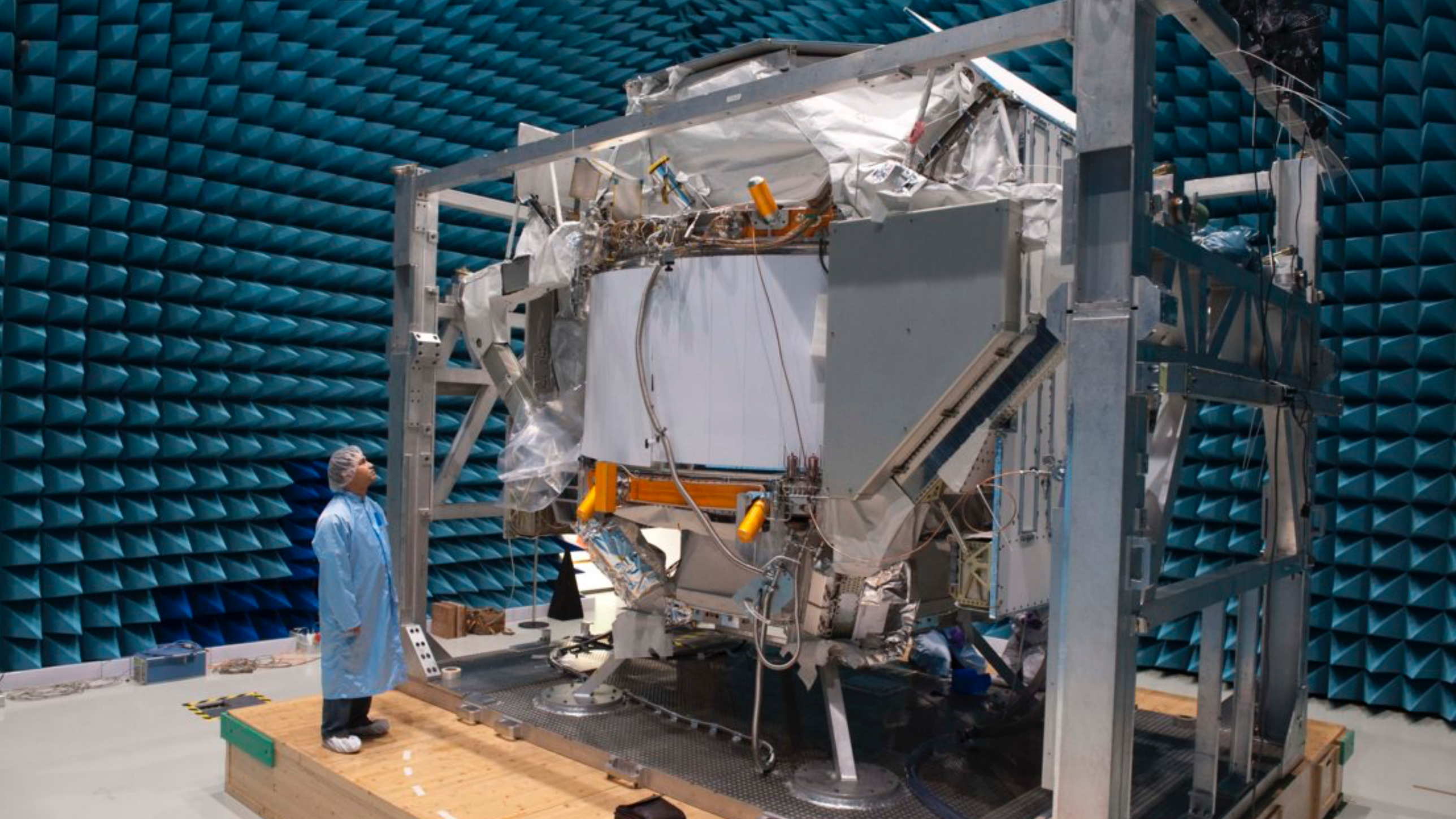


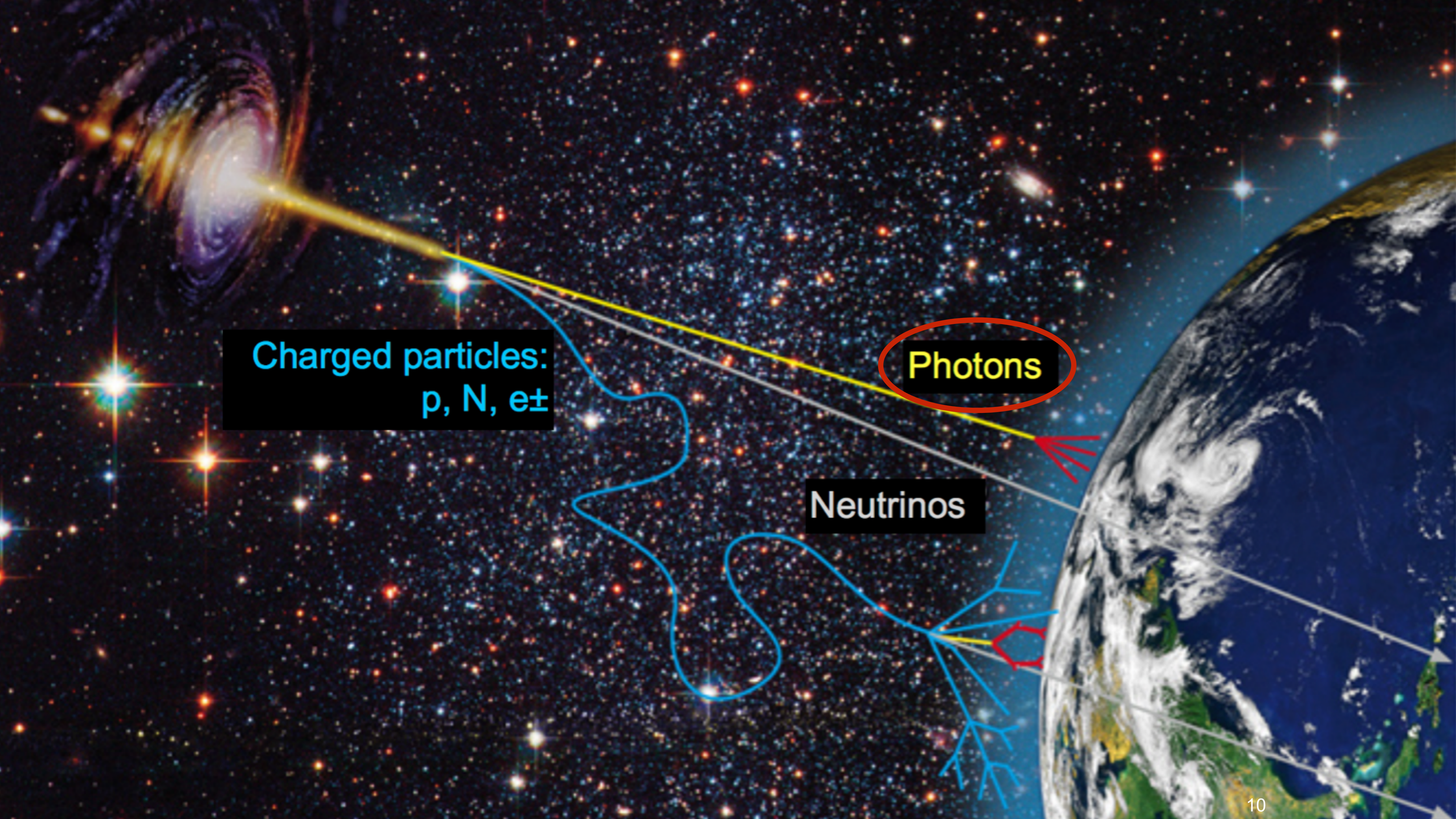

Charged particles:
p, N, e±
Photons
Neutrinos

Cosmic-ray experiments: Alpha Magnetic Spectrometer




AMS
AMS
Endeavour




Charged particles:
p, N, e±
Photons
Neutrinos

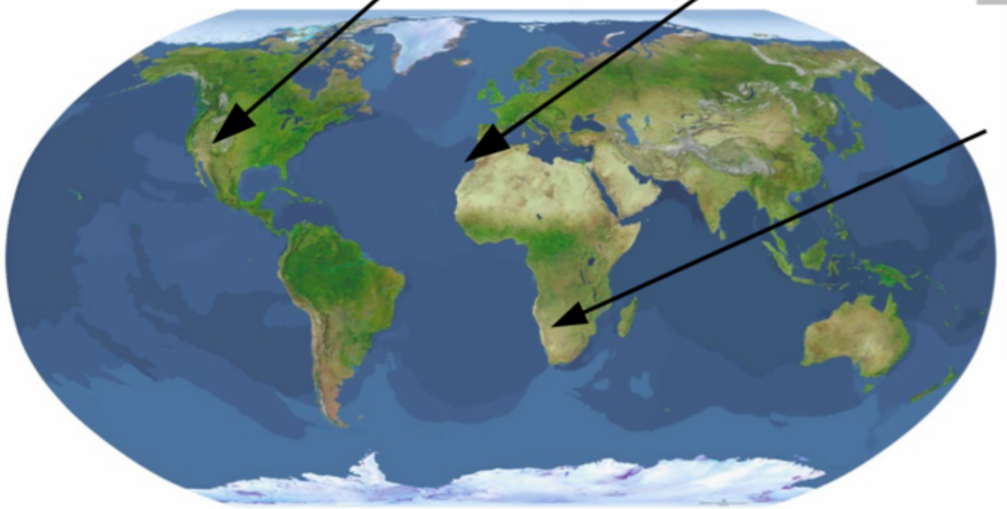
Space based:
(Pair conversion detector)

Fermi LAT
since 2008

20 MeV – 300 GeV
Effective area: $1m^2$
Obs. time: 10yr

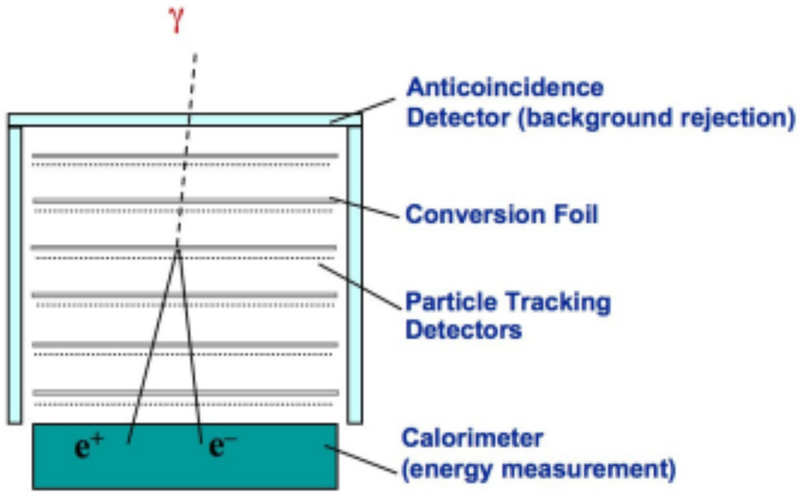
Ground based:
(Atmospheric Cherenkov Telescopes)

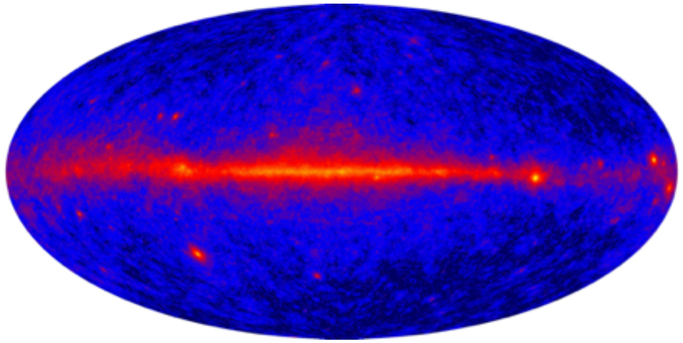
10 GeV – 10 TeV
Effective area: $1km^2$
Obs. Time: 100h

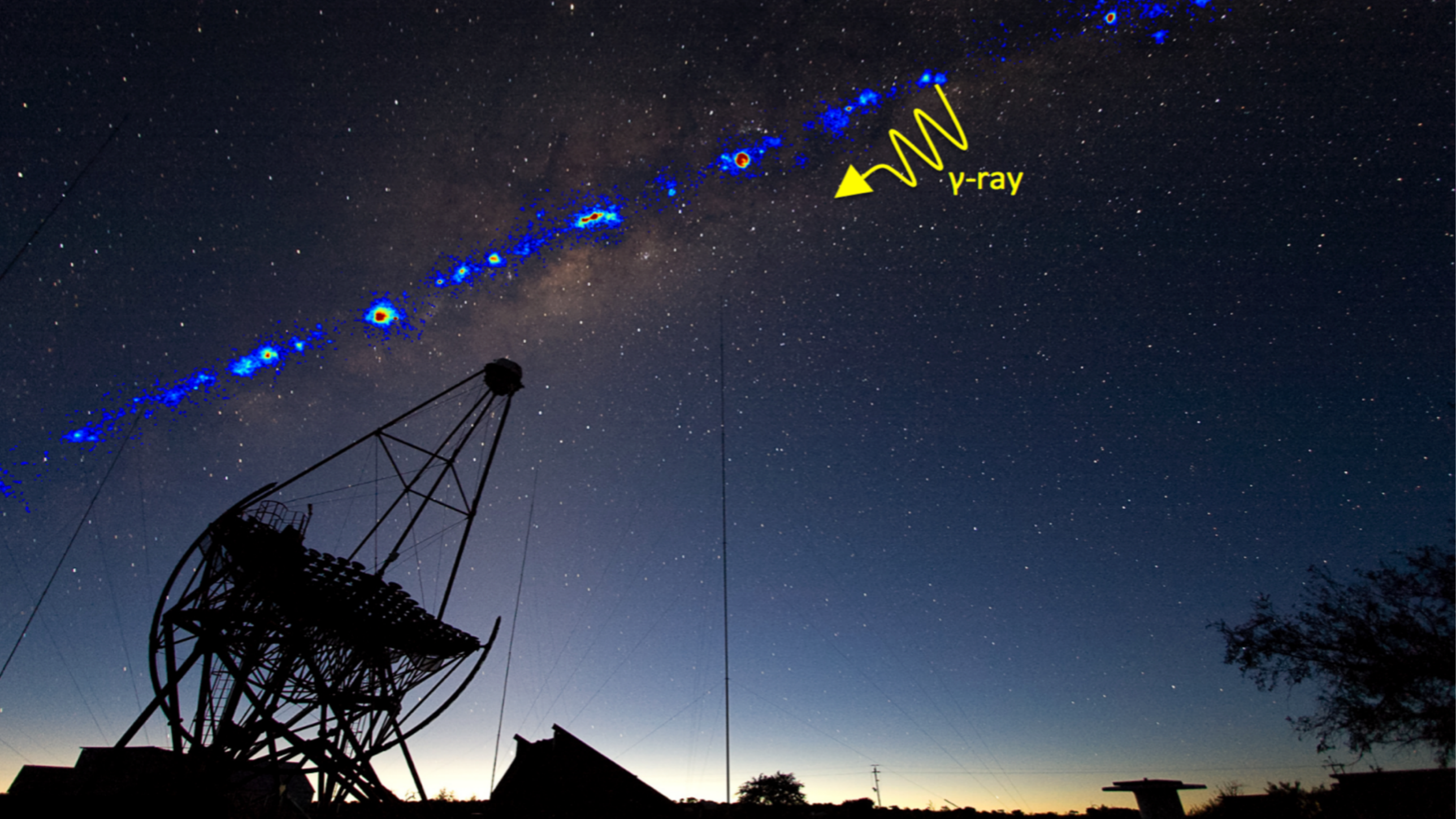


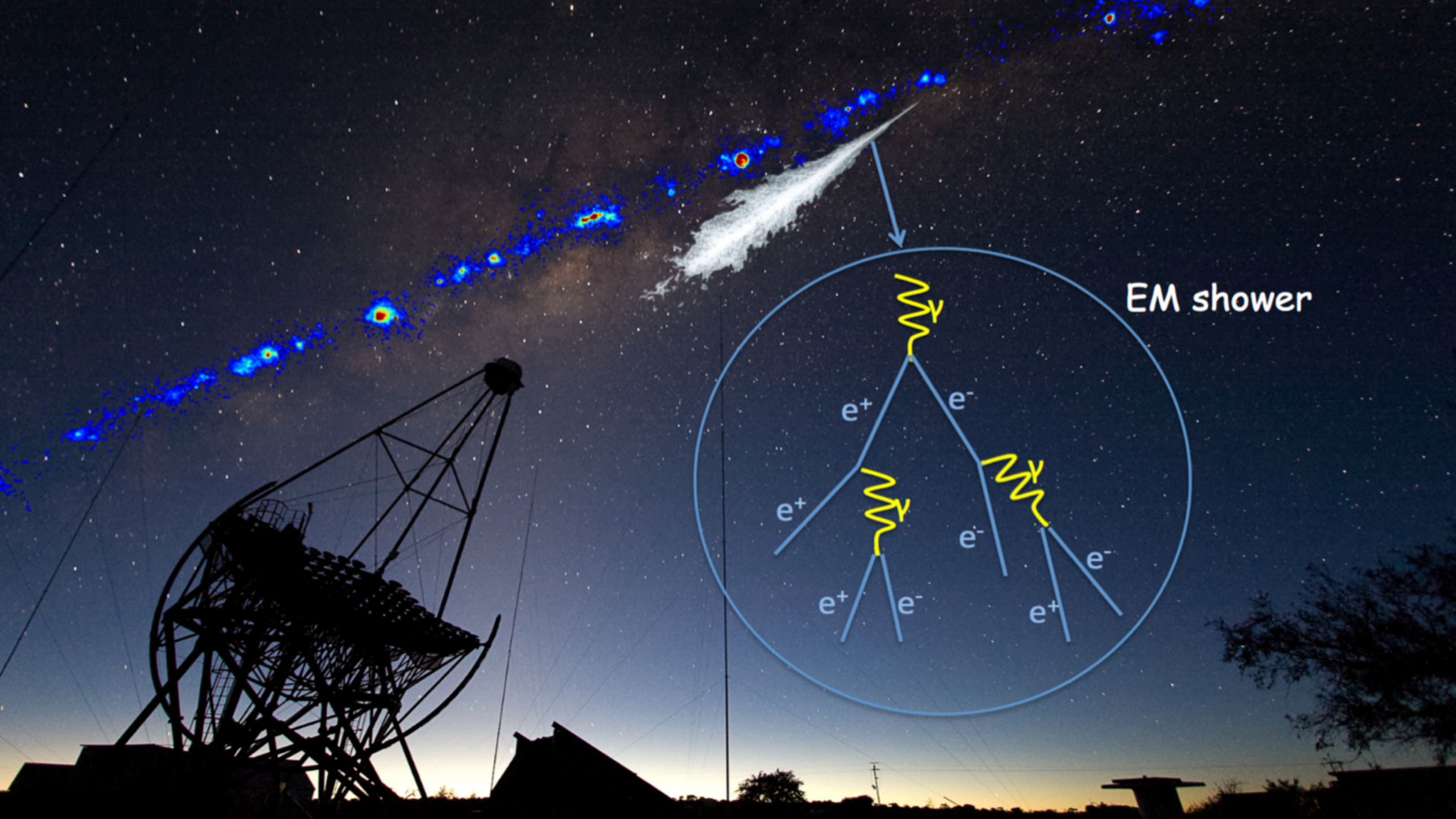
Future: CTA

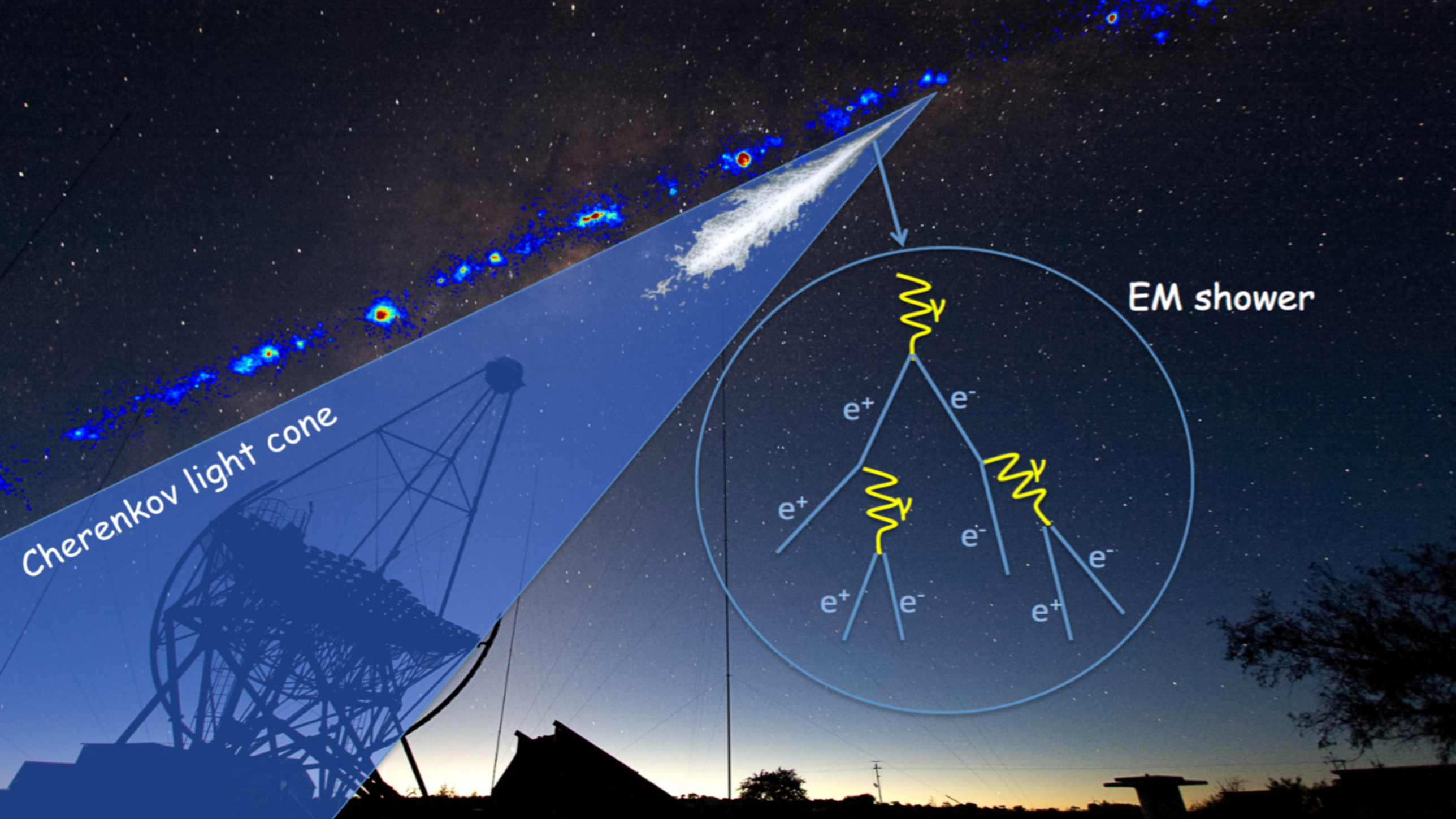
Fermi Large Area Telescope



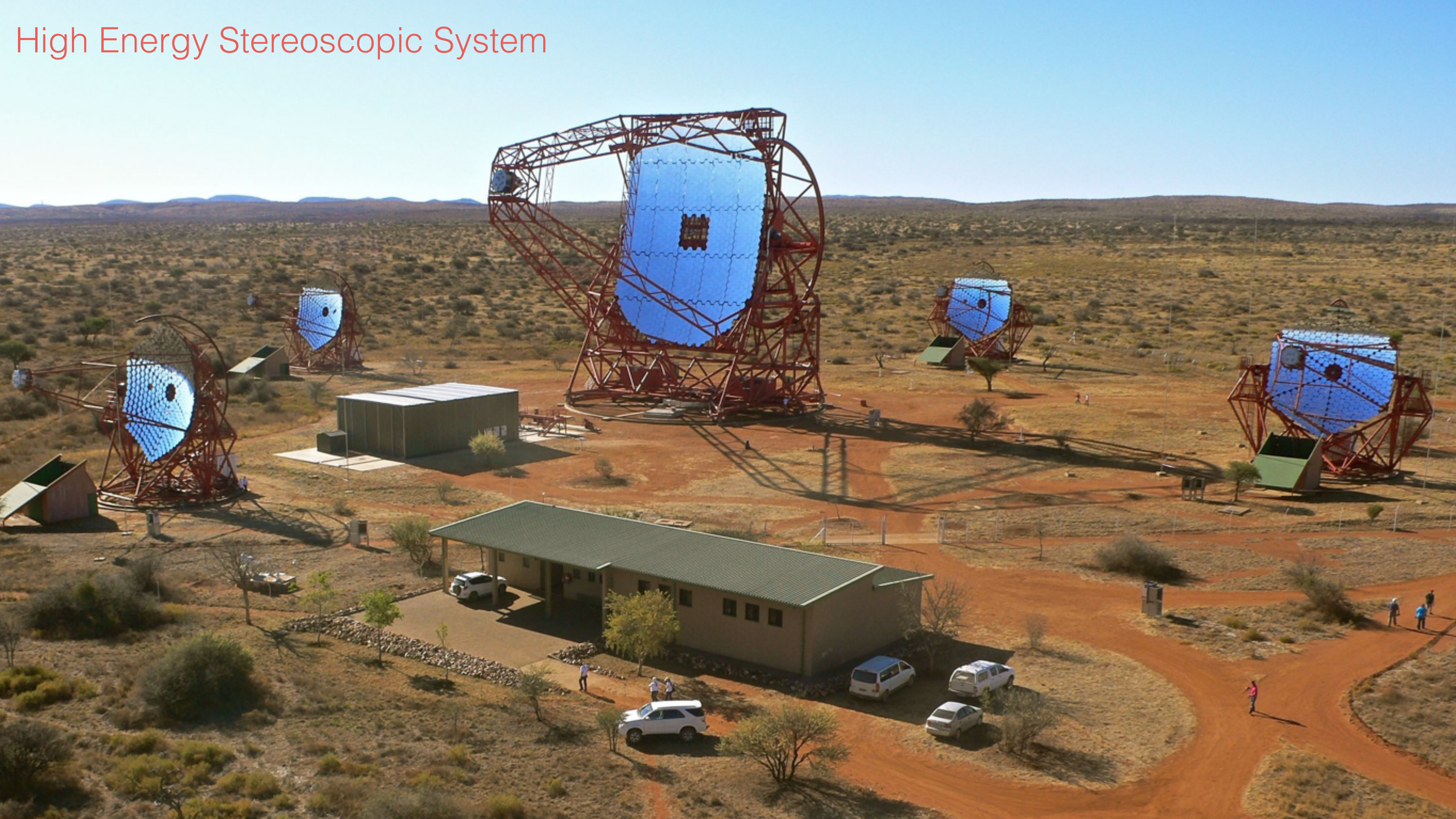


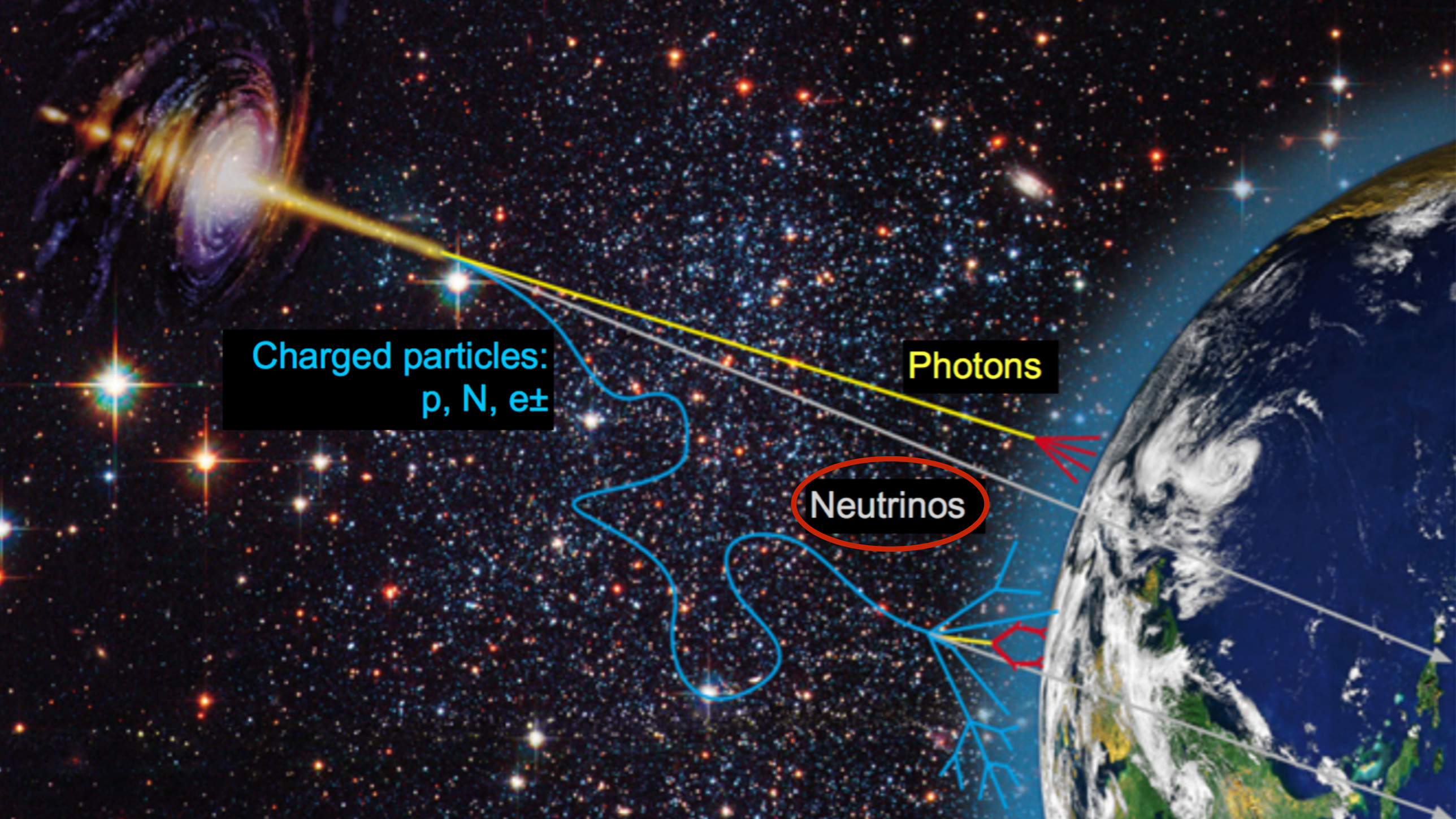

γ-ray

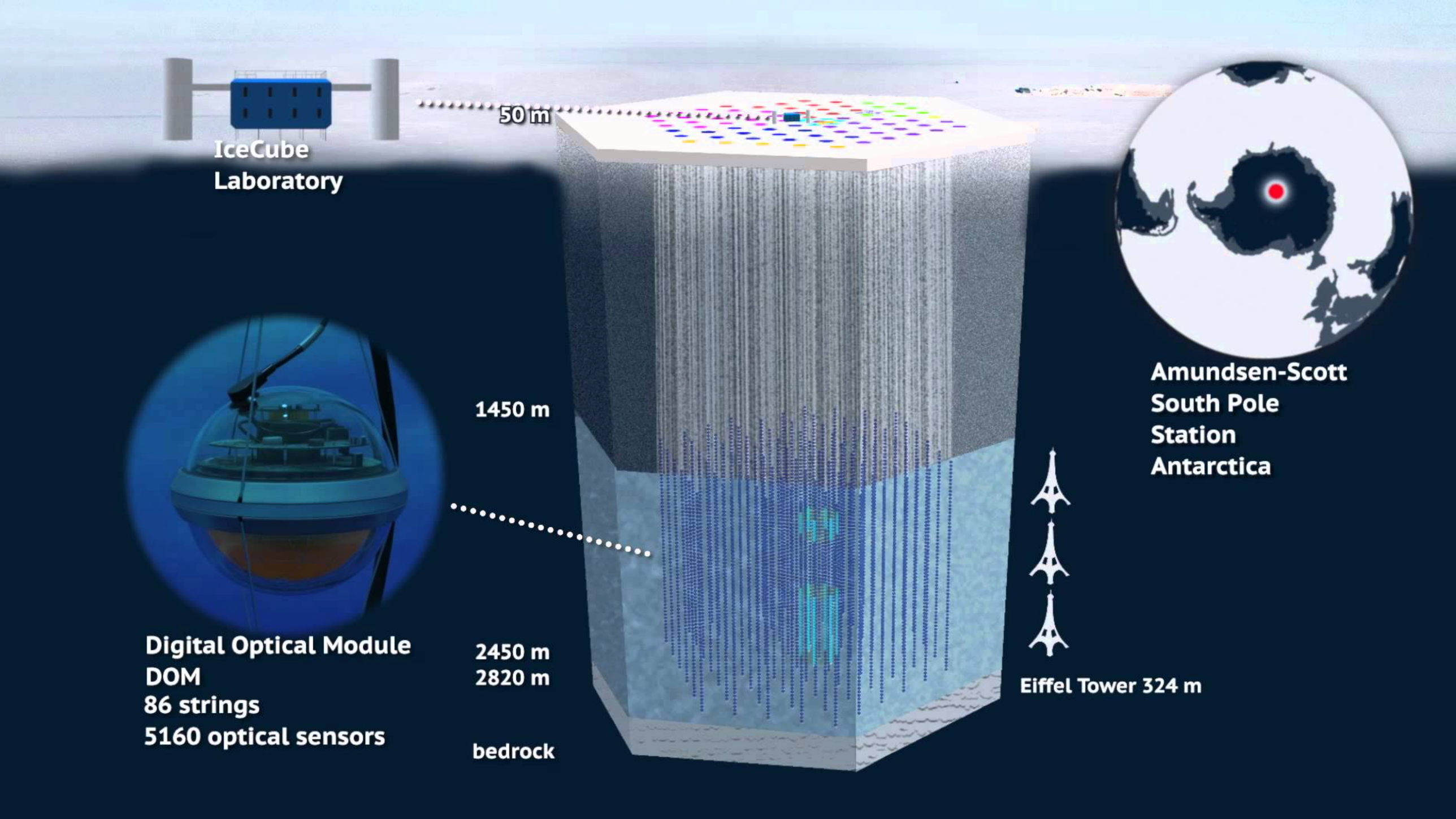

EM shower
γ
e+
e-
γ
γ
e+
e-
e-
e+
e-
e+


Cherenkov light cone
EM shower
e+
e-
e+
e-
e+
e-
e+
e-

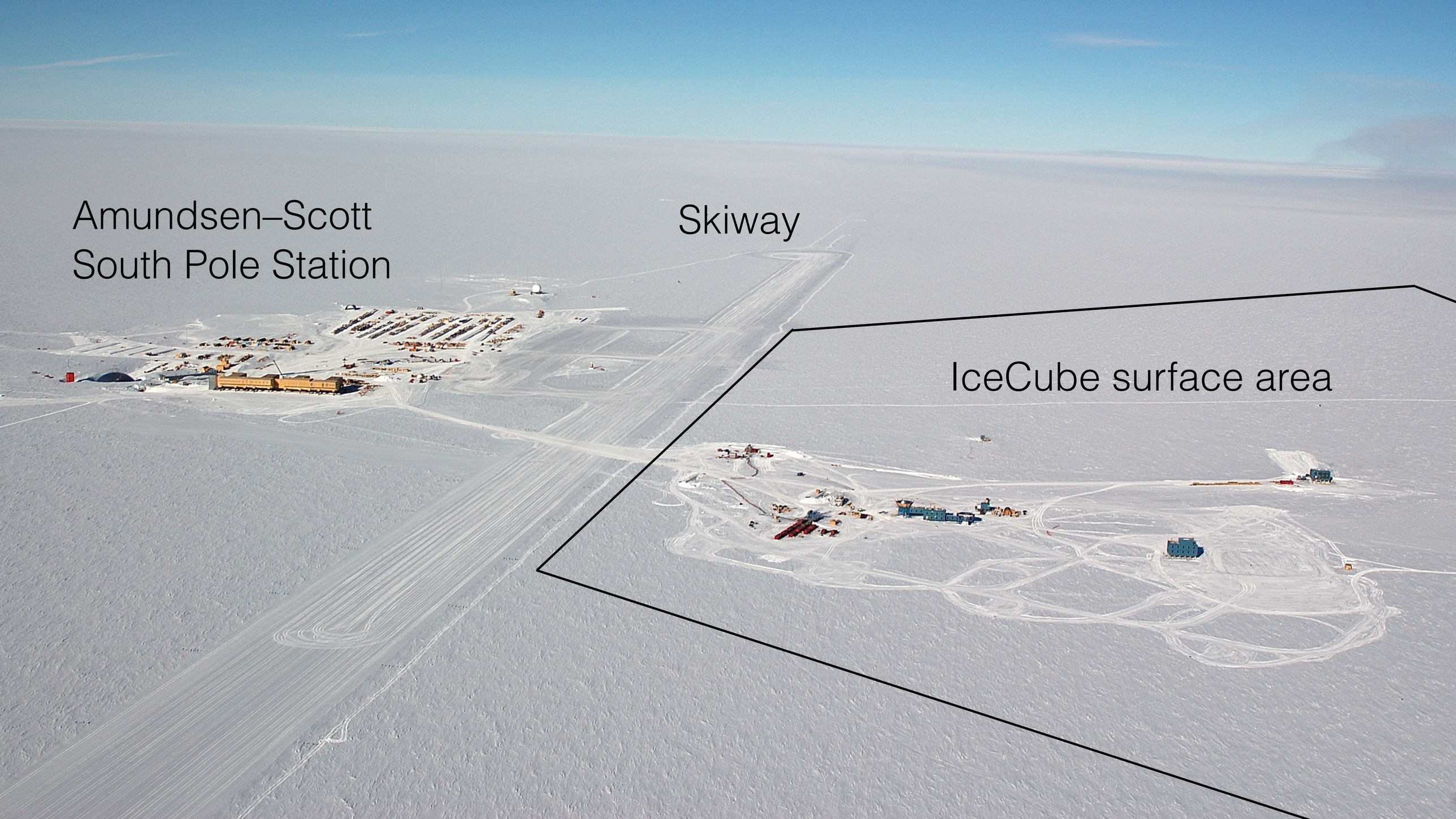
High Energy Stereoscopic System




Charged particles:
p, N, e±
Photons
Neutrinos


IceCube
Laboratory
50 m
1450 m
2450 m
2820 m
bedrock
Digital Optical Module
DOM
86 strings
5160 optical sensors
Eiffel Tower 324 m
Amundsen-Scott
South Pole
Station
Antarctica

TP
GM


Amundsen–Scott
South Pole Station
Skiway
IceCube surface area

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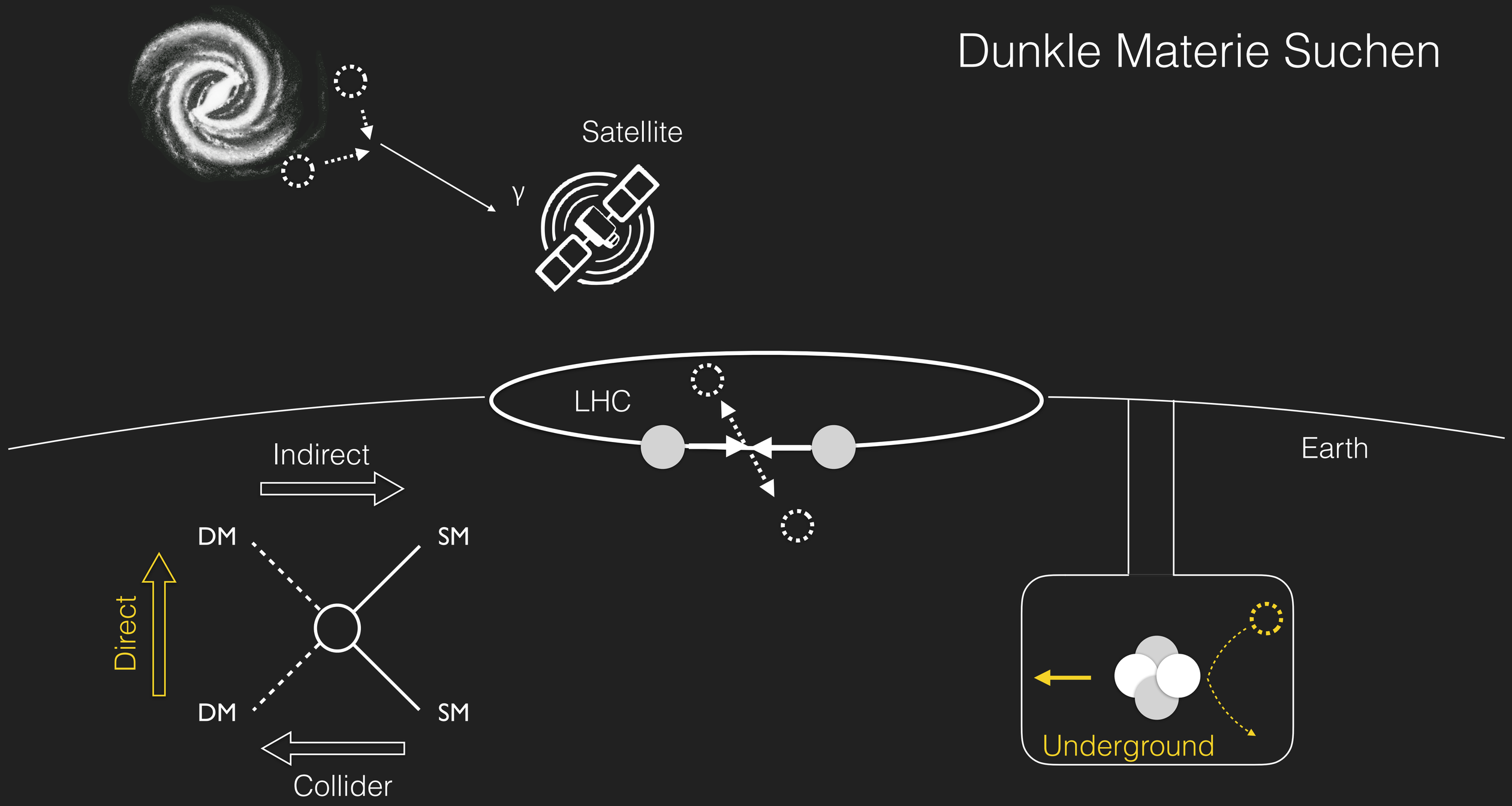
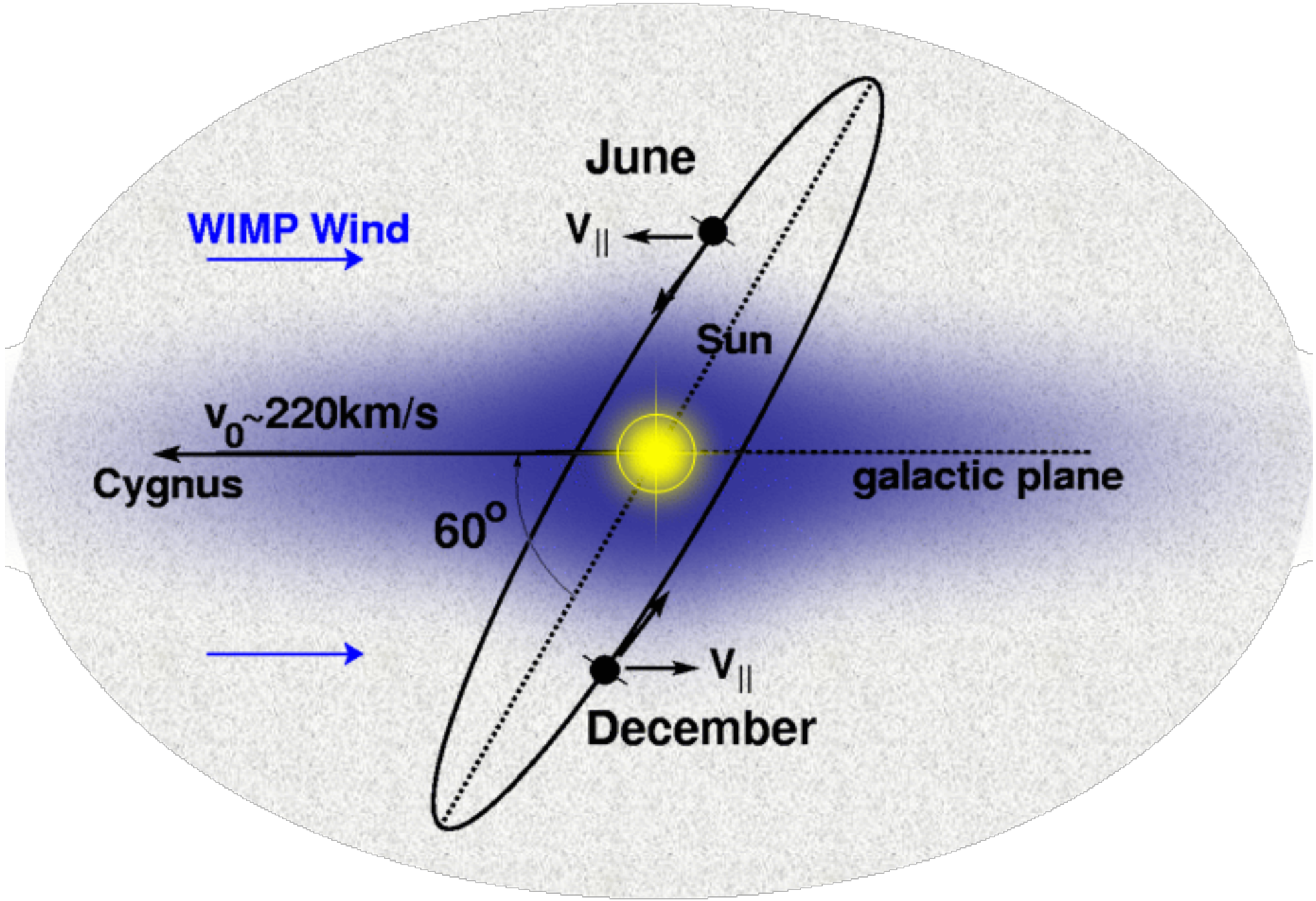
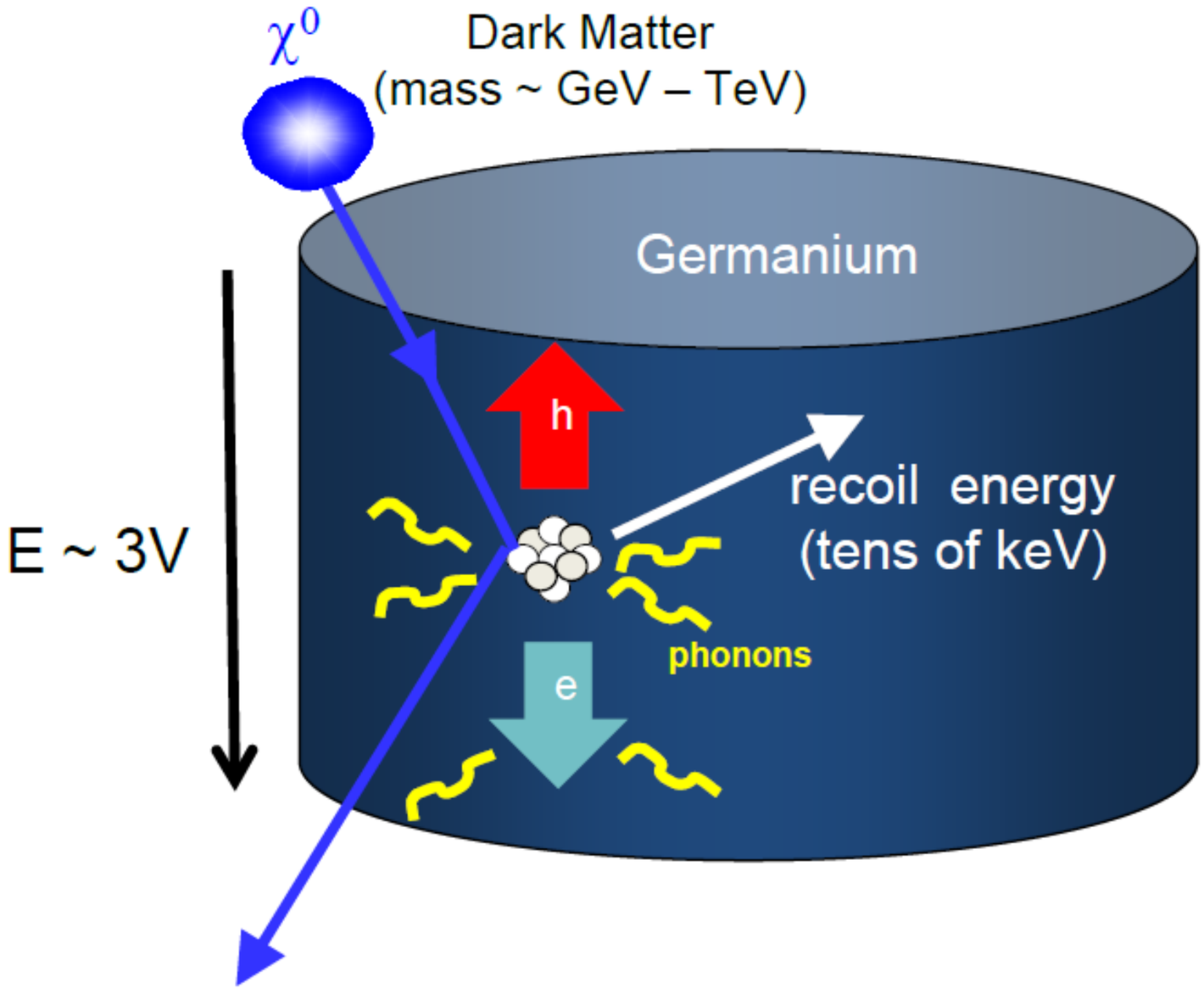


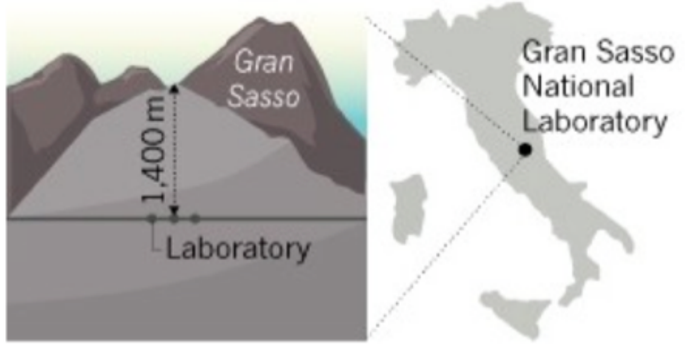

June
WIMP Wind
$v_{||}$
Sun
v_0~220km/s
Cygnus
galactic plane
60°
$v_{||}$
December

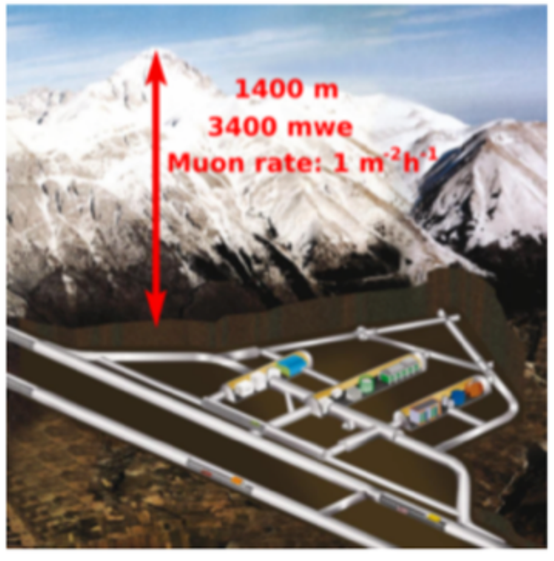
Direct detection



Soudan mine, northern Minnesota

Hosted by the
Laboratori Nazionali del Gran Sasso
(LNGS)





XENON10: 2005-07

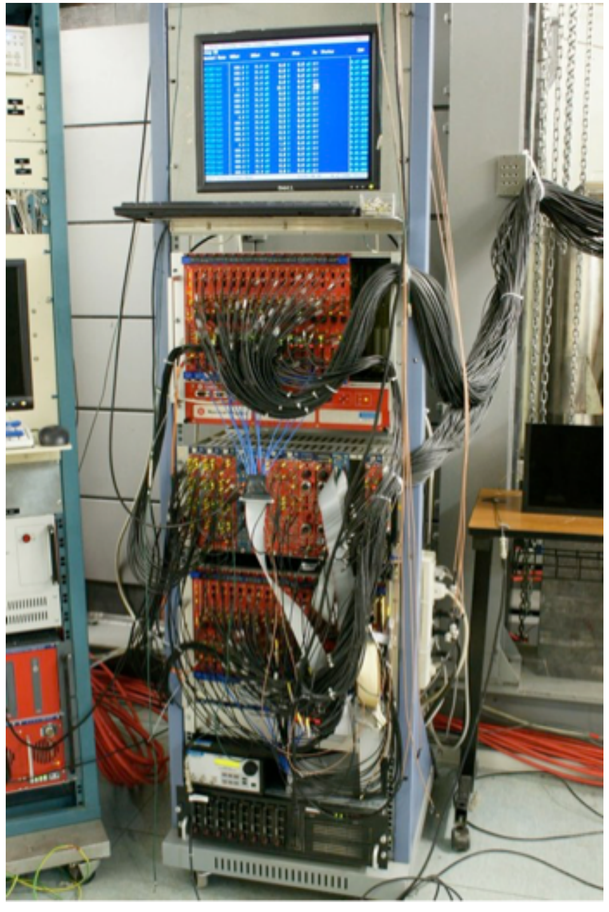
- 14 kg; 15 cm drift

XENON100: 2008-11

- 170 kg; 30 cm drift

XENON1T: soon

- 2,4 t; 90 cm drift




Xe
XENON
Dark Matter Project
XENON1
enlightening the

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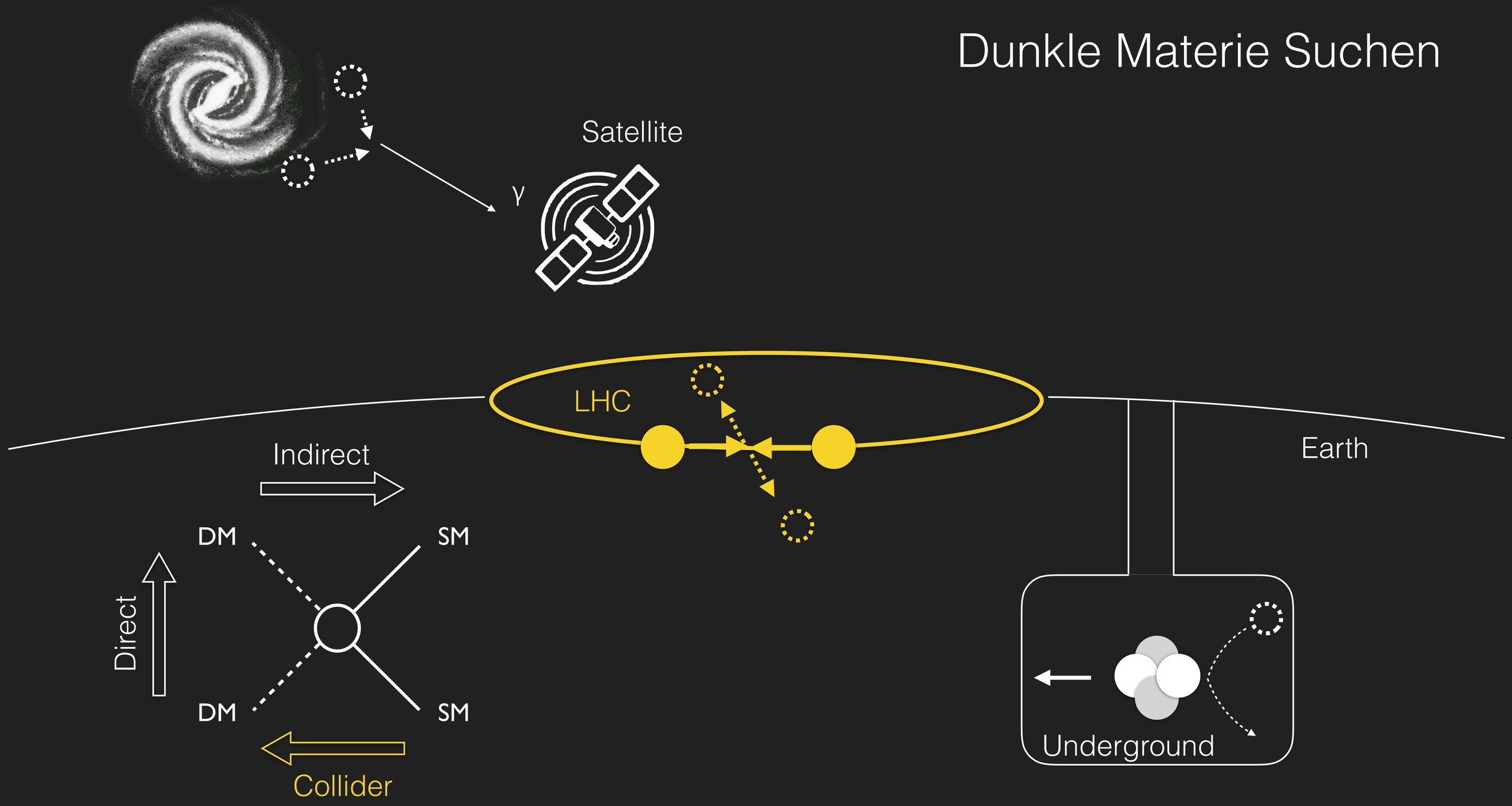
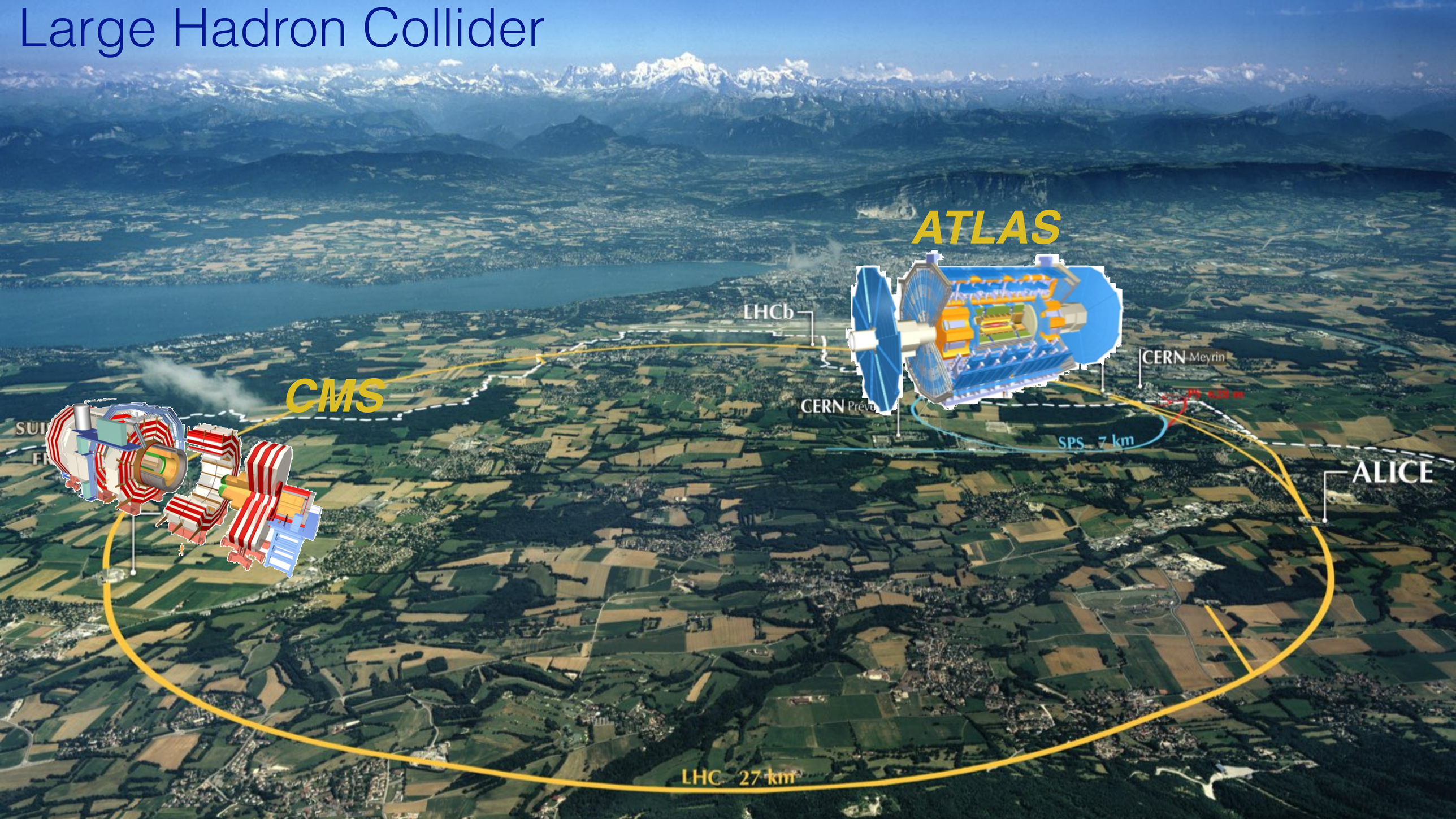
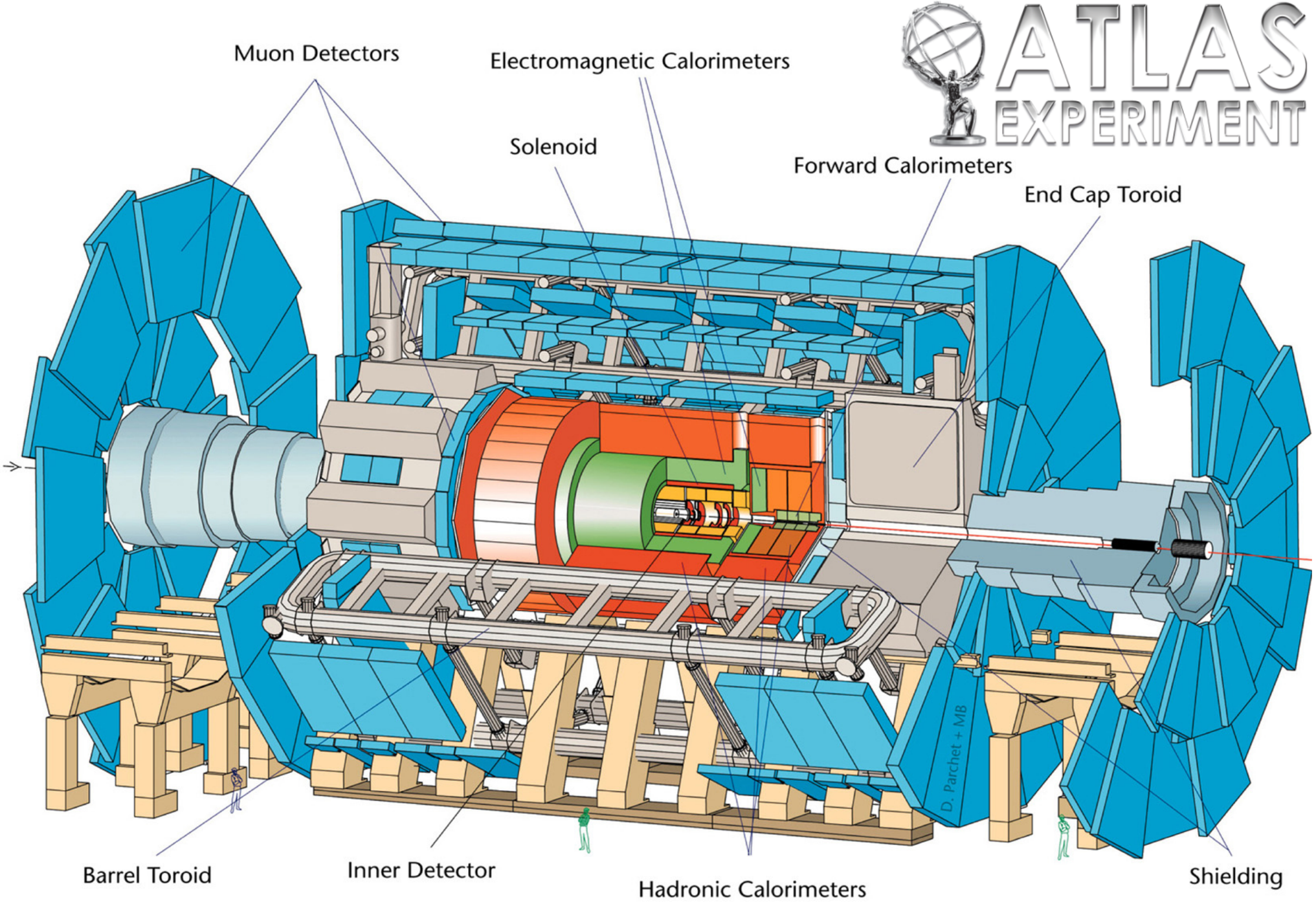
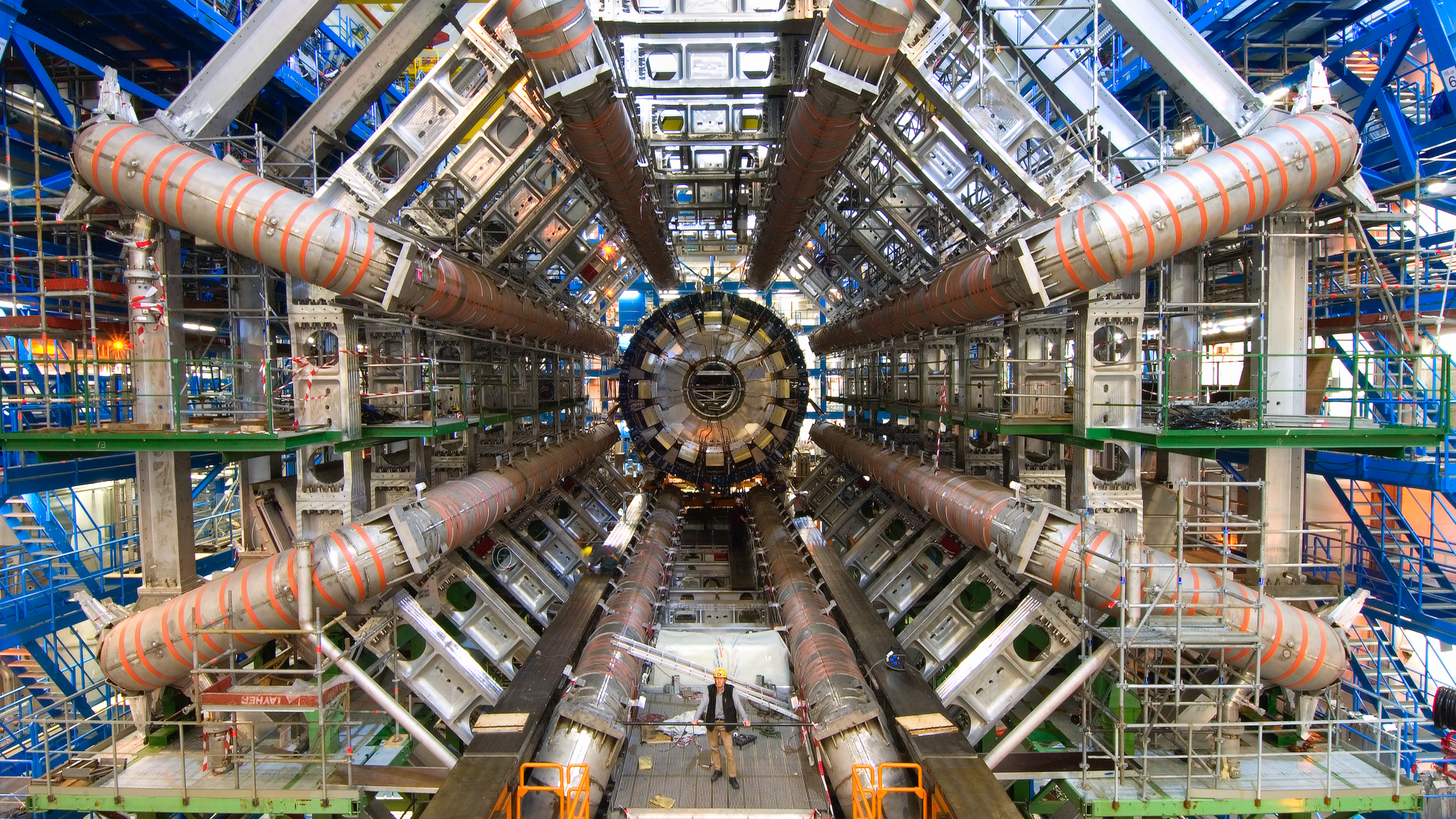
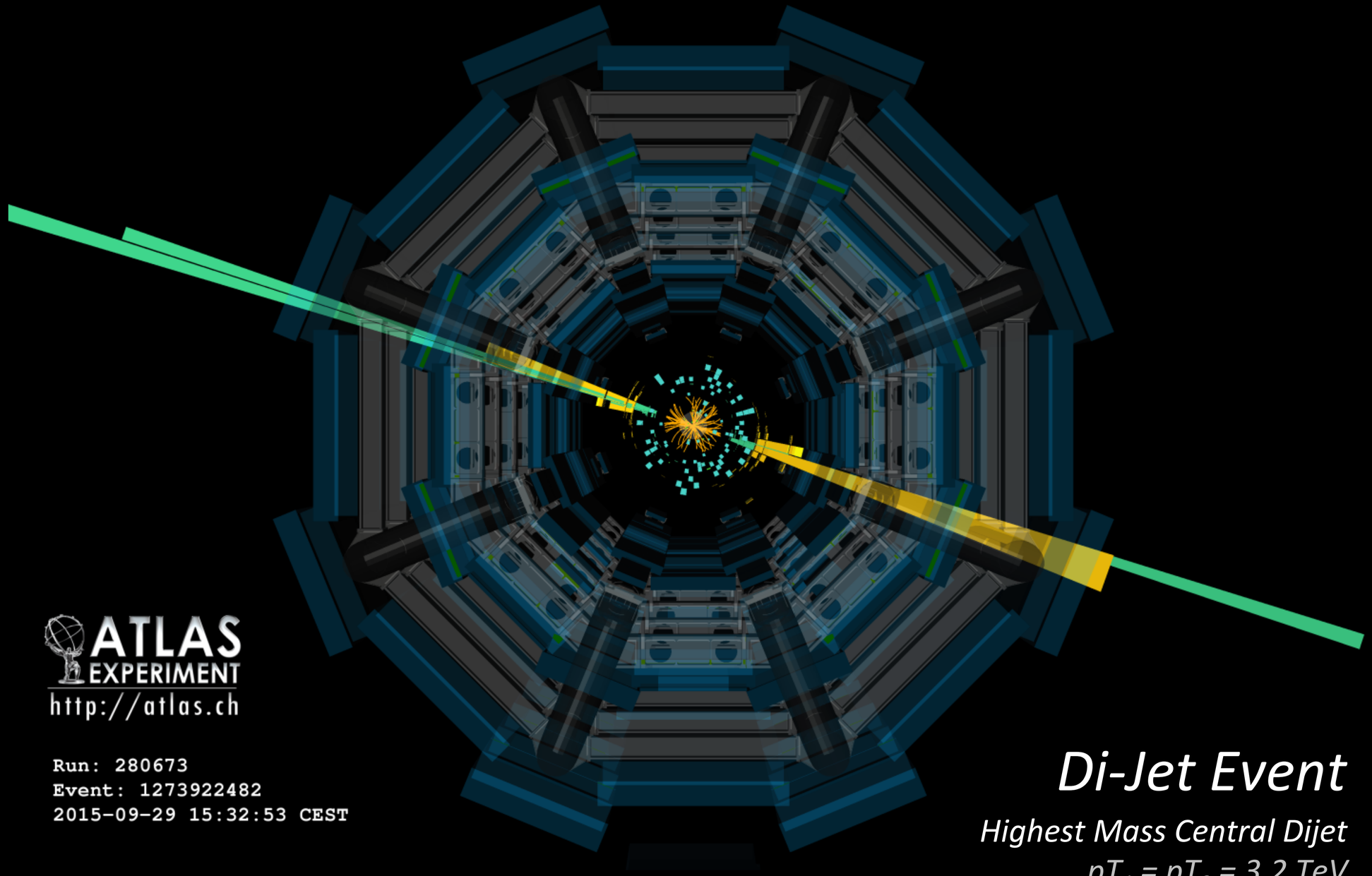


Large Hadron Collider




ATLAS EXPERIMENT
Muon Detectors
Electromagnetic Calorimeters
Solenoid
Forward Calorimeters
End Cap Toroid
Barrel Toroid
Inner Detector
Hadronic Calorimeters
Shielding
D. Parchet + MB





Di-Jet Event

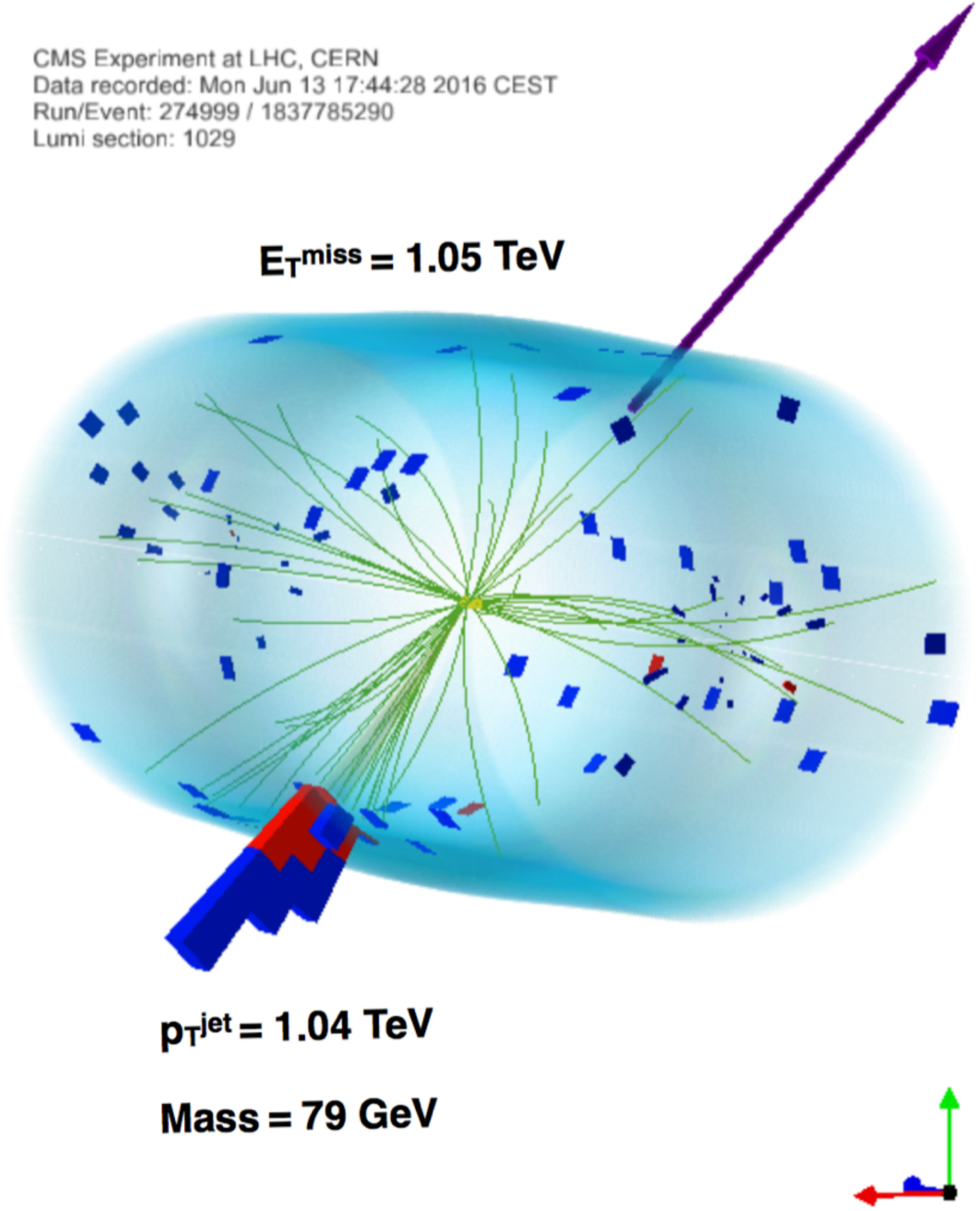
Highest Mass Central Dijet

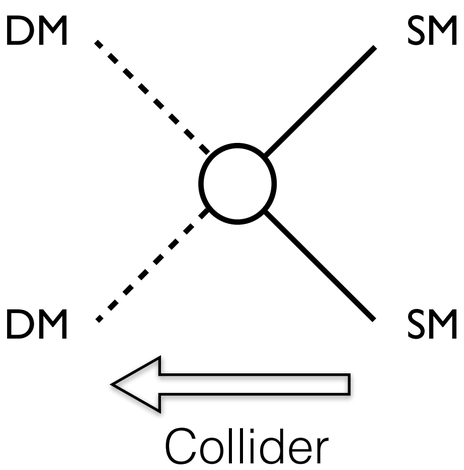
$pT_1 = pT_2 = 3.2$ *TeV*

$m_{JJ} = 6.9$ *TeV*

MET = 46 GeV

CMS Experiment at LHC, CERN
Data recorded: Mon Jun 13 17:44:28 2016 CEST
Run/Event: 274999 / 1837785290
Lumi section: 1029





CMS Experiment at LHC, CERN
Data recorded: Mon Jun 13 17:44:28 2016 CEST
Run/Event: 274999 / 1837785290
Lumi section: 1029