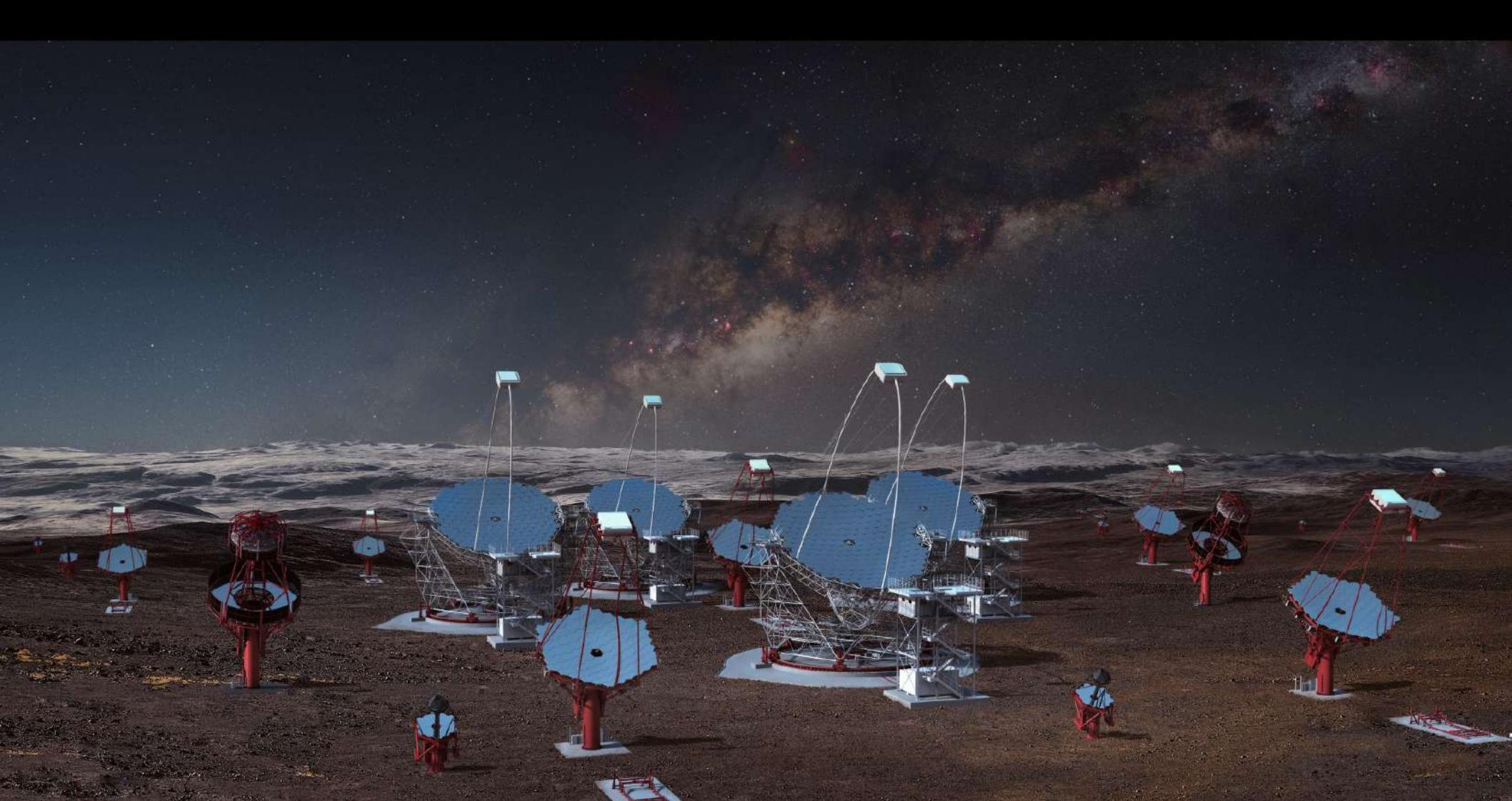


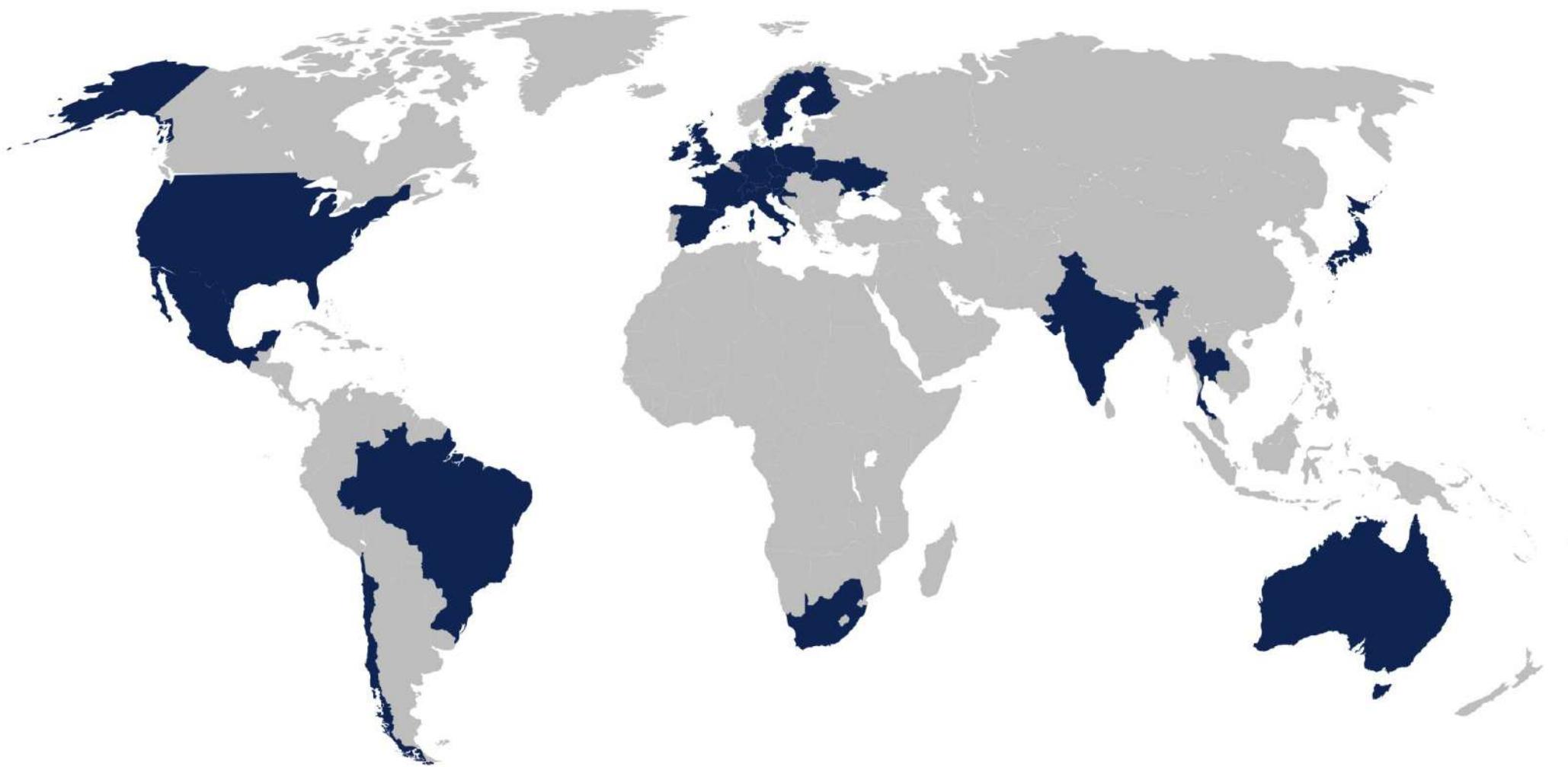
# **Novo doba visokoenergijske gama-astronomije**

Dario Hrupec

Tjedan svemira, Tehnički muzej Nikola Tesla  
7. listopada 2022.



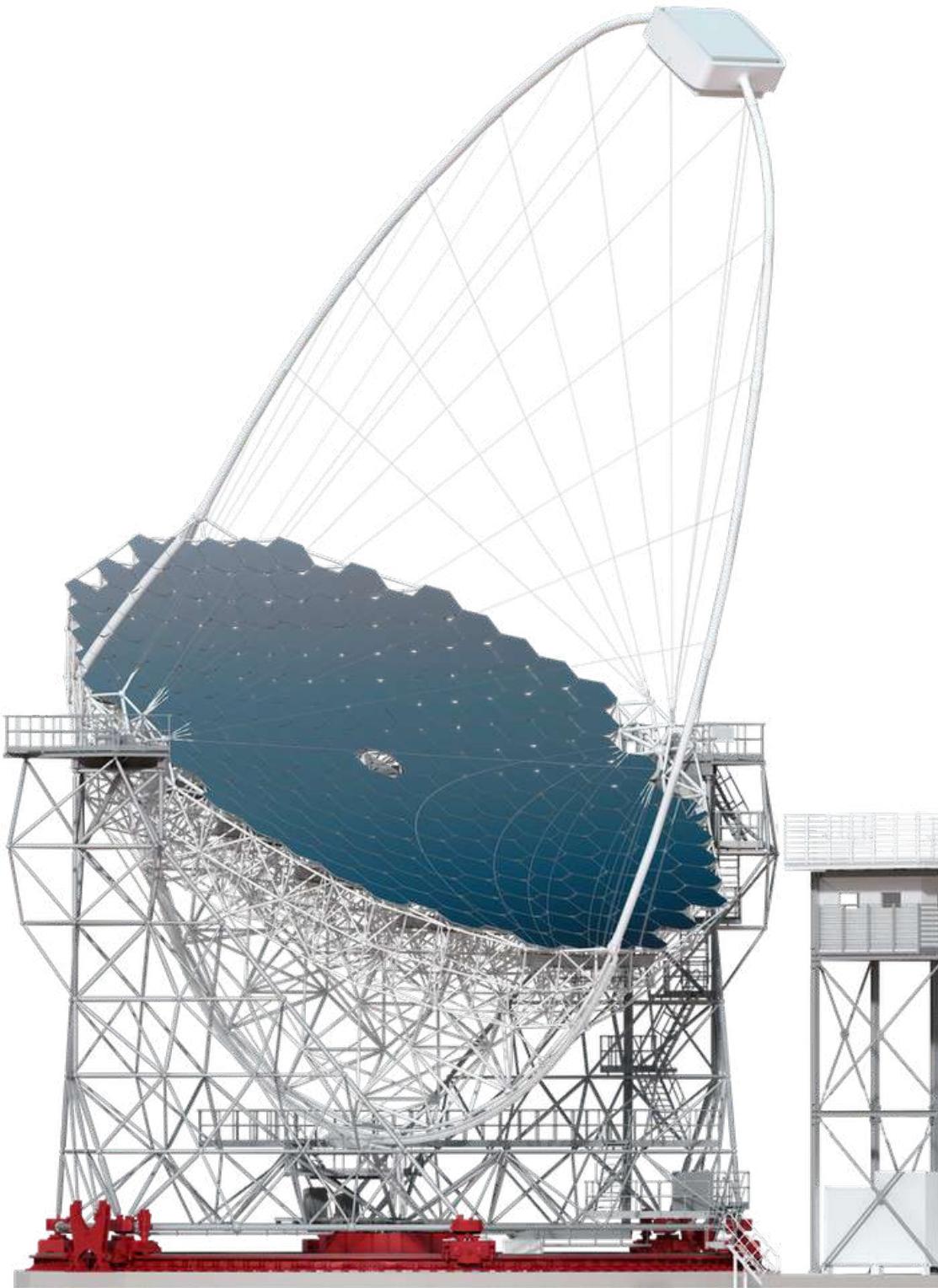
- ✓ CTA (Cherenkov Telescope Array, Postav Čerenkovljevih teleskopa)
- ✓ iduća generacija zemaljskog opservatorija za VHE gama-astronomiju
- ✓ najveći i najosjetljiviji opservatorij za VHE gama-astronomiju



- ✓ 1500 znanstvenika i inženjera
- ✓ 150 institucija
- ✓ 25 zemalja



✓ više od 100 teleskopa na sjevernoj i južnoj hemisferi



Large-Sized Telescope (LST)	
<b>Required energy range</b>	20 GeV – 3 TeV
<b>Energy range (in which subsystem provides full system sensitivity)</b>	20 GeV – 150 GeV
<b>Number of telescopes</b>	4 (South) 4 (North)
<b>Optical design</b>	Parabolic
<b>Primary reflector diameter</b>	23.0 m
<b>Secondary reflector diameter</b>	--
<b>Effective mirror area (including shadowing)</b>	370 m <sup>2</sup>
<b>Focal length</b>	28 m
<b>Total weight</b>	103 t
<b>Field of view</b>	4.3 deg
<b>Number of pixels in Cherenkov camera</b>	1855
<b>Pixel size (imaging)</b>	0.1 deg
<b>Photodetector type</b>	PMT
<b>Telescope readout event rate</b>	>7.0 kHz (after LST array trigger)
<b>Telescope data rates (readout of all pixels; before array trigger)</b>	24 Gb/s
<b>Positioning time to any point in the sky (&gt;30° elevation)</b>	30 s
<b>Pointing precision</b>	<14 arcseconds
<b>Observable sky</b>	Any astrophysical object with elevation > 24 degrees



Medium-Sized Telescope (MST)		
	FlashCam	NectarCam
Required energy range	80 GeV – 50 TeV	
Energy range (in which subsystem provides full system sensitivity)	150 GeV – 5 TeV	
Number of MST/SCT telescopes	25 (South) 15 (North)	
Optical design	Modified Davies-Cotton	
Primary reflector diameter	11.5 m	
Secondary reflector diameter	--	
Effective mirror area (including shadowing)	88 m <sup>2</sup>	
Focal length	16 m	
Total weight	82 t	
Field of view	7.5 deg	7.7 deg
Number of pixels in Cherenkov camera	1764	1855
Pixel size (imaging)	0.17 deg	0.17 deg
Photodetector type	PMT	PMT
Telescope readout event rate (before array trigger)	>6 kHz	>7.0 kHz
Telescope data rates (readout of all pixels; before array trigger)	12 Gb/s	
Positioning time to any point in the sky (>30° elevation)	90 s	
Pointing precision	<7 arcseconds	
Observable sky	Any astrophysical object with elevation > 24 degrees	



Small-Sized Telescope (SST)	
<b>Required energy range</b>	1 TeV – 300 TeV
<b>Energy range (in which subsystem provides full system sensitivity)</b>	5 TeV – 300 TeV
<b>Number of telescopes</b>	70 (South) 0 (North)
<b>Optical design</b>	Schwarzschild-Couder
<b>Primary reflector diameter</b>	4.3 m
<b>Secondary reflector diameter</b>	1.8 m
<b>Effective mirror area (including shadowing)</b>	8 m <sup>2</sup>
<b>Focal length</b>	2.15 m
<b>Total weight</b>	19 t
<b>Field of view</b>	10.5 deg
<b>Number of pixels in Cherenkov camera</b>	2368
<b>Pixel size (imaging)</b>	0.19 deg
<b>Photodetector type</b>	SiPM
<b>Telescope readout event rate (before array trigger)</b>	>0.3 kHz
<b>Telescope data rates (readout of all pixels; before array trigger)</b>	2 Gb/s
<b>Positioning time to any point in the sky (&gt;30° elevation)</b>	60 s
<b>Pointing precision</b>	<7 arcseconds
<b>Observable sky</b>	Any astrophysical object with elevation > 24 degrees



cherenkov  
telescope  
array

# The Electromagnetic Spectrum

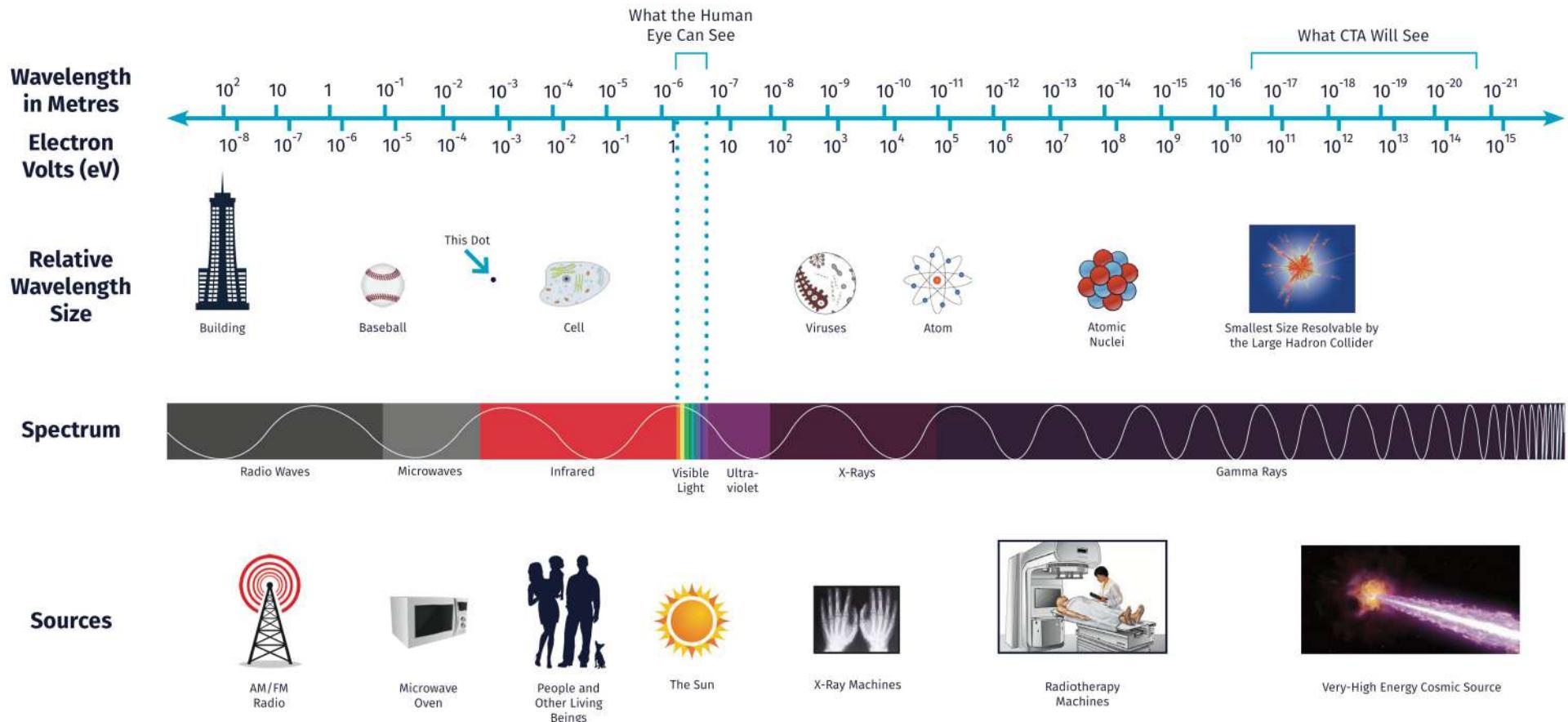
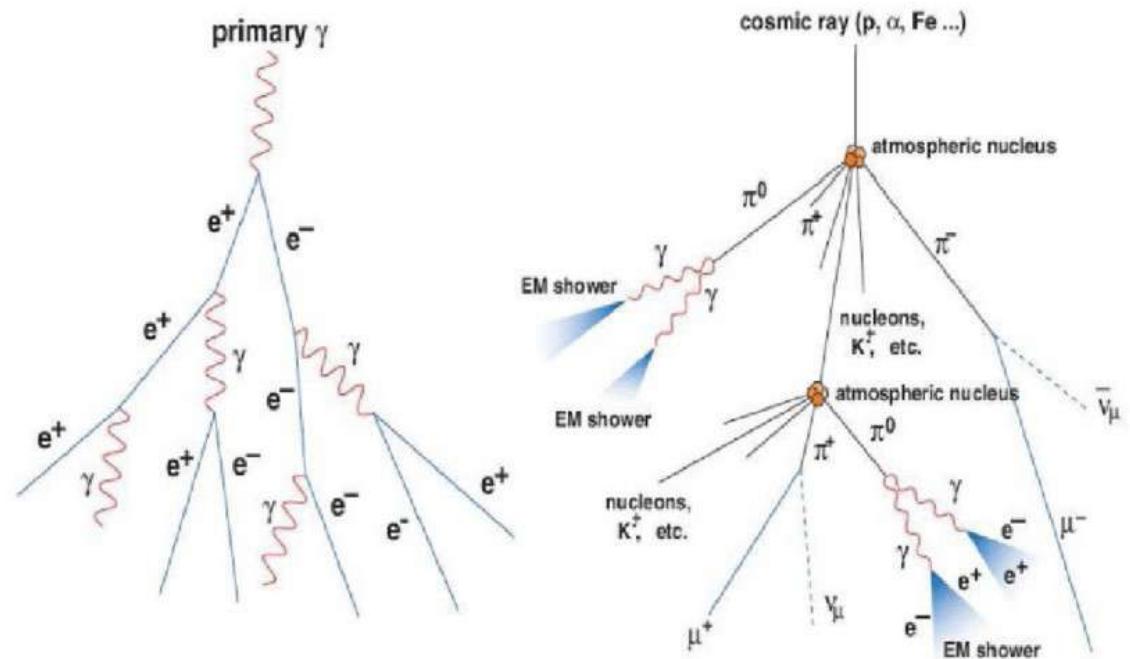
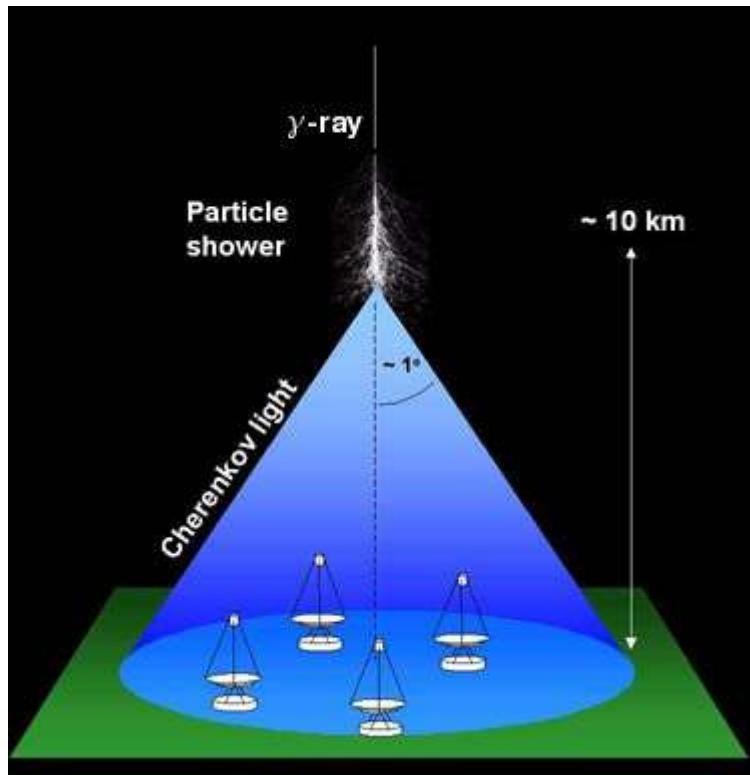
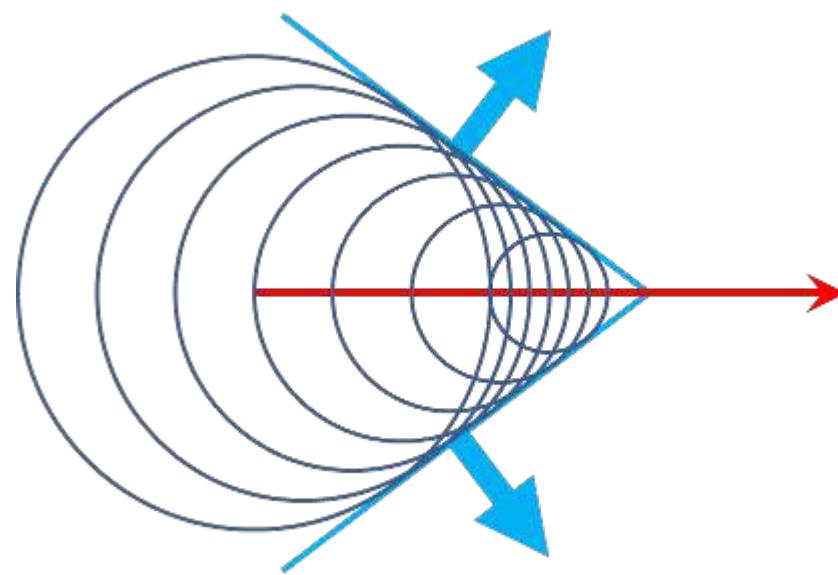
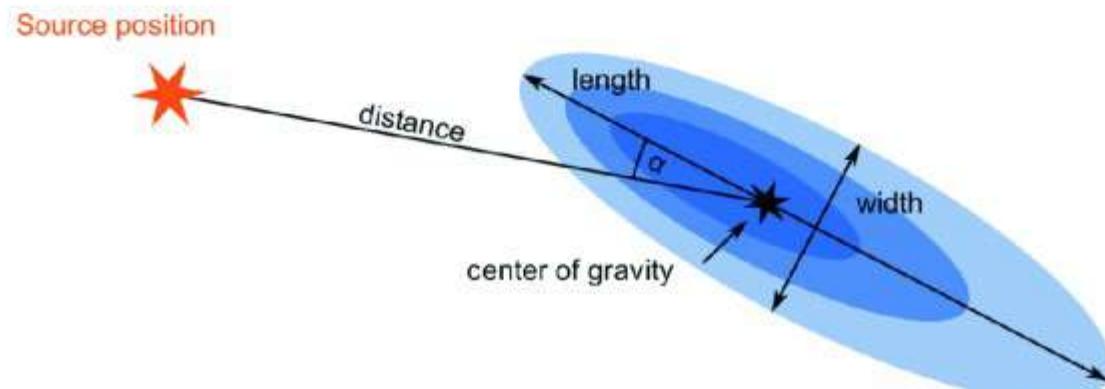
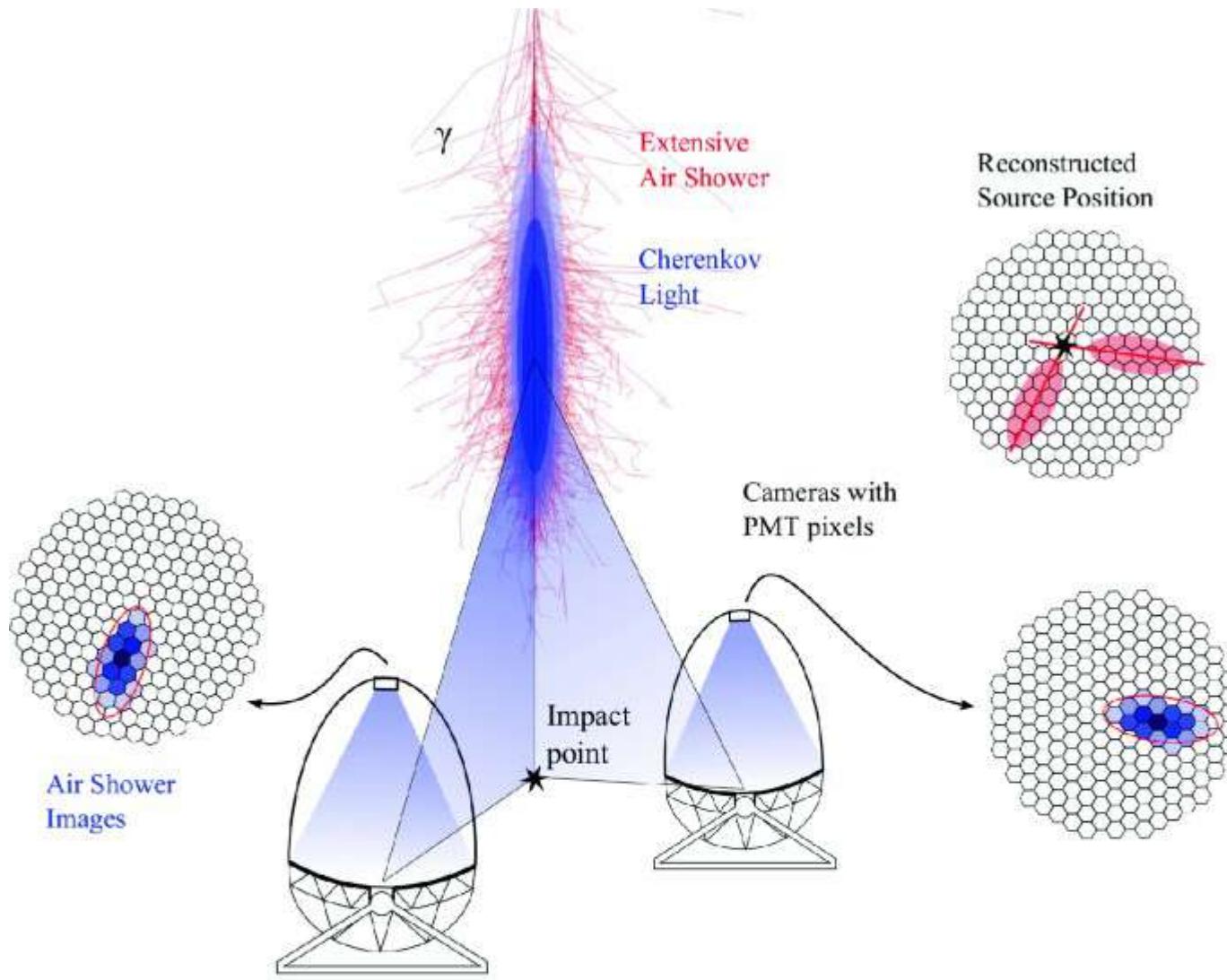
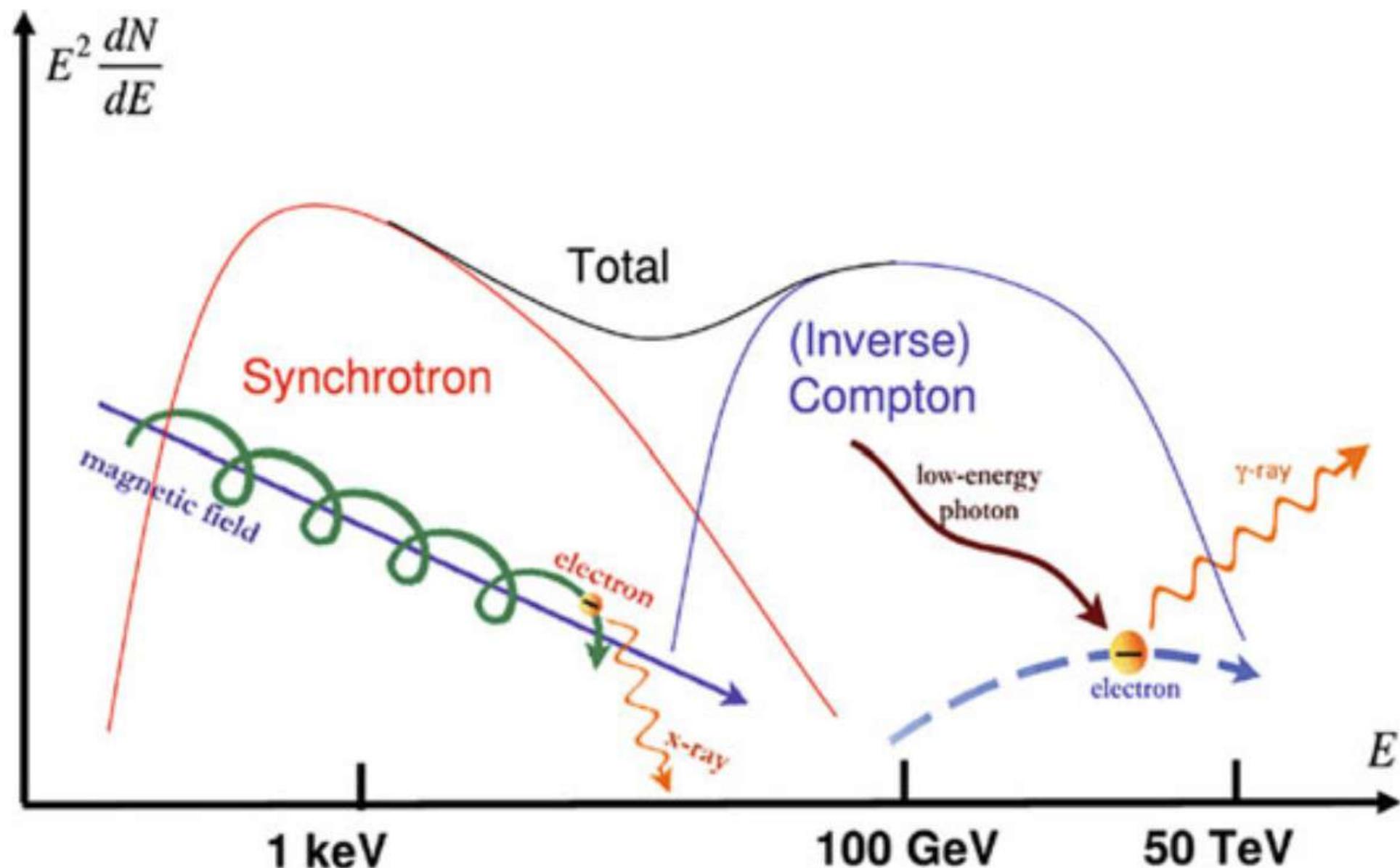


Image credits: Vecteezy.com, Dragonartz.net, NAOJ, NCI, CERN, NASA









## **Tema 1: Razumijevanje podrijetla i uloge VHE kozmičkih čestica**

Gdje se u svemiru ubrzavaju visokoenergijske čestice?

Koji su mehanizmi ubrzavanja kozmičkih čestica?

Kakvu ulogu kozmičke čestice imaju u nastanku zvijezda i razvoju galaksija?

## **Tema 2: Propitivanje ekstremnih okruženja**

Koji fizički procesi djeluju blizu neutronskih zvijezda i crnih rupa?

Koje su karakteristike relativističkih mlazova, vjetrova i eksplozija?

Kakva polja u kozmičkim voidovima i mijenjaju li se s vremenom?

## **Tema 3: Istraživanje granica fizike**

Koja je priroda tamne tvari i kako je tamna tvar raspoređena?

**Postoje li kvantno-gravitacijski utjecaji na propagaciju fotona?**

Postoje li čestice nalik aksionima?

