CHERENKOV LIGHT

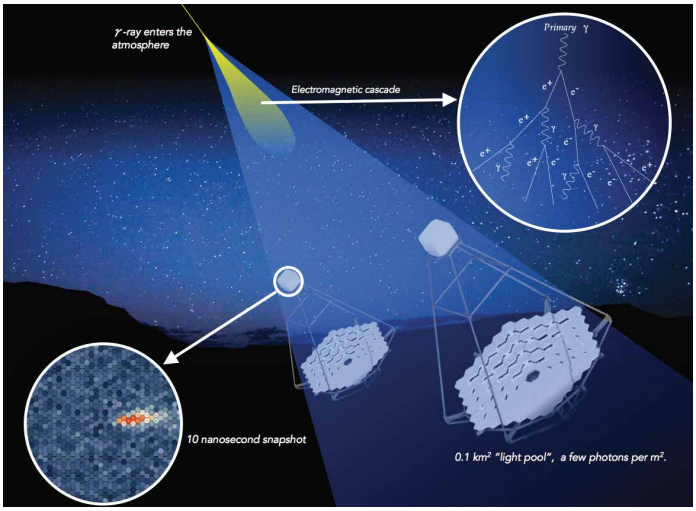
We know that there is nothing in the entire Universe that can travel faster than the speed of light in a vacuum - in space, the light moves at ~**300 millons of metres per second (m/s)**. However, in other mediums like water or the air of our atmosphere, the light moves slower. When charged particles (extremely small components, like tiny balls, which individually are invisible for the human eye but form matter) move faster than light in those mediums, they emit a very fast bluish/ultra-violet light. This light is the so-called Cherenkov light.

Credit image: DESY/Milde Science Comm./Exozet

When a **very high-energy gamma ray** arrives to the Earth, it is blocked by our atmosphere. There, it interacts with the existing molecules giving rise to charged particles. These particles, in turn, emit more light that produces more particles that give rise to more light and more particles and... suddenly, a so-called **electromagnetic cascade** (or generally, a **particle cascade**) is created. The particles of that cascade are very energetic and move faster than the light in the air. Thus, something magic happens: they emit the very fast bluish light named **Cherenkov light**.

Have you ever heard about the planes that move faster than the speed of sound? They create a sonic boom. The Cherenkov effect, produced by the charged particles moving faster than the speed of light in a medium, is a similar effect but, instead, it's a light (photonic) boom. Even though it has a bluish colour, we cannot see the Cherenkov light with our eyes. The flash only lasts around **0,000000003 seconds (3 nanoseconds),** so we are not able to process it, but we have built instruments that can: **the Cherenkov telescopes!**

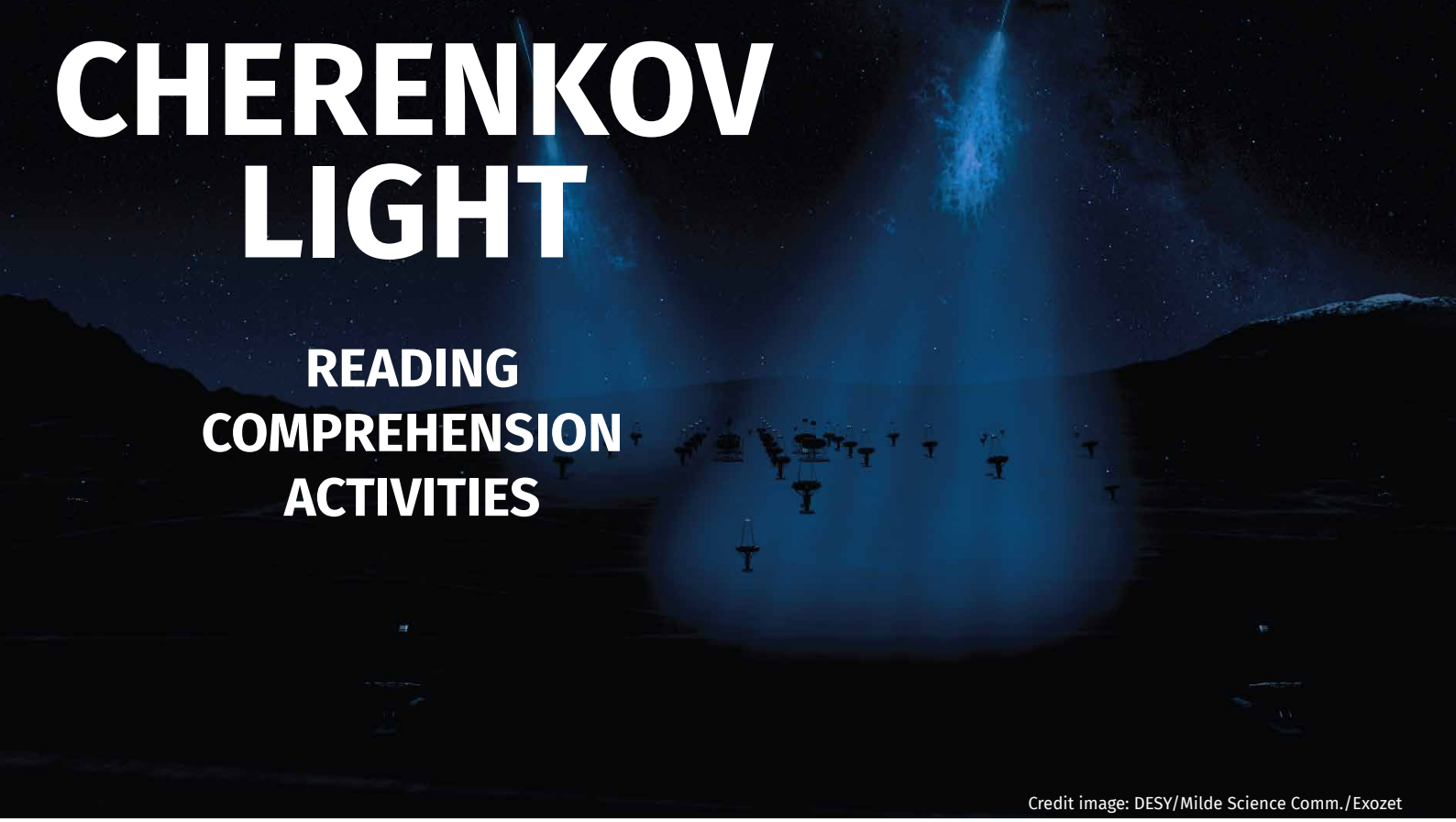
From Earth, the Cherenkov telescopes catch this light to analyze it and obtain valuable information of the primary gamma ray that initiated the cascade and, hence, its cosmic source. This technique is the one applied by the next generation gamma-ray observatory: the **Cherenkov Telescope Array (CTA)**. Imagine how fast and accurate our telescopes have to be in order to capture these super fast flashes!



Visit www.cta-observatory.org/outreach-education/CTA-for-educators

CHERENKOV LIGHT

READING COMPREHENSION ACTIVITIES



Credit image: DESY/Milde Science Comm./Exozet

1. What is Cherenkov light?

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2. Is Cherenkov light produced only in the air of the atmosphere?

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3. Although it is bluish, we cannot see the Cherenkov light with our eyes

☐ **True, it is too fast for our brain**

☐ **False, I can see the sonic booms and since the Cherenkov effect is similar, I can see Cherenkov light too**

4. What instruments can we use here on Earth to observe this Cherenkov light?

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5. What information does Cherenkov light provide us?

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6. Following the rendering and scheme of the previous page, draw how you imagine an electromagnetic cascade and the Cherenkov light that is produced from it. If you need it, ask for help, have a look to CTA website or watch "CTA Science: Emission to Discovery" on our YouTube channel.

Answers:

1. Light produced by charged particles moving faster than the speed of light in a certain medium
2. No, it can be produced in other mediums where charged particles move faster than light, for example water
3. True
4. Cherenkov telescopes, like the Cherenkov Telescope Array
5. It gives us information about the primary gamma ray and, therefore, its cosmic source

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cherenkov telescope array

the observatory for ground-based gamma-ray astronomy