Cherenkov Photons Introduction & CTAO

CORSIKA Workshop 2020

Gernot Maier
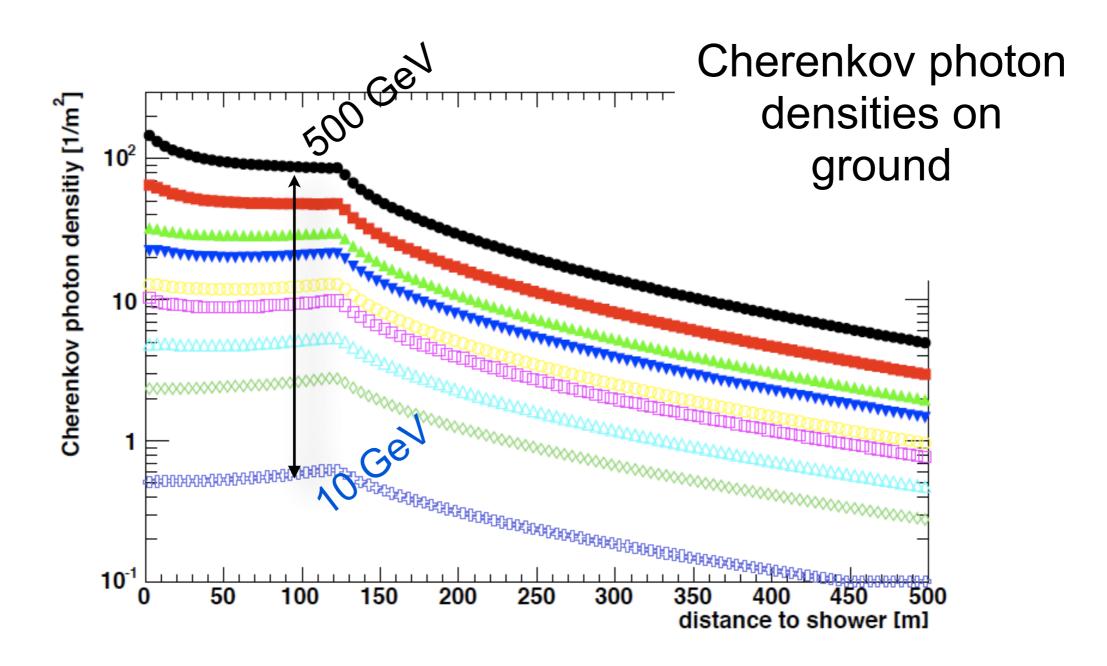
Gamma-ray Astronomy - Imaging Technique

camera/focal plane (viewed from zenith)

image of shower

C.Skole

image of shower axis

camera coordinates given in degree

shower

γ-photon

cherenkov light

θ_γ

φ_γ

shower axis

telescope

n-1 proportional to air density

Cherenkov light

Most powerful at gamma-ray energies from 10 GeV to 300 TeV

Cherenkov photon emission, scattering, absorption

'Light pool'

Cherenkov photon densities on ground

Single charged particle can emit >10^5 Cherenkov photons
100 TeV gamma-ray shower can emit up to 100 billion photons

MAGIC

VERITAS

H.E.S.S.

4
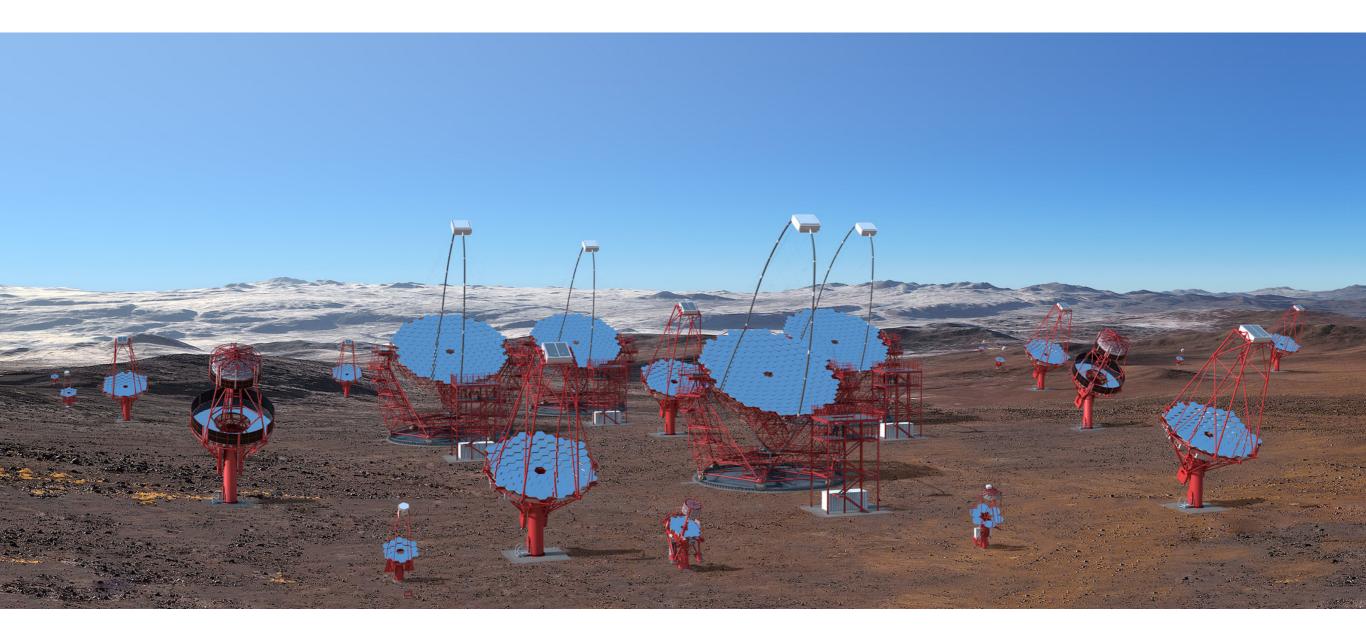
Cherenkov Telescope Array

Two arrays on both hemispheres (La Palma, Paranal)
Three telescope sizes for large energy range (20 GeV to 300 TeV)
x10 sensitivity compared to current arrays; precision instrument

CTAO and CORSIKA

- **The Cherenkov Telescope Array Observatory (CTA)**
    - will be run as an observatory providing high-quality data products including instrument response functions to its users for an expected life time of 30 years
    - will be a precision instrument requiring better modelling than current instruments

- **air-shower simulations (=CORSIKA) are a critical part of CTAO's simulation pipeline**
    - support in development and maintenance of air shower simulations accounted for in the CTA cost book
    - dedicated resources provided by CTA have to wait until the finalization of the legal entity (ERIC)
    - contributions to CORSIKA 8 starting now by CTAO/CTAC members

14:00 → 15:35 CORSIKA Workshop: Cherenkov photons

Conveners: Gernot Maier, Konrad Bernloehr, Luisa Arrabito

14:00 Introduction & CTAO ⏱ 15m

Speaker: Gernot Maier

14:15 Hadronic interaction models & IACTs ⏱ 15m

Speaker: Michiko

14:30 Corsika 7 optimization for the CTA use case ⏱ 10m

We will report about the optimization work done so far on CORSIKA 7 for the use case of CTA. We will present in particular how we have applied vectorization techniques to the Cherenkov module obtaining a speed-up of almost a factor 2.

Speaker: Matthieu Carrère (LUPM IN2P3/CNRS)

14:40 Cherenkov photons on GPU ⏱ 15m

Speaker: Dominik Baack (TU Dortmund)

14:55 Fluorescence emission & IACTS ⏱ 15m

Speakers: Daniel Morcuende (Universidad Complutense de Madrid), Jose Luis Vazquez-Poletti (Universidad Complutense de Madrid (Spain))

15:10 Combined discussion, Q&A ⏱ 25m

Speaker: Konrad Bernlöhr (MPI für Kernphysik)