

Absolute radiometric calibration of uniform light sources for UHECR experiments

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Basic information

8th International Symposium on Ultra High Energy Cosmic Rays (UHECR2026/7):

- Jan 18 — 22, 2027
- Taipei, Taiwan
- Abstract submission deadline: October 1
- Plan to propose for a talk

Preliminary Abstract and scope of the presentation

Abstract:

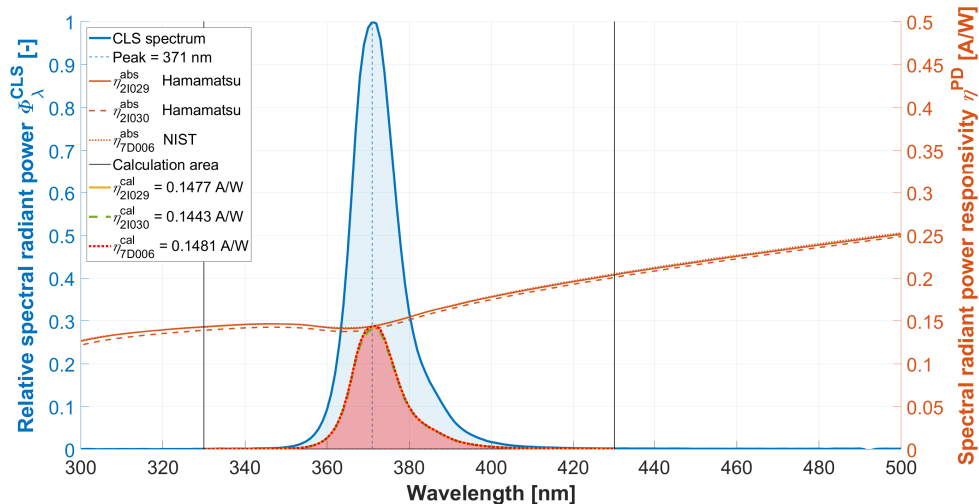
The calibration of a light source is a crucial requirement for accurate data evaluation and reconstruction of the energy of primary particle of UHECR entering the atmosphere. The fluorescence telescopes, for example, undergo an absolute end-to-end calibration that determines their absolute response to the detected signal. However, it must be performed using a reliable device that is a NIST-traceable absolutely calibrated light source with known number of photons leaving its emission area. The presented work describes a radiometric method to determine the the number of photons emitted by the light source based on the theory of the radiative heat transfer. The method is applicable to various shapes of uniform light sources, which makes it universal and increases its potential to beyond the need of a single observatory. At present, light sources used to calibrate FAST telescopes and fluorescence telescopes at the Pierre Auger Observatory are calibrated by this method.

Preliminary Abstract and scope of the presentation

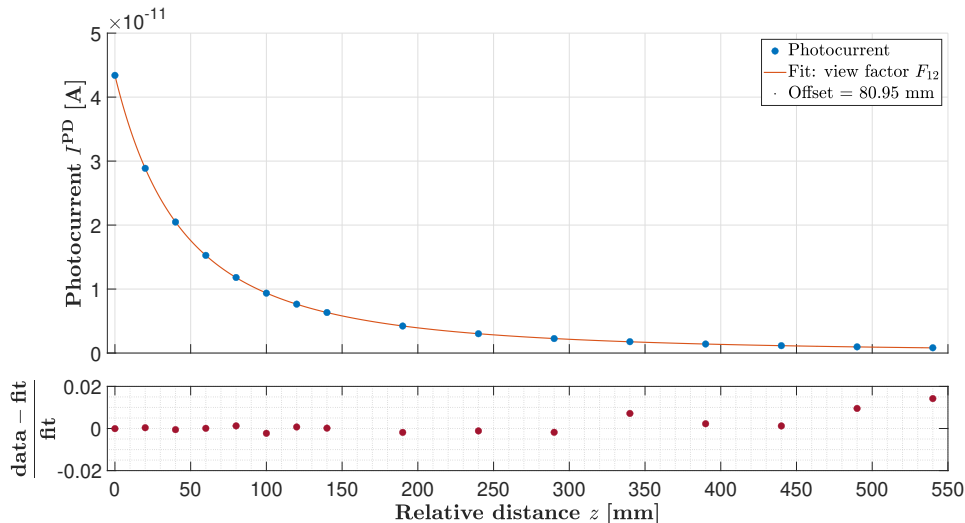
Scope:

- Present the Absolute radiometric calibration method in general
- Show universality of the method for some light source geometries
- Show examples of light sources and observatories calibrated by the method
- Present the spectral radiant power responsivity of PDs
- Present the $1/r^2$ dependence
- Present the frequency conversion factor
- Present the general configuration factor and specific examples
- Show the possibilities of our laboratory in terms of calibration

spectral radiant power responsivity



Distance dependence



Two unequal parallel coaxial discs

Main equation:

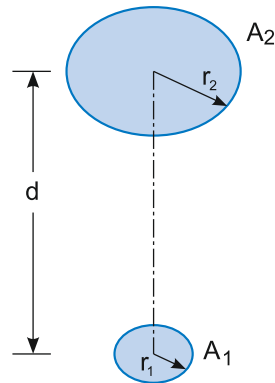
$$F_{12} = \frac{1}{2} \left\{ X - \left[X^2 - 4 \left(\frac{R_2}{R_1} \right)^2 \right]^{\frac{1}{2}} \right\}$$

Substitution 1):

$$X = 1 + \frac{1 + R_2^2}{R_1^2}$$

Substitution 2):

$$R = \frac{r}{d}$$



Spherical surface to parallel coaxial disc

Main equation:

$$F_{12} = \frac{1}{2} \left[1 - \frac{1}{(1 + R^2)^{\frac{1}{2}}} \right]$$

Substitution:

$$R = \frac{r}{d}$$

