PhysLight: An End-to-End Pipeline for Scene-Referred Lighting

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Figure 1: PhysLight enables artists to match accurately the characteristics of the cinema camera and lights, such as in this image of a fully digital Will Smith lit by a measured LED source from *Gemini Man*.

ABSTRACT

We present a visual effects production workflow for using spectral sensitivity data of DSLR and digital cinema cameras to reconstruct the spectral energy distribution of a given live-action scene and perform rendering in physical units. We can then create images that respect the real-world settings of the cinema camera, properly accounting for white balance, exposure, and the characteristics of the sensor.

CCS CONCEPTS

• **Computing methodologies** → **Rendering**.

KEYWORDS

rendering, image based lighting, HDRI, spectral rendering, lighting, path tracing

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1 INTRODUCTION

Despite the physical quantities involved in light transport being well understood, most production renderers use dimensionless units for lighting input, and artists typically rely on manual reference-matching to define the mapping between the renderer's working space and the "scene-referred" space of the physical world. Variance between shots caused by different camera settings used to capture the plates is either handled by grading the plates to match across a sequence (commonly termed 'neutral grading'), or by adjusting the lighting to account for differences in camera settings. Both are ad-hoc, error-prone processes.

In use in production since 2015, *PhysLight* builds on Weta Digital's spectral renderer, *Manuka* [Fascione et al. 2018], to perform rendering entirely in physically correct photometric units. We can use the camera data from each shot directly, and the virtual camera in the renderer—the *PhysCam*—correctly responds to settings