

# An Investigation into the Sustainable Evolution of Color Design within Chinese Science Fiction Films in the Context of Intelligent Science—Exemplified by the Wandering Earth Series

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**Abstract:** Science fiction films have unique colors. With the development of technology and the continuous advancement of digital technology, the visual effects of domestic science fiction films are becoming more sophisticated. In science fiction films, the "color," as a primary element of the picture, is endowed with more meaning. In science fiction films, the "sense of technology" is achieved primarily through color art. Colors can not only set the atmosphere and enhance visual effects but also depict the environment and characters' emotions. Studying the elements of color in science fiction films, which have attracted attention from the audience, not only contributes to the modernization and sustainable development of intelligent scientific application in film theory but also helps improve the production and audience aesthetic level of science fiction films. Therefore, this paper will conduct an in-depth exploration and research on the application of color in science fiction films.

**Keywords:** Intelligent Science, Science Fiction Films, Color, Sustainable Development

## 1. The Significance of Sustainable Evolution of Color Design in Science Fiction Films

For over eighty years, science fiction films have established a significant presence in China. These films have not only reflected on the complexities of reality but also explored the vast possibilities of the future, thereby internalizing themes and narratives that resonate deeply with Chinese audiences. Despite periods of restraint and variable policy support, Chinese science fiction films have demonstrated resilience and flourished, particularly with the advent of the digital age. Technology has increasingly informed and influenced science fiction, bringing to life once-imaginary concepts and rendering film images with greater finesse and realism. Consequently, color, as an integral aspect of visual representation, has also evolved proportionally, keeping pace with technological advancements and the expansion of its conceptual scope.

Giddings et al.<sup>[1]</sup> assert that sustainable development remains an ambiguous concept, prone to various interpretations and "derivatives." Within this context, colour, a pivotal component of the "Chinese science fiction ecosystem," is expected to undergo continuous enhancement as the maturity of this ecosystem progresses. As the ecosystem evolves, so too does the sophistication and complexity of colour usage, reflecting the intricate interconnectedness between artistic expression and technological advancement. The concept of "ecosystem," originally introduced by British ecologist Sir Arthur George Tansley in 1935, pertains to the dynamic equilibrium achieved when organisms and their environment coalesce into a unified entity within a designated spatial domain. This equilibrium remains relatively stable over time through mutual interactions and constraints. In the context of science fiction, the analogous "sci-fi ecosystem" refers to a film where characters and their narrative backdrop coalesce into a harmonious unity. This cohesion is achieved through the synergistic effects of policy support and technological advancements. The viewer serves as the primary evaluator of this ecosystem, experiencing its coherence through screen presentations. Within this framework, colour, as a critical aspect of science fiction film representation, emerges as an optimal tool for enhancing the viewer's experience. In 1934, Henri Coulon's groundbreaking work demonstrated that by establishing a harmonious connection between colour, atmosphere, action, and plot, and employing a minimalist approach to colour utilisation, the current state of colour cinema could undergo significant improvement. He advocated that, when appropriately implemented, colour could evolve into a dynamic and effective medium for conveying information, akin to sound effects or music. The colour design process, encompassing pre-lighting to

post-tuning stages, is a systematic endeavour that relies on a synergistic integration of lighting techniques, equipment, lenses, and other technological elements. The ultimate screen presentation of a film's colour scheme is inextricably linked to these intricate technological considerations.

The first installment, *Wandering Earth 1*, stands as a singular and epochal Chinese science fiction film. Derived from Liu Cixin's eponymous novel, the film narrates the plight of humanity as it confronts the destruction of the solar system and embarks on a journey of wandering with Earth. In contrast to *Wandering Earth 1* released in 2019, *Wandering Earth 2* functions as a prequel in terms of content. However, it significantly explores and upgrades various facets of technological utilization, screen presentation, and narrative techniques. This film represents a harmonious intersection of art and technology, further perpetuating the "continuous development" trajectory of Chinese science fiction films. Additionally, it serves as a pivotal case study for the ongoing advancement of domestic science fiction cinema.

## **2. Analysis of the Application Mode of Science Fiction Film Colour Design in the Context of Intelligent Science**

*Wandering Earth 2* boasts a significantly expanded scope of filming, with the number of scenes and production complexity escalating approximately fourfold compared to its predecessor. This film encompasses hundreds of diverse settings, marked by a substantial surge in the count of special effects shots, rising from 2,000 to 3,300. Whether it be the intricate design of the "space lift" or the intricate texture of the "moss look," the color palette of the screen represents a multifaceted undertaking. A standardized and meticulous production process is vital in averting avoidable errors and minimizing resource consumption, serving as a prerequisite for successful filmmaking and a crucial step towards the sustainable development of science fiction cinema. Liu Yin, the cinematographer of the *Wandering Earth* franchise, has offered insights into his filming methods. To achieve enhanced visual effects, the studio collaborated with numerous technology companies under the aegis of MOREVFX, integrating numerous innovative technologies into the filmmaking process. It is evident that the incorporation of unprecedented color procedures has resulted in a more systematic, nuanced, and comprehensive application of color throughout *Wandering Earth 2*, thereby fostering the sustainability of the film's color design.

### **2.1 Digital Lighting Technology**

In their academic treatise, *The Art of Cinema: Form and Style*, David Bordwell and Kristin Thompson assert that "each beam of light possesses a precise point of utmost brightness, followed by a terminus where it ceases to exist, and the trajectory traversed by the ray, from its genesis to its ultimate immersion in obscurity, encapsulates the essence of narrative and theatrical intrigue."<sup>[2]</sup> Colour is a phenomenon resulting from the reflection of light by objects and its subsequent reception by the human eye, thus establishing a mutual relationship between colour and light. The dynamic manipulation of light effects significantly enhances the realisation of colour's aesthetic potential. The rational utilisation of lighting mitigates post-production expenses and optimises time efficiency, thereby fostering the sustainable development of the science fiction film genre. The SkyPanel lighting system plays a pivotal role in *Wandering Earth 2*, particularly in terms of colour reproduction and colour matching tests. The availability of SkyPanel in various sizes and models, coupled with its colour-controllable capabilities, allows for the creation of ambient environments and tones across different times of day, enabling seamless gradient effects between diverse lighting sources. Furthermore, its ability to simulate a range of effects, including candlelight, floating clouds, nightclub atmospheres, and colour chases, provides filmmakers with significant convenience and flexibility during film and television shoots, thereby enhancing the overall visual impact of the production. Given the narrative's diverse settings, encompassing scenes in space, on Earth, and the Moon, as well as intricate special effects sequences like solar helium flashes and planetary engine activations, the SkyPanel lighting system holds paramount importance. In space scenes, it meticulously simulates starlight and the vast cosmic backdrop. On Earth and the Moon, it adeptly crafts distinct lighting atmospheres across varying times and locations. For the special effects sequences, the SkyPanel's high brightness and colour controllability facilitate the creation of breathtaking visual impacts. Notably, in the sequence where humans on the ground intercept debris from the Moon using a network of fiery weapons, the SkyPanel's ability to render the intense orange hue against the overall blue-black sky adds profound emotional depth to the scene. Liu Yin, the esteemed photographer of *Wandering Earth*, firmly maintains that the SkyPanel lighting method is poised to become the prevailing trend in colour application within Chinese science fiction films. The intricate scheduling of lighting within scenes, coupled with the utilization of dimming tables to meticulously

control colour, brightness, and saturation, achieves effects such as strobe lighting, colour gradients, rapid switching, and running lights. Notably, the SkyPanel lighting system has significantly facilitated the realization of these effects to the utmost degree, underscoring its pivotal role in advancing the visual aesthetics of science fiction cinema in China.

## ***2.2 Real-time monitoring of colors***

The attainment of a comprehensive narrative requires meticulous control of intricate details, and the utilization of high-definition monitors greatly aids the creative team in attaining a deeper comprehension and appreciation of the intricate visual elements within the imagery. High Dynamic Range (HDR) is an advanced image processing technique specifically engineered to enhance the range of luminance levels within an image, thereby optimizing the rendering of both shadowy and illuminated details, leading to a more comprehensive and immersive visual experience. In the realm of science fiction cinematography, HDR technology significantly enhances the quality of imagery through meticulous processing during filming, production, and exhibition. Given the intricate nature of light and shadow structures, the sophistication of the monitoring system not only elevates the overall visual quality of the film, resulting in richer contrast and finer details, but also optimizes cost-efficiency in the corresponding production processes, thereby fostering sustainable filmmaking practices. Notably, when depicting high-contrast scenarios, such as futuristic landscapes and extraterrestrial vistas, HDR technology excels in retaining nuanced details and heightening the realism of the imagery, ultimately delivering more immersive and impactful visual experiences to the audience. Firstly, HDR technology exhibits a broadened color gamut, thereby enhancing the vividness and intricacy of colors within the film, effectively captivating the fantastical hues of the future world and extraterrestrial landscapes. Secondly, HDR technology preserves a more authentic rendering of fine details, enabling the retention of numerous details within a single frame, including those in both highlighted and shadowed regions. In the context of science fiction films, this translates into the ability to clearly depict the luminous components of high-tech equipment, as well as the profound depths of the cosmic night sky or intricate elements lurking in dark areas, thereby offering a more immersive and realistic visual experience. During the monitoring phase of the production of *Wandering Earth 2*, a comprehensive array of display devices were deployed throughout the studio. This included 25 SDR Zunzheng AM210 monitors, two Barco 4K laser projectors, five Hisense 55-inch 4K HDR monitors, and three Hisense 85-inch 8K televisions. Additionally, four of DJI's latest wireless mapping devices and sixteen Apple terminals running the WIFI QTAKE Monitor APP were subsequently integrated into the setup, ensuring that monitoring capabilities were accessible in every corner of the studio<sup>[3]</sup>. Facilitated by high-precision monitors, departments such as lighting and props are able to effortlessly discern finer details, accurately reconstruct the shooting scene, and enhance production efficiency. This allows for a superior grasp of controlling highlights, dark regions, and mid-tone gray areas, while ensuring shooting consistency across multiple cameras. Ultimately, this provides the audience with an authentic visual experience that is deeply immersive, ensuring access to an optimized viewing environment tailored for HDR colors, and presenting a visually superior image.

## ***2.3 Onsite and Post-production Color Correction***

In his book, Marcel Mardin asserts that "the genuine inception of color in cinema ought to be traced to the moment when filmmakers grasped the concept that colors are not necessarily authentic, but rather ought to be employed consonant with the values and psychological as well as dramatic implications inherent in their various hues."<sup>[4]</sup> Colour mixing necessitates a rational methodology in framing and arranging the visual style of an image. Furthermore, in the specific process, colour mixing must embody an emotional approach towards the art, treating it as a creative expression that evokes deep emotional responses. *Wandering Earth 2* employs the ACES colour space in its filmmaking process, incorporating a stylized LUT (Look-Up Table) as a "colour filter". This LUT modifies the relationship between real and virtual hues, encompassing the natural colours of objects, the colour temperature of lighting sources, and other attributes. It serves as the primary determinant of the film's shooting style, establishing a consistent tonal foundation. Prior to filming, it acts as the cornerstone of the entire photographic process, providing initial colour control and ensuring colour consistency across various scenes in the film, thereby preventing visual discontinuities that may arise during scene transitions. Through the modulation of colour parameters within the LUT, adjustments to brightness, contrast, and saturation are feasible, resulting in a more vivid and distinct visual presentation. In *Wandering Earth 2*, LUTs are employed to amplify the visual impact of scenes such as the frozen Earth and the abyssal darkness of space, fostering a more intense and captivating atmosphere.

Utilizing RV as an auditing tool, technicians have developed a capability to automatically transition between colour spaces and deploy LUTs based on footage metadata and media formats. This innovation significantly simplifies the process for colourists who require colour space conversions to maintain colour consistency when comparing mov and exr sequences, thereby enhancing the efficiency and accuracy of post-production colour management. Beyond the initial stage of colour correction, Da Vinci's second-level colour grading technology is implemented to meticulously adjust and refine the colour palette of the imagery, aiming to align more closely with the director's intentions and the overall thematic style of the film (Figure1). By manipulating highlights, shadows, and other pertinent parameters, individual elements within the frame are emphasized or softened, averting issues such as colour overflow or undue darkness, and conferring a more pronounced three-dimensionality and hierarchical structure to the image. This fine-tuning process enriches the colour palette, conferring a greater degree of nuance and delicacy, while simultaneously enhancing the ability to convey the emotional and atmospheric nuances intended by the director. In contrast to the first-level colour correction, which focuses on harmonizing the colour profiles of multiple shots to a uniform standard, the second-level colour grading places greater emphasis on accentuating the thematic elements, skewing the overall video towards a particular colour aesthetic.

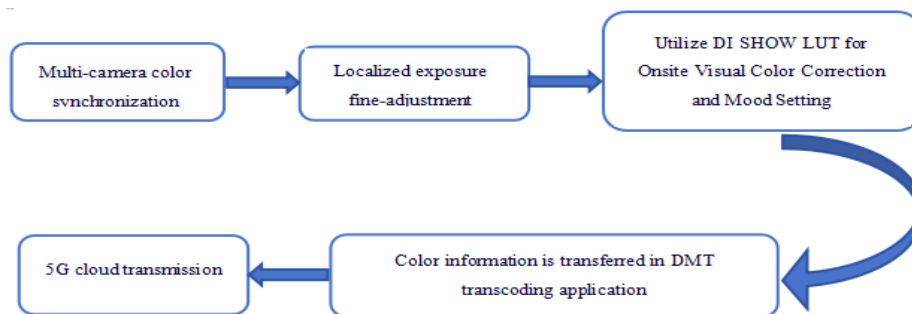


Figure 1: Diagrammatic Representation of the On-Site Colour Mixing

### 3. Analysis of the Visual Artistic Traits of Colour Design within the Application Mode

The physical attributes of colour have been optimized through technological advancements and the systematic enhancement of technological capabilities. The employment of colour design models facilitates the portrayal of more vibrant visuals and precise expressions in film. The colour design of science fiction films distinguishes itself from other film genres in terms of hierarchical structure, realism, and emotional communication.

#### 3.1. Stratification of Colours

Arnheim maintains that "variations in colour have the capacity to convey emotions and sentiments that are unattainable through facial expressions devoid of colour."<sup>[5]</sup> Given the intricate concepts and scenes often present in these science fiction films, the selection and application of colours serve as a pivotal tool in constructing these environments. By exploiting contrasts in warm and cold tones, brightness and darkness, as well as alterations in saturation, filmmakers are able to fashion a visually layered space. This allows the audience to discern the distinctions and interconnections among various scenes and objects with clarity. The establishment of such a hierarchical visual structure not only facilitates the audience's comprehension of the narrative, but also elevates the overall viewing experience, enhancing the film's immersive qualities. In *Wandering Earth 2*, the filmmakers expertly utilize the contrast between light and dark hues to establish a profound sense of spatial depth. The austere and somber space station, dominated by shades of grey and blue, stands in stark contrast to the icy blue continent of the heavens and snow-covered landscapes. This contrast not only accentuates the environmental disparities between outer space and Earth, but also introduces a heightened tension in the film's color palette. The vast continent is artistically rendered with darker recesses, where the intensity of blackness gradually diminishes from the periphery towards the center, thereby fostering a perception of depth within the imagery.

In addition, the manipulation of local saturation and the contrast between light and dark is deliberately focused on the primary subjects. The rescue team members are constantly confronted with scenes of crisis depicted in vivid red hues, creating a powerful visual contrast that further amplifies the sense of hierarchy within the imagery. Once again, it is the delineation of object boundaries that accentuates the

perception of depth through the variance in lighting intensity and hue. The metallic texture of the space station is emphasized under bright illumination, whereas the blue continent of Earth appears all the more vast and majestic beneath the radiance of the sun. Additionally, the film employs shifts in color palette to subtly suggest the progression of the narrative and the evolving psychological states of the characters. As the narrative unfolds, the palette of the film undergoes a corresponding transformation, shifting from brightness to darkness and from warmth to coolness. This strategic utilization of color contrast effectively underscores the tension between technological advancement and human nature, as well as the conflict between present reality and future aspirations. These chromatic shifts not only resonate with the narrative's progression but also facilitate a deeper comprehension of the characters' inner landscapes and emotional arcs among the audience. By artfully manipulating these hues, the filmmakers achieve a richer and more three-dimensional visual experience, thereby enhancing the overall visual impact and allowing the audience to fully appreciate the allure of science fiction cinema.

### ***3.2. Sense of Reality in Colour***

Herbert W. Franke, a renowned figure from the western academic community, once artfully articulated that "science fiction films meticulously portray momentous occurrences within a realm of fictitious yet conceptually plausible configurations, offering a speculative glimpse into potential futures."<sup>[6]</sup> In his esteemed work, *The World Seen: Reflections on the Ontology of Cinema*, American scholar Stanley Cavell profoundly posits that "Cinema serves as the dynamic image of scepticism, where despite the absence of tangible reality or perhaps precisely because of its absence and the mere necessity to observe, our customary senses are Nonetheless gratified in the belief that reality is immanently present."<sup>[7]</sup> The chromatic essence of science fiction cinema serves as a realistic portrayal of fantastical futures. Western science fiction films frequently employ vibrant and contrasting hues to evoke a sense of the future or surrealism. For instance, in depictions of futuristic cities or high-tech equipment, an array of cool colors such as blue, purple, or silver are often utilized, imparting a sense of modernity, advancement, and mystique. Additionally, by leveraging high brightness and saturation levels, these films create a dazzling visual impact that immerses the audience in a world of boundless fantasy and imagination.

While traditional hard science fiction films tend to focus on the portrayal of futuristic worlds or extraterrestrial civilizations, *Wandering Earth 2* innovatively integrates realistic scenarios to foster a sense of authenticity within a sci-fi era that is typically consumed through the lens of imagination. The *Dungeon* employs a realistic color palette to achieve a highly authentic and life-like visual impact, resonating deeply with the local audience. Primarily, the *dungeon's* hues are comprised of neutral tones, including grey, brown, and beige, among others. These colors are inspired by commonly used building materials in real-world settings, such as concrete, stone, and soil. This color scheme not only enhances the *dungeon's* realism, but also alludes to the myriad challenges facing humanity. Additionally, this design not only enhances the *Dungeon's* realism and credibility, but also serves as a testament to the ingenuity and perseverance of humans in utilizing available resources to construct a habitable space amidst crisis. Furthermore, the designers took meticulous care in incorporating details into the color scheme to impart a sense of warmth and vitality to the *Dungeon*. Notably, the living quarters feature light-toned decorations and graffiti on their walls, while public spaces such as shops and restaurants employ a more vibrant palette, lending a degree of brightness to the *dungeon's* daily life. This approach underscores a restoration of realistic coloration, fostering a deeper immersion for the audience within the film's fictitious world.

### ***3.3. Emotions in Colour***

Technology lacks the capacity for emotional expression; however, it serves as a medium through which humans ascribe emotional valence to colors, thus conferring upon them symbolic significance. Johann Wolfgang von Goethe observed that "Symbolism represents the elevation of a phenomenon into an abstract concept, and the subsequent transformation of this concept into visual imagery, thus evoking an infinite and inscrutable journey for the observer through the realm of the imagination."<sup>[8]</sup> Colour design serves a multifaceted role in filmmaking, extending beyond mere aesthetic enhancement to actively participate in the narrative construction of the film. In the context of science fiction films, various hues serve to represent distinct concepts, emotions, or states, thereby distinguishing them from other film subgenres and enriching the narrative tapestry. The unique utilization of symbolism within science fiction films is further amplified through the integration of local cultural and historical elements, resulting in narratives that are not solely speculative and entertaining, but also possess profound ideological

implications. This intricate layering of meaning transcends the realm of pure scientific rationality and requires the viewer to engage with the creator's (human) artistic vision, facilitated by technological advancements. Technology itself lacks the capacity for interpretation, yet it serves as a medium through which the artist/creator expands the significance of colour, bestowing upon it a richer and more nuanced meaning.

The utilization and symbolism of the monochromatic color palette in "Wandering Earth" exhibit a profound and multifaceted nature. Visually, it not only generates rhythmic impact but also enhances the emotional and social allegorical depth of the film. Within the film, blue is omnipresent, whether it manifests in the dystopian technological environments, the radiant space stations, the icy void of outer space, or the rogue artificial intelligence residing within the station. Consequently, blue serves as a symbol of both futuristic technology and the melancholic aftermath of apocalypse, reflecting rational human thought. In Chinese cinematography, the color red holds a profound cultural significance, evolving over time to become a highly recognizable national emblem. Despite the dire circumstances faced by the planet in the narrative, red remains a vibrant hue that instills hope in the audience, symbolizing optimism and resilience in the midst of adversity. It serves as a poignant reminder of humanity's resilience and courage in resisting disaster and pursuing survival amidst the apocalyptic backdrop. Orange, as a transitional hue, bridges the softness of yellow with the intensity of red. In portraying emotional exchanges between characters, the gradual shift towards an orange palette in the portrayal of Liu Peiqiang's father-son relationship suggests a warmth underlying their parting, highlighting the emotional depth of the scene. Additionally, the emergence of orange tones is often accompanied by explosive visuals of heavy metal space stations, planetary engines, and the solar system. It symbolizes mankind's resolve in facing exploration and challenges, as well as the hopeful anticipation of victory.

#### **4. The Enduring Impact of Intelligent Science on the Color Design of Science Fiction Films**

The sustainable impact of intelligent science on the colour design of science fiction films manifests itself in numerous ways, ranging from the innovation of colour concepts to the enhancement of design efficiency, and ultimately promoting the diversity and richness of colour expression. These advancements not only underscore the significant role of intelligent science in the sustainable development of science fiction filmmaking, but also contribute to the evolution of visual storytelling and aesthetic experiences within this genre.

Firstly, intelligent science introduces a novel and innovative concept to the colour design of science fiction films, leveraging its formidable computing capabilities and data analysis technology. Filmmakers can leverage intelligent algorithms and machine learning techniques to conduct more rigorous and extensive analysis and research on colours, enabling the discovery of novel colour combinations and matching methodologies. This, in turn, facilitates the creation of more distinctive and captivating visual effects, advancing the artistic and technological boundaries of science fiction cinematography. Secondly, intelligent science significantly enhances the efficiency of colour design in science fiction films. By leveraging advanced colour management systems and automated colour mixing tools, designers are able to exercise greater precision in controlling colours, while swiftly adjusting and optimizing the visual impact of the footage. This streamlines the design process, reduces manual labour, and ultimately facilitates the creation of more refined and impactful visual experiences. Concurrently, augmented reality technology enables the realtime preview and adjustment of film creations within a virtual environment. This facilitates further improvements in design efficiency, subsequently minimizing production costs and enhancing the focus on creativity and artistic expression through colour. By leveraging this technology, filmmakers can iterate and refine their designs in a controlled and cost-effective manner, ultimately elevating the quality and impact of their visual narratives. Furthermore, intelligent science has fostered a diverse and rich palette of colour expression in science fiction films. The utilization of high-definition digital cameras, sophisticated colour management systems, and post-colour grading techniques enables filmmakers to meticulously capture and manipulate the colours on screen. This enhanced precision and control over colour reproduction not only elevates the visual quality of the films but also contributes to the creation of more immersive and engaging narratives. By harnessing the capabilities of technology, intelligent science prompts the emotional semantics of colour in science fiction films. Ultimately, the sustainable impact of intelligent science on science fiction film colour design is also evident in its contribution to environmental protection and sustainable development. Through intelligent colour management and optimization techniques, energy consumption and waste generation during the production process can be minimized, fostering a more environmentally friendly and sustainable approach to filmmaking.

## 5. Conclusion

Film, as a "flowing scroll," and the viewer, as a "visual animal," underscore the pivotal role of colour. Propelled by intelligent science and situated within the context of China's film development, the current situation, and future prospects, China's science fiction film colour design has achieved noteworthy advancements and sustainable growth. This progress has been facilitated by the exploration of the constituent elements of colour expression, including its breakage, reorganization, overlapping, deconstruction, and ultimate completion. This exploration has been enabled by the foundation of advanced technologies such as digitalization, automation, and artificial intelligence. The Wandering Earth series, regarded as one of the preeminent examples in its genre, offers profound inspiration and a valuable reference for the colour production of Chinese science fiction films. The colour design process application model explored in Wandering Earth 2, encompassing the coordination of lighting scenes with digital lighting technology in the initial phase, high-specification real-time monitoring in the intermediate stage, and on-site colour mixing culminating in overall colour integration, presents an innovative framework for the sustainable development of colour design in future Chinese science fiction films. Utilizing this application model, the efficiency and precision of science fiction film colour design are significantly augmented, fostering innovation and progress in the field. Furthermore, it augments the sustainable development of science fiction film colour design. By leveraging technology-driven colour manipulation and its integration into emotional expression, Wandering Earth 2 exhibits highly advanced graphics and special effects, portraying a more intricate and emotionally resonant Chinese narrative. This, in turn, contributes to the formation of a more cohesive filmic emotional landscape and worldview. Science and technology have intricately outlined the ethereal concept of "wandering," mirroring the sentiment of "Chinese rescue" and nostalgia for one's homeland. The sophisticated colour design of Wandering Earth 2 has translated the Chinese people's vision of the future onto the global stage of science fiction cinema, fostering a sustainable development trajectory for Chinese science fiction films in the era of intelligent science's advancement and upgrading. As intelligent science continues to evolve and progress, it is anticipated that Chinese science fiction films will exhibit even greater achievements and innovations in colour design in the future.

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