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Articles

Optical Effect with Small Apertures as Result of Diffraction. Camera Obscura

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Abstract

In 1976, one of the co-authors, Ignatov, at 13 years old, described a phenomenon where small apertures produced optical effects. This was documented in a letter published in the Bulgarian scientific magazine “Cosmos.” During the socialism in Bulgaria, access to information was limited to educational institutions and libraries. There was a lack of information about the described phenomenon at that time.

The phenomenon, where images are observed through small apertures, occurs entirely by chance. A camera obscura was constructed, projecting images through a narrow gap.

Also, a model for photographing images with a small aperture is suggested so operators can be trained to capture images under specific conditions.

Keywords: colors, shades, additive mixing, optical effects, image through a small aperture.

1. Introduction

A camera obscura is a specific device that mimics the anatomical structure of the human eye. It can change the lens's focal length, while a pinhole camera cannot. Thus, the human eye can be considered a compatible sensor (Kumar, Ashish, Gowtham, 2020). Cameras and photographic devices control the amount of light with an aperture (Ignatov, Vanlyan, 2020). The aperture changes the opening of the camera. Photography using a pinhole camera illustrates the Lorentz transformation's power. It can capture the contraction of length, which conventional photography cannot achieve. Using the Lorentz transformation, the emission of light rays from the source and their reception in the pinhole was investigated, and it was shown that depending on its orientation, the image could be a line or a curve. The image of a relativistic moving sphere in a pinhole camera forms an ellipse, elongated in the direction of motion. The image of such a sphere is a circle if it moves directly toward or away from the camera (Hassani, 2017).

2. Methods and materials

An experiment with Camera Obscura was conducted to project an image through a small aperture with a size of 1 mm. The object of the study was a needle (Figure 1).

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Fig. 1. The object of the experiment is image projection through a small aperture.

3. Results

The results of the experiment on image projection through a small aperture are presented in Figure 2.

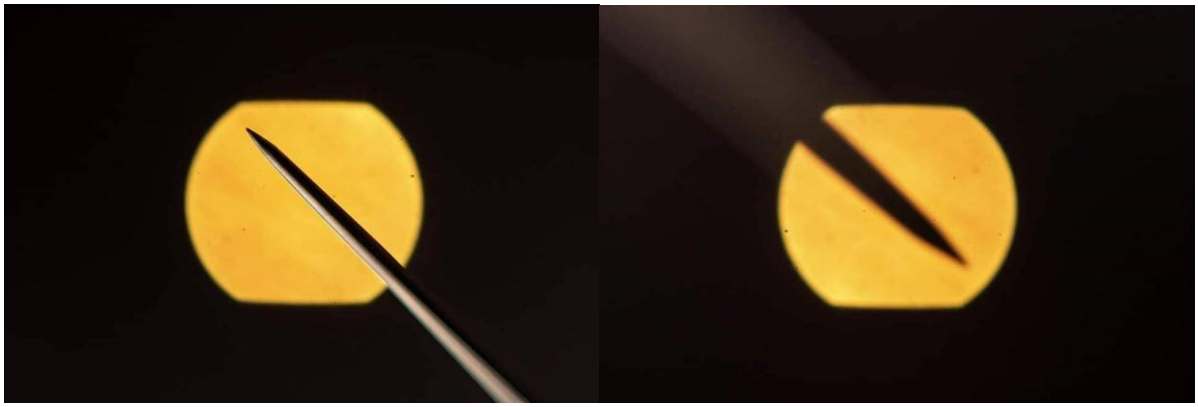

Fig. 2. Needle Projection through a Small Aperture (photo K. Vanlyan)

The image in Figure 2 is enlarged 1.5 times. The explanation given by 13-year-old Ignat Ignatov in 1976 is a diffraction effect. The aperture is 1 mm. The image is reduced when the distance from the object to the aperture increases. With this proposed exercise, operators can be trained in photographing an object and its image under specific conditions. The photography is done through a small aperture. The calculations of the object/image allow for the construction of a model for working in challenging conditions.

The camera obscura with a flat virtual screen is the standard model for obtaining images used in ray tracing. Figure 3 shows the demonstrative scheme of the museum in Teteven, Bulgaria.

A model with camera obscura can be extended with a cylindrical virtual screen to achieve a 360° or more extensive field of view. By using a suitable angular distribution of objects along the vertical axis, a 180° vertical field of view can also be obtained. This way, the entire celestial sphere can be mapped onto a planar image with acceptable distortion. The resulting panoramic images can be useful for interactive viewing of static images in a virtual reality system (Kenton, 1992). However, when the object is positioned behind glass, for example, a framed painting, and a pinhole camera and point light source are used, the path of light passes through the glass, and then the point at which it intersects the image is determined entirely by the refraction effect. Regardless of the light's direction, it reflects off the diffuse surface and refracts upon exiting the glass, resulting

in significant dispersion (Pharr, Jakob, Humphreys, 2017). Similar effects form the basis of virtual reality and magic as a form of art illusion designed to appear contradictory to the laws of nature. Research into ways to enhance this sensation continues. For example, the Oculus Rift adaptation is designed to create a virtual reality with a stereoscopic 3D view. Unlike 3D in television or movies, this is achieved through unique parallel images for each eye (Lander, 2015). It demonstrates how flexible our sense of presence in reality is and that we still don't fully understand it. Virtual reality creates the illusion of actual presence in the virtual environment and the observer's sensation of physically being in another space. Illusions are also used in painting, often created through perspective (Lander, 2015; Pharr et al., 2017; Marelli et al., 2015; Jensen, Christensen, 2023). Capturing images with small apertures is challenging. It is practically helpful for photographers and operators.

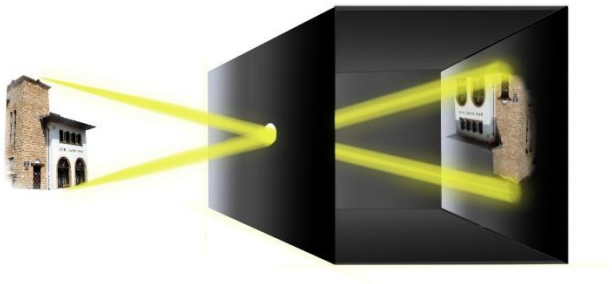

Fig. 3. A museum model in Teteven, Bulgaria, with camera obscura

A model for photographing images with a small aperture is suggested so operators can use camera obscura to simulate depth of field in the image. However, here, the fact that the surface of the lens provides a sequence of different views of the surroundings is not taken into account. This drawback is overcome by tracking the distribution of rays, but an embedded technique for the imaging process is required. The visibility of the surface is combined with the depth of the background in a limited way without integrating shading with background depth trained to capture images under specific conditions (Schofield et al., 2010).

4. Conclusion

This study corroborates the observation of diffraction effects by revisiting Ignatov's 1976 achievement of optical effects via small apertures and experimentally validating these phenomena through a Camera Obscura. The projective qualities of a 1 mm aperture align with initial insights, forming the basis for a proposed model facilitating image capture under specific conditions. This model, leveraging Camera Obscura's emulsion of depth of field akin to the human eye, offers a platform for operator training in image capture. Practical exercises conducted with photographers and operators using the described model system for capturing diffraction images enable the practical application of optical effects. On the other hand, fine-tuning the aperture and camera for specific captures in laboratory conditions is practice. Natural phenomena require professionalism and assessment of background and color characteristics.

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"European Journal of Molecular Biotechnology" (2013–2023): Some Results of the Decade

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Abstract

The article is dedicated to the 10th anniversary of the "European Journal of Molecular Biotechnology". The research material was articles published from 2013 to 2023. 102 articles were published during the specified period. Such research methods as the method of historical content analysis (historiographic/bibliographic method), the historical-typological method and the synthesis method were used in the work.

The application of molecular biotechnologies in such fields as medicine, genetics, agricultural and industrial production, etc. is analyzed.

The analysis of the articles showed that most of the research was published on human problems: medical, genetic and archaeological aspects of molecular biotechnologies, etc. In second place – research in virology, bacteriology, as well as work on crop production, animal husbandry and research of biotechnologies in agricultural production. In third place in terms of the number of publications were works on climatology, certain problems of chemistry, etc. The smallest number of articles is on research in the field of industrial production.

Keywords: journal, "European Journal of Molecular Biotechnology", molecular biotechnologies, 2013-2023.

1. Введение

Статья посвящена 10-летнему юбилею журнала «European Journal of Molecular Biotechnology», который публикует исследования по молекулярной биотехнологии. Миссия журнала, согласно информации на официальном сайте, «заключается в публикации высококачественных оригинальных результатов исследований, выполненных в области молекулярных биотехнологий. Важное значение уделяется формированию информационного пространства, направленного на повышение профессиональной компетенции специалистов данной сферы». В период с 2013 по 2023 годы было опубликовано 102 статьи.

Публикация статьи в журнале «European Journal of Molecular Biotechnology» является бесплатной, материалы размещаются в открытом доступе, разрешается их использование, копирование и тиражирование, но с обязательной ссылкой на источник. Коммерческое использование статей, размещенных в журнале, запрещено.

Для удобства восприятия мы классифицировали все статьи по сферам применения проведенного и опубликованного исследования: то есть применение молекулярных биотехнологий технологий в медицине с точки зрения человека, в аграрной промышленности, животноводстве, растениеводстве, генетике и т.п. В данной работе мы кратко проанализируем

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темы, которые поднимались на страницах журнала за прошедшие 10 лет.

2. Материалы и методы

Материалом для данной рукописи послужили исследования, опубликованные в журнале «European Journal of Molecular Biotechnology» в период с 2013 по 2023 годы.

Методологический комплекс включает в себя такие методы исследования как:

- контент-анализ / историографический / библиографический метод: применялся для анализа содержания статей, опубликованных в журнале «European Journal of Molecular Biotechnology» за прошедшие 10 лет.

- историко-типологический метод: применялся для классификации представленных в журнале трудов по тематикам/сферам исследования:

- метод синтеза: применялся для формулирования выводов исследования.

3. Результаты

Как указывалось выше, для удобства восприятия мы классифицировали все статьи по сферам применения исследования.

Биомолекулярные технологии, касающиеся человека (в том числе в медицине, генетике, археологии и пр.), анализировали такие исследователи как Н.М. Гайфуллин, А.В. Бачурин (Gaifullin, Bachurin, 2013), Д.А. Антонов (Antonov, 2013), П.А. Крылов (Krylov, 2014), А.А. Широкий, А.В. Волков, В.В. Новочадов (Shiroky et al., 2014), Р.С. Ядав, С. Тяги, Ш. Джаверия, Р.К. Гангвар (Yadav et al., 2014), В.В. Новочадов, К.А. Бовольская, С.А. Липницкая, Е.В. Перевалова, Е.Ю. Шувалова, З.Н. Загребина, В.Г. Зайцев, А.А. Широкий и другие соавторы (Novochadov, 2013; Novochadov et al., 2014; Shirokiy, Novochadov, 2016; Novochadov et al., 2016), С. Саидфар, М. Негахбан, М.М. Соурестани (Saeedfar et al., 2015), Ю.А. Шатырь, А.М. Бондарев, В.В. Новочадов, А.Б. Мулик (Shatyr et al., 2015), А.С. Аль-Рубаи, С.Т. Абд, Н.М. Кадим (AL-Rubaee Eaman et al., 2015), А.О. Зекий (Zekiy, 2015), А.С. Семенов, В.В. Булат (Semenov, Bulat, 2016a; Semenov, Bulat, 2016b), Н.А. Сидорова, Ф.Д. Воронов (Sidorova, Voronov, 2016), И. Игнатов, Ю. Пешева и соавторы (Ignatov, 2017; Ignatov, Pesheva, 2018a; Ignatov, Pesheva, 2018b), Б. Лавсандорж, Т. Мориген (Luvsandorj, Morigen, 2017), А.Х. Аль-Хумаири (Al-Humairi, 2019; Al-Humairi et al., 2021), Е.Н. Несмеянова, Ю.А. Зимина и соавторы (Nesmeyanova et al., 2021).

Молекулярные биотехнологии в аграрном производстве, растениеводстве и животноводстве освещали такие авторы как Е. Нефедьева, Т. Веселова, В. Веселовский, В. Лысак (Nefed'eva et al., 2013), В. Павлова, Е. Васичкина и соавторы (Pavlova et al., 2013a; Pavlova et al., 2013b), Х. Бузид, Ф.Т. Бенали, Р. Чадли, М. Бузуина, А. Бузид, А. Бенчохра, М.М. Диф (Bouzid et al., 2014; Chadli et al., 2015), А. Томер, Р. Сингх, М.К. Маурья (Tomer et al., 2014), А.С.А. Аль-Джанаби (Ali Saeed Atiyah AL-Janabi, 2015; Saeed, AL-Janabi, 2016), Г.А. Геращенков, Г.Р. Ясыбаева, Н.А. Рожнова, А.В. Чемерис (Gerashchenkov et al., 2015), Д.А. Хусейн (Hussain, 2015), Ф.Р. Аль-Самарай, А.А. Аль-Казаз (Al-Samarai, Al-Kazaz, 2015), Д. Крастев, П. Пеньков и соавторы (Krastev et al., 2016), И.А.А. Ибрагим, М.М. Мохаммад, А.А. Фейсал, Х. Муса, Г.Алтине, А. Бунуну и соавторы (Ibrahim et al., 2017; Ibrahim et al., 2017; Ibrahim et al., 2018), В.В. Новочадов и соавторы (Novochadov et al., 2018; Novochadov et al., 2019), В.Г. Зайцев, Р.Ю. Иващенко, Д.А. Куркина, А.С. Попова (Zaitsev et al., 2019), С. Борсали, Р. Чадли (Borsali, Chadli, 2019), С. Караджов, И. Игнатов, Х. Найденски, Т. Попова, В. Люпке, Г. Глухчев, Н. Колев, С. Балабанов (Karadzhov et al., 2019), П.А. Крылов и соавторы (Krylov et al., 2022).

Проблемы молекулярных биотехнологий, используемых в изучении вирусологии и бактериологии исследовали О. Мосин, И. Игнатов, Д. Складнев, В. Швец и другие соавторы (Mosin et al., 2013; Mosin, Ignatov, 2014; Mosin, et al., 2014; Mosin, Ignatov, 2014a; Mosin et al., 2015; Ignatov, Mosin, 2014; Ignatov, Mosin, 2015a; Mosin, Ignatov, 2015a; Ignatov, Mosin, 2015b; Mosin, Ignatov, 2015b; Ignatov, Mosin, 2015c; Ignatov, Mosin, 2015d; Mosin, Ignatov, 2016; Huether et al., 2020), О.В. Колотова, И.В. Владимирцева, С.Н. Орлова, И.В. Соколова (Kolotova et al., 2014), Г. Глухчев и соавторы (Gluhchev et al., 2015), Х.А. Шинди, А.К. Халафалла, М.М. Гома, А.Х. Еед (Shindy et al., 2016; Shindy et al., 2018; Shindy et al., 2019), А.С. Афошин, Ф.В. Кочетков, Ж.И. Андреева-Ковалевская, Ж.И. Бударина, М.В. Захарова,

А.В. Лисов, А.М. Шадрин, А.А. Леонтьевский (Afoshin et al., 2017), М.Д. Давиташвили, Г.С. Азикури (Davitashvili, Azikuri, 2019), М. Ель-Идрисси (El idrissi, 2019).

Биотехнологии молекулярного уровня, применяемые в сфере окружающей среды, климатологии, химии, а также отдельные более узкие сферы применения данных технологий анализировали Д.М. Фролов, В.Г. Зайцев (Frolov, Zaitsev, 2013), И. Игнатов, О. Мосин, Б. Великов, Э. Бауэр, Г. Тыминский (Ignatov et al., 2014; Mosin, Ignatov, 2014b; Ignatov et al., 2014; Mosin et al., 2014c; Ignatov, Mosin, Ignatov, 2016; Ignatov, 2019; Ignatov, 2020; Ignatov et al., 2022; Ignatov, 2022), С. Тяги, Р. Сингх, Ш. Джаверия (Tyagi et al., 2014), В.В. Новочадов и соавторы (Novochadov et al., 2016; Krylov et al., 2020), Д. Механджиев, С. Караджов, Г. Глухчев, А. Атанасов и др. (Mehandjiev et al., 2017), А. Зеруаль, М. Эль-Идрисси, Р. Эль-Аджлауи, Н. Ууририсс, С. Абурича, Н. Мазуар, А. Бенхарреф, А. Эль-Хаджби (Zeroual et al., 2017), Н. Уурисс, А. Зеруал, К. А. Гадхи, А. Бенхарреф, А. Абурриче, А. Беннамара, А. Эльхаджби (Ourhriss et al., 2017), О.В. Градов (Gradov, 2017), А. Беналлу, Х. Эль-Алауи Эль-Абдаллауи, Х.Гармес (Benallou et al., 2018a; Benallou et al., 2018b; Benallou, 2018c), Е.А. Иванцова, Н.В. Онистратенко, Н.В. Герман, П.А. Крылов, А.А. Тихонова и др. (Ivantsova et al., 2018; Krylov et al., 2019), И.Н. Онуче, А.Д. Олуватопе (Onuche, Oluwatope, 2021), С. Мукерджи, С. Дас и соавторы (Mukherjee et al., 2021).

Вопросы биомолекулярных технологий, связанных с организацией жизнедеятельности человека (работа коммунальных служб и пр.), а также в промышленном производстве исследовали И.Г. Шайхиев (Shaikhiev, 2014), И. Игнатов, О. Мосин (Mosin, Ignatov, 2014), В.В. Новочадов, П.А. Крылов (Novochadov, Krylov, 2016), А.Н. Берлина, Д.В. Сотников, С.А. Еремин, Л. Лю, Ч. Сюй, А.В. Жердев (Berlina et al., 2016), Х.А. Шинди (Shindy, 2016; Shindy et al., 2017; Shindy, 2019), А. Тунси, М.Эль-Идрисси, З. Джалиль, А. Бархуми, А. Зеруаль, М. Мбарки и др. (Tounsi, El Idrissi, 2018; Jalil et al., 2019; Aboulouard et al., 2020), М.М. Гомаа (Gomaa, 2019; Gomaa, Mahmoud, 2021), Ю.А. Зимина и соавторы (Zimina et al., 2020).

4. Заключение

В ходе проделанной работы мы можем сделать следующие выводы:

1. Больше всего исследований было опубликовано по проблемам человека: медицинские, генетические и археологические аспекты молекулярных биотехнологий и пр. На втором месте – исследования по вирусологии, бактериологии, а также работы по растениеводству, животноводству и исследованию биотехнологий в аграрном производстве. На третьем месте по количеству публикаций оказались работы по климатологии, отдельным проблемам химии и пр.

2. Наименьшее количество статей по исследованиям в сфере промышленного производства.

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«European Journal of Molecular Biotechnology» (2013–2023): некоторые итоги десятилетия

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Аннотация. Статья посвящена 10-летнему юбилею журнала «European Journal of Molecular Biotechnology». Материалом исследования послужили статьи, опубликованные за период с 2013 по 2023 годы. За указанный период было выпущено 102 статьи. В работе применялись такие методы исследования как метод исторического контент-анализа (историографический/библиографический метод), историко-типологический метод и метод синтеза.

Анализируется применение молекулярных биотехнологий в таки сферах как медицина, генетика, аграрное и промышленное производство и пр.

Анализ статей показал, что больше всего исследований было опубликовано по проблемам человека: медицинские, генетические и археологические аспекты молекулярных биотехнологий и пр. На втором месте – исследования по вирусологии, бактериологии, а также работы по растениеводству, животноводству и исследованию биотехнологий в аграрном производстве. На третьем месте по количеству публикаций оказались работы по климатологии, отдельным проблемам химии и пр. Наименьшее количество статей по исследованиям в сфере промышленного производства.

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