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1 Introduction to the conference

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Electromagnetic scattering by a homogeneous, isotropic sphere is commonly referred to as Mie theory, although *Gustav Mie* (1868–1957) was not the first to formulate this electromagnetic scattering problem. Before him *Alfred Clebsch* (1833–72), solving the elastic point source scattering problem of a perfectly rigid sphere using potential functions [1], and *Ludvig Lorenz* (1829–91) [3, 2] contributed to this problem [4]. In 1909 *Peter Debye* (1884 – 1966) considered the related problem of radiation pressure on a spherical particle [5] utilizing two scalar potential functions. Therefore plane wave scattering by a homogeneous isotropic sphere is also referred to as Lorenz-Mie theory [6], or even Lorenz-Mie-Debye theory [7]. The incorrect name Lorentz-Mie theory seems also to be quit common (e.g. in Burlak [8]). Kerker provides an extensive postscript on the history of scattering by a sphere [9].

German physicist *Gustav Mie* published his classical paper on the simulation of the colour effects connected with colloidal gold particles using the classical Maxwell equations in 1908 [10] when he was professor of physics in Greifswald. This paper gave an outline of how to compute light scattering by small spherical particles and it became the classic contribution to this subject. To cite *Eugene Garfield* from his 1985 investigation on articles most cited in the SCI from 1961 to 1982 [11]: "The oldest paper was published in Annalen der Physik in 1908 by Gustav Mie. It is one of three articles in Table 1 written in German. This paper discusses the electric and magnetic vibrations and optical properties of particles in colloidal solutions. Interestingly, it continues to be heavily cited even today - 45 times in 1983 alone, 75 years later. It is interesting to speculate why it has not become the common wisdom of physics, which often leads to obliteration of citations to classic work."

Cardona and Marx [12] comment, that this paper was almost ignored until about 1945 but its importance rose with increasing interest in colloids starting from the 1950s such that hundred years after publication the paper is still much cited [14] with currently 160 citations a year (Fig. 1.1). The paper is called Dornröschen (Sleeping Beauty) by the researchers at Information Retrieval Services of Max Planck Society [13] because of its low recognition considering the number of citations during the first years after its publication. But in the 1930s contemporary scientists acknowledged the importance of his contribution. In a special issue devoted to Mie's 70s birthday *Ilse Fränz-Gotthold* and *Max von Laue* [15] dedicate their paper to "*Gustav Mie* whom physics owes the mathematical treatment of diffraction by a sphere".

The current citations of Mie's paper show that the applications of Mie theory cover

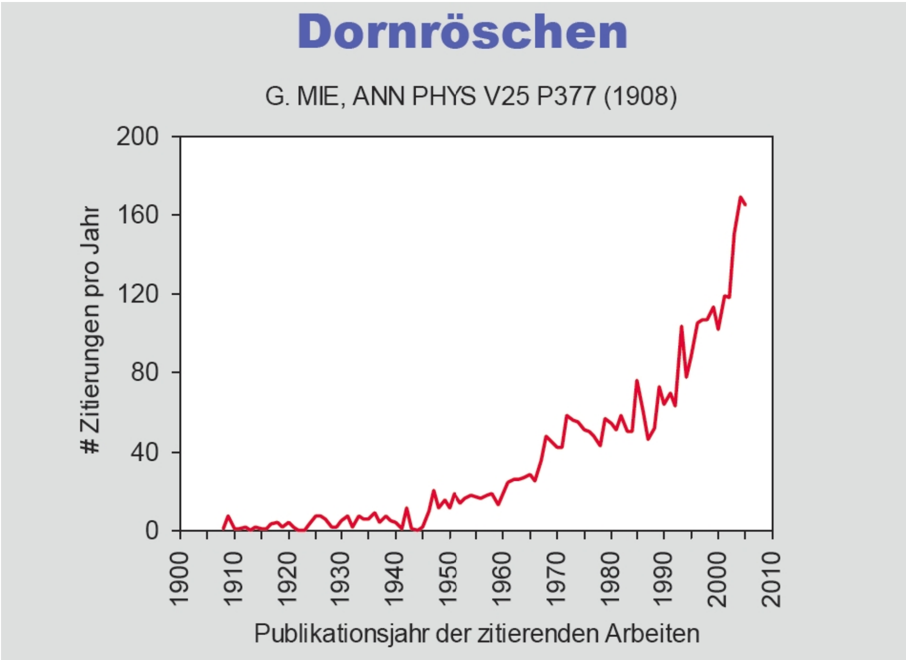

Figure 1.1: Number of citations of Mie's paper according to *Bowman and Marx* [13].

a wide range of subjects like climate research, optical particle characterization or interstellar dust in astrophysics.

Understandably prior to the development of electronic computers in the middle of last century not many papers were published on computing scattering problems using Mie's theory since the computational labour involved in evaluating functions such as Ricatti-Bessel functions was quite extreme.

Even with the rapid evolution of the computer it took some time before stable algorithms were developed. Gradually reliable and stable scattering programs were published. Early well known algorithms were published by *Giese* [16] and *Dave* [17]. The IBM report by *Dave* from 1968 was still send out on request in the 1990s. Nowadays a number of efficient algorithms and programs are available. A major step was the program MIEV0 written by *Wiscombe* [18, 19], which is based on *Lentz's* continued-fraction method for the calculation of spherical Bessel functions [20]. It has been demonstrated that Mie's theory can be successfully applied up to size parameters of 500 [21, 22, 23] and this year Mie's theory has even been programmed on a Java enabled Mobile Phone using a Matlab clone [24]. As the scattering of a plane electromagnetic wave by a dielectric sphere is considered a canonical problem, Mie's theory is still used as a standard reference to validate methods intended for more complex scattering problems [25, 26, 27].

Apparently one of the first English language versions of Mie's theory was published by *Bateman* [28]. Mie's original paper was translated into the English language as late as 1976 by the Royal Aircraft Establishment in the UK [29] and two years later by Sandia Laboratories in US [30]. Recently a Spanish translation of the original paper became available [31] and Chinese and Hebrew translations are on the way [32].

In the published literature, when citing derivation of Mie's theory first major references of a full description of the theory were to *Stratton* [33], *Born and Wolf* [34] and *van de Hulst* [35]. Later *Bohren and Hufman* [36] were cited commonly.

As in 2008 hundred years after its publication scientists from various diciplines all over the world still deal with Mie's theory applying or extending it, it its seems that this year might be suitable date to celebrate this 100 years history by having a close look at *Present developments and interdisciplinary aspects of light scattering.*

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