

Chladni meets Napoleon*

H.-J. Stöckmann[†]

Fachbereich Physik der Philipps-Universität Marburg, 35032 Marburg, Germany

Abstract. Chladni belonged to those few scientists who have been able to arouse enthusiasm for their work not only in professional circles, but also in the lay public. During several journeys all over Europe Chladni demonstrated the sound figures he had discovered as well as the musical instruments invented by him. In this respect the invitation pronounced by Napoleon during a longer stay in Paris to show his experiments at the imperial court was undoubtedly a highlight. Chladni has given a personal report on this event. In this article it shall be tried to sketch Chladni's character, based on his own writings but also on comments of his contemporaries.

1 Introduction

On a February evening of the year 1809 in Paris, a carriage drove up before Tuilerie Palace, the official residence of Napoleon Bonaparte, emperor of the French people. The passengers were the Count de la Place, chancellor of the senate, La Cépède, great chancellor of the Legion of Honour, Bertholet, senator of the empire, and a Dr. Chladni from Wittenberg. Chladni had become known for his experiments on vibrating plates, and stopped for a longer stay in Paris while on a lecture tour through Europe. There he got to know the leading contemporary scientists in person. Apart from the three already mentioned, the mathematician Count de la Place, better known as Laplace, the chemist Bertholet, and the biologist La Cépède, those were among others Poisson, Savart, and Biot, as well as Alexander von Humboldt, who stayed in Paris at the same time.

Napoleon was interested in a demonstration of Chladni's experiments and invited him to the Tuileries through the mediation of Laplace. While performing artists were rather often invited to court, the invitation of a scientist was a singularity. Chladni has given a detailed personal account of his meeting with Napoleon, which will be represented later on.

But let us first consider the year 1756, when Ernst Florens Friedrich Chladni was born on Nov. 30th (see Fig. 1 of Ref. [1]). As a consequence of the Reformation in the 16th century, Wittenberg had become the cultural centre of Europe due to the work of Luther and Melancthon, and the University Leucorea of Wittenberg was considered the most important north of the Alps. In Chladni's year of birth, however, Wittenberg had meanwhile degraded to the status of a provincial town in Electoral Saxony, and the university as well had lost its great renown. Chladni's great-grandfather, a protestant, had to leave his native country Hungary during the Counter-Reformation and settled with his family in Wittenberg in 1673. Chladni's grandfather had been a professor of theology in Wittenberg, and his father was a professor of laws and a highly renowned councillor of Electoral Saxony.

Chladni spent a sheltered youth. A bit too sheltered, as it seemed. Let us listen to Chladni's own words: "In my paternal home I was indeed kindly treated, and was well instructed by

* An abbreviated version of this article appeared in German in the November issue of the *Physik-Journal*. Translation into English by E.-B. Stöckmann.

[†] e-mail: stoekmann@physik.uni-marburg.de

honest and able teachers, but I had to submit to such restrictions that I could leave the house only on rare occasions, and never alone. I could get to know other young people of my age only in church. And, due to exaggerated care for the only son, I was merely allowed to get a breath of fresh air in the court and garden near the house, when the weather was very fine."¹ Since the age of six years the boy made use of the time spent compulsorily indoors by reading books of geography and travels. At the age of fourteen Chladni was sent to the boarding-school at Grimma, and there as well he complained of a strongly restricted freedom of movement (for more details on Chladni's youth see Ref. [1]).

At the age of eighteen he took up law in Wittenberg. He would have much more preferred medicine, but yielded to the pressure of his father. At least he attained the permission to continue his studies in Leipzig. Here he finished with even two dissertations on philosophy and law in 1781 and in 1782. Soon after his father died. After years of tutelage he could now finally pursue his own interest. Instead of taking up law, which would have assured him a secured position and a regular income, he decided to study natural sciences he had already dealt with just for the fun of it.

2 Discovery of the sound figures

Vibrations of bars and plates soon became his main field of interest, and in this domain he made the discovery which is associated with his name till today. Let us listen to his personal report: "Among other things I had observed that any glass or metal plate of a size not too small produced a variety of sounds whenever I held and stroke them in different positions, and I wished to know the reason for this variability which nobody had ever before investigated. By means of a vice I fixed the pivot in the middle of a brass plate taken from a grinding machine, and noticed that strokes with a violin bow could produce different sounds which were stronger and more constant than those obtained by mere strokes of the hand."² Chladni knew the experiments of Lichtenberg who had made visible the traces of electric discharges in insulators by spreading powder on the corresponding places. This gave him the idea to try the procedure at his vibrating brass plate. He spread sand on the plate, stroke it with the violin bow, and within a few seconds the sand brought about the shape of a star with ten rays. This was the birth of Chladni's sound patterns. In 1787 Chladni published his experiences in his first acoustic work on *Entdeckungen über die Theorie des Klanges*.³

Actually Chladni was not the first to observe those vibration patterns. Leonardo da Vinci had already mentioned them in his note-book, and Galilei treated them in a longer passage of his *Dialogo sopra i due massimi sistemi*.⁴ It is, however, indisputable that Chladni was the first to examine the phenomenon systematically.

After having renounced a legal profession Chladni had become a private scholar without a regular income. The money he got for guest lectures given at the University of Wittenberg was not sufficient to secure his living. Several applications for a professorial chair failed. This gave him the idea to earn his money by means of lecture tours: "It occurred to me that an artist

¹ "Im väterlichen Hause ward ich zwar freundlich behandelt, und genoß von braven und geschickten Lehrern guten Unterricht, ward aber immer mit einer solchen Einschränkung gehalten, daß ich nur selten, und nie allein, aus dem Hause gehen durfte, und andere junge Menschen meines Alters nie anders, als etwa in der Kirche zu sehen bekam; es ward mir sogar, aus übertriebener Sorgfalt für mich als den einzigen Sohn, nur bei sehr guter Witterung verstatet, in dem am Hause befindlichen Hofe und Garten in die freie Luft zu gehen."

² "Unter anderem hatte ich bemerkt, daß jede nicht gar zu kleine Glas-oder Metallscheibe mannichfaltige Töne gab, wenn ich sie an verschiedenen Stellen hielt und anschlug, und wünschte den Grund dieser von noch niemanden untersuchten Verschiedenheit der Töne zu wissen. Ich spannte eine messingene Scheibe, die zu einer Schweißmaschine gehörte, an einem in ihrer Mitte befindlichen Zapfen in einen Schraubenstock, und bemerkte, daß durch Striche mit dem Violinbogen sich darauf verschiedene Töne hervorbringen ließen, die stärker und anhaltender waren, als man sie durch Anschlagen erhalten kann."

³ *Discoveries Concerning the Theory of Sound*.

⁴ *Dialogue Concerning the Two Chief World Systems*.

who knows how to give himself some publicity is less attached to a certain place and has more opportunities of being received kindly and profiting nearly everywhere than a scholar dedicated to academic life, and I hoped to succeed likewise, not by means of virtuosity, because I had so late in life begun to learn music, but due to the invention of a new instrument. I thought myself more able to achieve it than any other man, because I had studied the nature of many a sounding body beforehand.”⁵

At first Chladni had apparently not the slightest idea that the mere demonstration of the sound patterns could be of interest for the general public. After a longer period of trying and several vain experiments in 1790 Chladni finished his first invented instrument to which he gave the ambitious name Euphon (Greek: *εὐφώνου*, i. e. beautiful sound). The sound was produced by glass rods bringing about vibrations when excited by friction rods fixed perpendicularly to the axle. Having packed up the Euphon and his plates, Chladni set out for his first lecture tour all over Europe. Travelling should not let him go for the rest of his life.

It soon became evident that the public was actually interested in the sound patterns and not in the new instrument. Fig. 2 of Ref. [1] shows Chladni during a demonstration. It took place in the palace of prince Thurn and Taxis in Regensburg in 1800. In general the public was less interested in physics but simply in a good show. The sketch shows how Chladni could bring about individual vibration patterns by fixing the plate at different positions between thumb and index. He developed an impressive skill in executing this technique.

In 1800 Chladni invented a second musical instrument which he called Clavicylinder. The sound was produced by metallic vibration bars, similarly as had been the case with the Euphon. The excitation, however, was brought about via a rotating cylinder against which the bar could be pressed by means of a key. The keys were arranged as those of the piano. Chladni tried to keep the principle of the Clavicylinder a secret, but in vain. Soon afterwards other instruments appeared, namely the Melodion and the Terpodion which imitated the principle of the Clavicylinder [2].

In 1802 Chladni moved from the house where he had been born to a flat in Schlosstr. 10. In the same house Wilhelm Weber grew up who became famous later on for his experiments on magnetism. At the age of only 21 he published a monograph on the science of waves, together with his elder brother Ernst Heinrich, his senior by nine years. The book was dedicated to “our dear friend Chladni, the initiator of acoustics based on experiments.”⁶

In 1802 Chladni’s main work *Die Akustik*⁷ appeared, in which he summarises every fact known in this field up to that period [3]. The main discoveries were Chladni’s own. Apart from the sound figures Chladni was the first to observe longitudinal vibrations of bars. It is no exaggeration to state that acoustics has become a discipline of its own due to this book.

Since the theory on the vibrations of elastic plates did not yet exist, the description of the sound figures had to remain qualitative. Chladni classifies the patterns observed for rectangular plates according to the number of nodal lines parallel to both sides, and he assigns to the frequencies the corresponding tones of the scale up to semitone precision, ascribing the tone G arbitrarily to the figure with the lowest frequency. Fig. 1 shows a plate from his *Akustik* with a variety of sound figures of the square. For circular plates he discovers an empirical relation between the frequency ν belonging to a sound pattern, and the number of its diametric and radial nodal lines n , m , respectively,

$$\nu \sim (n + 2m)^2, \quad (1)$$

today known as Chladni’s law (see Ref. [3], p. 131).

⁵ “Ich hatte dabei den Gedanken, daß ein Künstler, der einige Aufmerksamkeit zu erregen weiß, weniger an einen bestimmten Ort gebunden ist und mehrere Gelegenheiten hat, fast überall Vortheil und eine gute Aufnahme zu finden, als ein Gelehrter, der sich dem akademischen Leben widmet, und hoffe, es auch dahin zu bringen, zwar nicht durch Virtuosentalent, weil ich so spät angefangen hatte, Musik zu erlernen, aber doch durch Erfindung eines neuen Instrumentes, welches ich eher, als ein Anderer, auszuführen glaubte, weil ich die Natur so mancher klingenden Körper zuerst untersucht hatte.”

⁶ “verehrtem Freunde Chladni, dem Begründer einer auf Versuchen beruhenden Akustik”.

⁷ *Acoustics*.

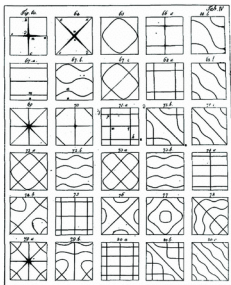


Fig. 1. Sound figures of a quadratic plate (E. F. F. Chladni, *Die Akustik* 1802 [3]).

On the occasion of a visit to Weimar in 1803 Chladni met Goethe to whom he gave a copy of his book. In this connection Goethe wrote the following in a letter to Schiller: "Doctor Chladni has arrived and has brought his complete Acoustics in a quarto volume. I have already read half of it and shall give you a somewhat agreeable oral report on its content, substance, method, and form. He belongs to . . . those blissful persons who have not the faintest idea that there is something as natural philosophy and who are only attentively trying to observe phenomena which they will then classify and make use of them as well as their natural talent is capable in the matter and is trained for the matter."⁸

As to the background of this not so flattering characterisation of Chladni's personality, we can only speculate. Trying "to observe phenomena and classify them well" is a characterisation of the experimental physicist, and can hardly be rated as a reproach nowadays. As is generally known, Goethe regarded himself as a natural scientist and did not underrate his achievements in this field. May be Goethe had tried to convince Chladni of his *Theory of Colours* and had

⁸ "Doktor Chladni ist angekommen und hat seine ausgearbeitete Akustik in einem Quartband mitgebracht. Ich habe sie schon zur Hälfte gelesen und werde Ihnen darüber mündlich, über Inhalt, Gehalt, Methode und Form manches Erfresliche sagen können. Er gehört . . . unter die Glückseligen, welche auch nicht eine Ahnung haben, daß es eine Naturphilosophie gibt, und die nur, mit Aufmerksamkeit, suchen die Phänomene gewahr zu werden, um sie nachher so gut zu ordnen und zu nutzen, als es nur gehen will und als ihr angebornes, in der Sache und zur Sache geübtes Talent vermag."

not provoked the enthusiasm he had hoped for. However, a few years later Goethe has made several positive statements on Chladni's behalf in public [1].

Another poet, Thomas Mann, who liked to compare himself to Goethe, erects a literary monument to Chladni. In the introductory chapter of his great late novel *Dr. Faustus* the poet introduces the father of his hero Adrian Leverkühn. This father likes to "speculate," i.e. "to labour on nature, to stimulate phenomena to tempt it by exposing its work through experiments." These experiments are rather peculiar. There are drops moving like amoebae and eating up each other. There are structures grown in saline solutions suggesting to be mosses or algae. And there are sounds appearing in the form of geometrical patterns. All these phenomena and experimenting anyway in the poet's eyes are the work of the "tempter."

3 Chladni in Paris

In 1806 Chladni set off again on a long journey leading him via the Netherlands and Brussels to Paris, where he stayed from 1808 to 1810. This was the very period when the aforementioned meeting with Napoleon took place. Let us again listen to Chladni's own words: "When I entered, he welcomed me, standing in the centre of the room, with the expressions of his favour. Except him there were also present his spouse Josephine, a still beautiful and charming lady, his mother Lilitia, whose physiognomy and behaviour expressed good-naturedness, and . . ." ⁹ others.

"I first played some pieces on the Clavicylinder which seemed to please the persons present. Napoleon did also want to produce some sounds, but though I had told him that the keys must only be pressed very softly, and although he did believe to have pressed them very softly, it happened so vigorously that in my opinion even this showed that his energy dominated his softness." ¹⁰

Subsequently Chladni demonstrated the sound figures: "Napoleon showed much interest in my experiments and explanations, and asked me, as an expert in mathematical questions, to explain all topics thoroughly, so that I could not take the matter too easy. He was well informed that one is not yet able to apply a calculation to areas curved in more than one direction, and that, if one were successful in this respect, it could be useful for applications to other subjects as well." ¹¹

Napoleon and science could be the topic of a whole essay of its own. He actually had an excellent knowledge of mathematics, as we got to know from his school reports. And when in 1796, he was still a young general at this period, his troupes plundered Pavia, he gave orders to spare the homes of the university professors, among them the house of Alessandro Volta [4]. Later on in Paris, in 1801, Volta also got the chance to present his experiments to Napoleon Bonaparte, who was then still the first consul of the French republic. As we have already learnt, the leading scientists held high positions at the imperial court. Later on Laplace was even appointed marquis.

⁹ "Als ich eintrat, empfing er mich, in der Mitte des Zimmers stehend, mit Aeusserungen des Wohlwollens. Ausser ihm waren noch zugegen seine Gemahlin Josephine, eine damals noch sehr wohlgebildete, lebenswürdige Dame, seine Mutter Lilitia, deren Ansehen und Benehmen Gutmüthigkeit verrieth, und . . ."

¹⁰ "Ich spielte erst etwas auf dem Clavicylinder, welches den Anwesenden zu gefallen schien; Napoleon wollte hierauf auch einige Töne angeben, aber, wiewohl ich ihm gesagt hatte, dass die Tasten nur sehr gelind müssten niedergedrückt werden, und er sie auch nur sehr schwach niederzudrücken glaubte, so geschah es doch mit solcher Stärke, dass meines Erachtens auch hierin seine mehrere Energie als Sanftheit sich zu erkennen gab."

¹¹ "Napoleon bezeugte meinen Experimenten und Erklärungen viele Aufmerksamkeit, und verlangte, als Kenner mathematischer Gegenstände, dass ich ihm Alles recht von Grund aus erklären sollte, so dass ich also die Sache nicht oben von der leichten Seite nehmen durfte. Er wusste auch recht wohl, dass man noch nicht im Stande ist, Flächen, die nach mehr als einer Richtung auf verschiedene Art gekrümmt sind, so dem Calcul zu unterwerfen, wie krumme Linien, dass, wenn man hierin weitere Fortschritte machen könnte, es auch zur Anwendung auf manche andere Gegenstände nützlich sein würde."

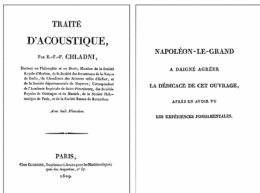


Fig. 2. Dedication of the *Traité d'Acoustique* to Napoleon.

The next morning Chladni got a gratuity of 6000 francs, connected to the request to publish the *Akustik* in French. In doing this work Chladni encountered a problem. For the German terms *Schall*, *Klang*, and *Ton*, used by Chladni with different meanings, the French language only knows one concept, namely *son*, i. e. Sound. A Frenchman he asked about this matter gave him the following answer, which was not very helpful: “*Notre diabolisme de langue ne peut pas se prêter à l'expression de toutes les idées possibles. Il faut même quelquefois sacrifier une idée aux caprices de la langue.*”¹² Chladni seized this opportunity to a thorough modification, he eliminated the out-of-date and added new ideas. In November 1809 the book was published under the title of *Traité d'Acoustique*. Chladni made the following remark: “The royalties I got from the bookshop were those the French scientists usually received for physical or mathematical books which is not by far as much as e. g. the royalties Madame de Staël or others, who have a much greater public, get for their scripts.”¹³ This is (unfortunately!) still the same today.

Chladni dedicated the book to Napoleon, after Laplace had advised him to ask the emperor's permission (Fig. 2). Chladni had a lot of difficulties in doing so: “The greatest trouble I took with the unavoidable dedication. That is to say I did not succeed in writing a satisfactory *épître dédicatoire*, which on the one hand would have avoided all kinds of flattery (which is not my taste), and on the other hand would have expressed all the same every proper respect and gratitude. Finally I got out of it in a way that everybody was content, namely by means of the following dedication in the lapidary style:¹⁴ *Napoléon le Grand a daigné agréer la dédicace de*

¹² “Our devil of a language does not want to lend itself to the expression of all ideas possible. Sometimes it is even necessary to sacrifice an idea to the caprices of the language.”

¹³ “Das von der Buchhandlung entrichtete Honorar war übrigens eben so, wie es gewöhnlich die dortigen wissenschaftlichen Männer für physikalische oder mathematische Bücher erhalten, welches aber doch bei weitem nicht so Viel beträgt, wie etwa das Honorar für Schriften von Frau von Staël und Anderen, die ein weit grösseres Publikum haben.”

¹⁴ “Die meiste Mühe hat mir die nicht zu vermeidende Dedication gemacht. Es wollte mir nämlich nicht gelingen eine *épître dédicatoire* abzufassen, mit der man recht wäre zufrieden gewesen, und in der man auf der einen Seite alle Schmeichelei (die meine Sache nicht ist) vermieden, und auf der anderen Seite doch alle gebührende Achtung und Dankbarkeit ausgedrückt hätte. Endlich zog ich mich aus der

cet ouvrage, après en avoir eu les expériences fondamentales.”¹⁵ Perhaps that was what really happened. There is, however, good reason to be doubtful. In 1826, when Chladni drew up his report, conditions in Europe had dramatically changed. Some years before Napoleon had died on St Helena, and an atmosphere of repression reigned all over Europe. The dedication had thus become a problem.

In addition to the personal gratuity for Chladni Napoleon held out a prize of 3000 francs for the mathematical theory of the sound patterns. In 1816 this prize was awarded Sophie Germain for an essay entitled *Recherches sur la théorie des surfaces élastiques*¹⁶. From her previous knowledge Sophie Germain was a mathematician. Being a woman a proper education had been denied to her. She had therefore acquired the necessary knowledge by self-instruction. She made some important contributions to number theory, and exchanged scientific letters with Gauss, in the beginning under an assumed male name, as she feared a woman would not be taken seriously [5].

Sophie Germain's explanation of the sound patterns was incomplete. The prize was given to her all the same since it was acknowledged that her treatise signified an essential progress. The problem proved to be obstinate. The complete solution for circular plates was found by Robert Kirchhoff not before 1850, and still in 1891 one could read in the *Handbuch der Physik* [6]: “As to the strict mathematical theory, only a few cases are known in which it yielded results appropriate to be universally applied to the experiment.”¹⁷

Chladni figures of irregularly shaped plates have experienced a surprising topicality nowadays. The reason is the equivalence between the stationary wave equation, the Helmholtz equation, and the stationary Schrödinger equation for a particle moving freely in a box with reflecting walls. This enables the examination of such quantum billiards, and, in the case of irregularly formed walls, of the quantum chaos by means of vibrating plates [7]. Nodal patterns are also of central importance in totally different domains, in fields of light [8], in earthquake damage pattern [9], and even in pattern formation in the visual cortex [10]. The 368th Wilhelm-and-Else-Heraeus seminar dealt exactly with these questions. In view of this development Napoleon's prediction “that if further progress could be made in this respect”, namely in understanding the Chladni figures of irregularly formed plates, “this could be also useful when applied to other objects” can only be called visionary.

After a long absence Chladni returned to Germany via Switzerland and Italy in the summer of 1812. He omitted Rome and Naples, “since the roads leading there were too unsafe because of the many street robbers and murderers.”¹⁸ Back home again, Napoleon for a last time affects his life, this time indirectly, and with less delightful consequences. In the summer of 1813, the remains of the *grande armée* were entangled in numerous fights and skirmishes in Saxony after the retreat from Moscow. Wittenberg was besieged by the Prussians, so Chladni was compelled to move to the small town of Kemberg, situated 15 kilometres to the south of his home town. In the autumn of the same year the flat he left in Wittenberg burnt out, flared up by a fire rocket which had hit the neighbouring house. Chladni deplored the loss of many objects dear to him. He had been, however, so lucky to have rescued most of his belongings, among them the Euphon and the Clavicylinder. As we know from a report of the young Felix Mendelssohn-Bartholdy, who had visited Chladni in Kemberg in 1821, he lived there in cramped conditions [2]. A single room had to serve him as bed-room, workshop, and drawing room at the same time.

In Kemberg Chladni spent the rest of his life, only interrupted by the still numerous lecture tours. During one of these he died in Breslau on April 4th 1827.

Verlegenheit auf eine Art, mit der man allgemein zufrieden war, nämlich durch folgende Dedication im Lapidarstyl:”

¹⁵ *Napoleon the Great has deigned to accept the dedication of this work, after he had seen the pertinent fundamental experiments.*

¹⁶ *Research on the Theory of the Elastic Surfaces.*

¹⁷ “Was die strenge mathematische Theorie betrifft, so ist sie wohl erst nur in wenigen Fällen dahin gelangt, Resultate zu liefern, die allseitig eine Anwendung auf das Experiment gestatten.”

¹⁸ “weil die Wege dorthin wegen der vielen Straßenräuber und Mörder gar zu unsicher waren.”

4 Résumé

With good reason Chladni is regarded as the father of acoustics. Here we must not forget that he had also done pioneer work in a totally different field. In the late 18th century it was vehemently discussed whether meteorites were of terrestrial or cosmic origin. During his journeys Chladni seized every opportunity to compile any knowledge of meteorites which could be found in libraries. He summarised his findings in the following paper published in 1794: *Ueber den Ursprung der von Pallas gefundenen und anderer ihr ähnlicher Eisenmassen*,¹⁹ and his comment left no doubt that he supported the cosmic origin. Having dealt with an initial scepticism, all the important minds of his period agreed with his view, so e.g. Lichtenberg and Alexander von Humboldt. The latter wrote [11]: "Although the annals of the different peoples relate the fall of stones since three thousand five hundred years, and several examples have been watched by trustworthy eyewitnesses ... Chladni, who had already gained an immortal merit about physics by discovering his sound figures, is the only one to have observed such a great phenomenon and its close connection to the rest of the planetary system."²⁰ As a special honour for this merit a moon crater was posthumously named after Chladni, which, however, with a diameter of only 13 kilometres, is only a rather modest one.

As Chladni tells us, he was often pitied for his unsteady life: "Some have been so kind as to deplore my somewhat nomadic way of living, since I have actually never received a call, and least of all an acceptable offer of a professorship. But I am of the opinion that this has neither been a disadvantage for science nor for myself. If I had got a position in a particular place (except for Göttingen where such an extensive library can be consulted), I would have neither been able to work properly on acoustics nor on the teachings of the meteor masses, since it had been absolutely necessary for this purpose to inform myself of any former observations and examinations of others as far as possible."²¹

Chladni was born in the same year as Mozart, and died in the same year as Beethoven. What kind of a man had he been? The great mediator of physics (Napoleon Bonaparte)? The scientist of genius (Alexander v. Humboldt)? Merely a mediocre personality (Johann Wolfgang v. Goethe)? Even a man of the devil (Thomas Mann)? The latter estimation may well be ascribed to poetic licence. There is, however, much to be said for it that Chladni's personality actually showed some traces of the educational imperfections in his youth. And it seems that he had never got over the repeated futile endeavours to get a permanent position, although he denies it. His method to present physics to a lay public had been unique and died with him. His musical instruments are nowadays of a mere historical interest. The only thing outlasting are his contributions to acoustics and to the science of meteorites, which have a permanent effect until today.

In writing this paper I could widely go back to Chladni's original quotations. In the introduction to the *Akustik* [3] as well as in the *Neue Beiträge zur Akustik* [12] Chladni gave a detailed survey of his life,

¹⁹ *On the Origin of the Iron Masses Found by Pallas and Others Similar to it.*

²⁰ "Obgleich seit dritthalbtausend Jahren die Annalen der Völker von Steinfallen erzählen, mehrere Beispiele derselben durch unverwerfliche Augenzeugen ausser allem Zweifel gesetzt waren, ... so ist doch bis auf Chladni, der schon durch die Entdeckung seiner Klangfiguren sich ein unsterbliches Verdienst um die Physik erworben hatte, ein so grosses Phänomen fast unbeobachtet, in seinem innigen Zusammenhang mit dem übrigen Planetensysteme unerkant geblieben."

²¹ "Mehrere sind so gutmüthig gewesen, mich wegen meiner etwas nomadischen Lebensweise zu bedauern, wie ich denn auch wirklich nie einen Ruf, am wenigsten einen annehmblichen Ruf zu irgend einer Stelle erhalten habe. Ich finde aber, daß dieses weder ein Schade für die Wissenschaft, noch für mich gewesen ist. Wäre ich an einem bestimmten Orte (etwa nur Göttingen ausgenommen, wo man eine so reichhaltige Bibliothek benutzen kann,) angestellt worden, so würde ich weder die Akustik, noch die Lehre von den Meteor Massen haben gehörig bearbeiten können, weil es dazu schlechterdings erforderlich war, mich selbst von allen früheren Beobachtungen und Untersuchungen Anderer möglichst zu unterrichten."

which is very unusual from the actual point of view. Chladni's report on his meeting with Napoleon is reprinted in the essay on Chladni's life and work by F. Melde [11].

I am indebted to my wife E.-B. Stöckmann for the translation of this article.

References

1. D. Ullmann, *Eur. Phys. J. Special Topics* **145**, 25 (2007)
2. B. Heise, *Eur. Phys. J. Special Topics* **145**, 3 (2007)
3. E.F.F. Chladni, *Die Akustik* (Breitkopf und Härtel, Leipzig, 1802)
4. V. Cronin, *Napoleon* (William Collins Sons, Glasgow, 1971)
5. A.D. Dalmédico, *Scient. Amer.* **265**, 77 (1991)
6. F. Melde, in: A. Winkelmann, *Handbuch der Physik* (Eduard Trewendt, Breslau, 1891), p. 732
7. H.J. Stöckmann, *Quantum Chaos - An Introduction* (University Press, Cambridge, 1999)
8. M. Dennis, *Eur. Phys. J. Special Topics* **145**, 189 (2007)
9. J. Flores, *Eur. Phys. J. Special Topics* **145**, 63 (2007)
10. F. Wolf, *Eur. Phys. J. Special Topics* **145**, 137 (2007)
11. F. Melde, *Chladni's Leben und Wirken* (N. G. Elwert'sche Verlagsbuchhandlung, Marburg, 1888)
12. E.F.F. Chladni, *Neue Beiträge zur Akustik* (Breitkopf und Härtel, Leipzig, 1817)