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Enschede, December 8, 2003

Re: Letter of recommendation Dr. S. Hilgenfeldt
Ref. to: Position Vacancy
Letternr: 4700-045/DL/JL

Dear Professor de Ruyter van Steveninck,

Sascha Hilgenfeldt has done his PhD work on single bubble sonoluminescence with me from July 1995 to May 1997. This is the fastest PhD work ever done in the group "Statistical Physics" (headed by Professor Siegfried Grossmann) at Marburg University. The degree Sascha Hilgenfeldt got is "summa cum laude", a degree very rarely (less than 10%) given for PhD works at German Universities and in particular in Marburg.

The main subject of the PhD work was to analytically understand the phase space for single bubble sonoluminescence from Rayleigh-Plesset dynamics. The problem to analytically access the Rayleigh-Plesset equation has been a long standing one which now has come to a solution. Sascha Hilgenfeldt derived various scaling laws for the Blake threshold, the energy focusing condition, the maximal radius, and the diffusive equilibrium curves. Of course, all of these results are carefully checked against numerics.

Before performing this work, Sascha Hilgenfeldt substantially contributed to the numerical calculation of the phase diagrams of sonoluminescing bubbles. It was him who checked the approximations against a full PDE code of the advection/diffusion equation. For this purpose he came up with a new numerical scheme and considerably improved the precision we had achieved before.

His most important papers on sonoluminescence are the two papers on the light emitting mechanism (Phys. of Fluids, 1999 and Nature, 1999) which prove that thermal bremsstrahlung is the light emitting mechanism. For further papers on sonoluminescence I refer to his publication list.

Furthermore, Sascha Hilgenfeldt worked on ultrasound diagnostics. He could predict in which parameter regime oscillating bubbles emit strong sound in the second harmonic. This project was motivated from an interaction with the pharmaceutical industry and I share the judgment of our industrial collaborators that the results will eventually lead to an improvement of ultrasonic sensitivity.

Sascha Hilgenfeldt's interests go far beyond bubble dynamics and sonoluminescence. In the last years his work focused on foams and on bubble-cell interaction, both leading to very important contributions to the fields. In close interaction with a postdoc whom Sascha is guiding he developed an analytical approach for the movement of vesicles in the field of a sound driven bubble. The solution is found to be in excellent agreement with the experiments the two performed. This work led to a publication in Nature, which got lots of attention in the scientific and non-scientific journals, e.g., in the New York Times.

Sascha is also very strong in teaching. He gave an excellent advanced class on "Soft Matter" which I myself attended. Furthermore, together with me, he taught "Dynamics" and "Physics of Fluids" for 1st and 2nd year students. The students seem to have enjoyed those classes very much. Sascha also guided several master students, which lead to very nice results. He also took care of an advanced class in which assignments for 2 or 3 weeks are given to the students. Some of the students later joined our group for their master thesis; so they seem to have enjoyed it.

It is a pleasure to collaborate with Sascha Hilgenfeldt. He thinks extremely fast and deep and he is a very hard worker whom one can meet at work late at night and nearly every single weekend. Sascha Hilgenfeldt has a compassion for analytical insight into problems. Nonetheless, his numerical skills are also very good and he handles the computer virtuously in many ways. His verbal skills are outstanding, both in English and German, both written and in oral form. He gives very good and well organized talks. From my point of view his greatest strength however is the remarkable care he treats any problem with. I have always benefited a lot from Sascha's broad knowledge and his penetrating insight when discussing scientific problem with him.

Right now Sascha Hilgenfeldt has a permanent position as University Docent in my group. He is a fully independent scientist, writing his own proposals and having his own subgroup. He clearly is now ready to have his own Chair.

I have no doubt that Sascha Hilgenfeldt will continue to have a great career in science.

Sincerely,

D. Lohse