

BERLIN-NAIROBI EXCHANGE

Solar cells research

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About this document

This document will be revised and extended regularly. The most current version can always be found at the internet address above. Everyone is strongly encouraged to provide input to this document. Please send your contributions and/or your request to be informed about the development of our activities to j.theiss@sbcglobal.net.

Abstract

The Berlin-Nairobi Exchange (a nonprofit corporation) has been initiating and coordinating activities in the field of solar cells research in Berlin and Nairobi. A collaboration between the Hahn-Meitner Institute (HMI) in Berlin and the University of Nairobi is being established. This document summarizes all past and present activities and suggests future activities, which could include further institutions beyond Berlin and Nairobi. By being updated regularly, this document is intended to serve as a guide for all parties involved. This solar cells project should not be confused with the energy project [1] of the Berlin-Nairobi Exchange.

1 Introduction

The Berlin-Nairobi Exchange has been primarily a physics student exchange. Since 1998, it has sent thirteen Berlin students to Nairobi and two Nairobi students to Berlin [2]. For most of the participating students the Berlin-Nairobi Exchange succeeded in obtaining funding from the German Academic Exchange Service (DAAD). The Berlin-Nairobi Exchange decided to use the student exchange to promote research on solar cells. Two Berlin and two Nairobi students have carried out projects on solar cells at their respective partner institutions, which are the University of Nairobi and the Hahn-Meitner Institute (HMI) in Berlin. Their contribution now serves as the base to develop further activities in solar cells research in Berlin, Nairobi and beyond.

The Berlin-Nairobi Exchange has been transformed from a physics student exchange programme to a nonprofit corporation, which was incorporated in California in June 2004. It will soon be registered in Germany and it is planned to form an NGO in Kenya as an affiliate to the Berlin-Nairobi Exchange. Apart from the physics student exchange and this project on solar cells, the Berlin-Nairobi Exchange has projects on energy [1], multimedia software for physics education, and atmospheric measurements in Nairobi.

In section 2, I introduce the current partners, that is, HMI in Berlin and the University of Nairobi. In section 3, I summarize the past, present, and possible future activities, which are student projects, visits of scientists and research collaborations, and the obtaining of equipment for Nairobi. In section 4, I suggest how new partners could be incorporated and a Master programme established. In section 5, I explain the 5% contribution to the Berlin-Nairobi Exchange. In section 6, I give a summary and a call for input.

People are mentioned without their title and position. Full details are given in the contacts section.

2 Partners of the Berlin-Nairobi Exchange

HMI in Berlin consists of several Divisions. One Division is dedicated to Solar Energy Research, which is subdivided into six different Departments. The collaboration with the University of Nairobi is with Department SE2 that is dedicated to Heterogeneous Material Systems [3]. The principal contact for the Berlin-Nairobi Exchange is Thomas Dittrich.

The University of Nairobi has a Department of Physics, whose Condensed Matter Research Group [4] is its biggest research group. The principal contact for the Berlin-Nairobi Exchange is Bernard Aduda.

3 Past, present, and possible future activities

3.1 Student projects

Past and present

All of the following student projects were carried out by Berlin-Nairobi Exchange students at their respective host institutions and supported by funds that were raised by the Berlin-Nairobi Exchange except where stated.

Claudius Chapus, in Nairobi in 2001/02, supervisor: Sebastian Waita

Undergraduate project: "Performance of Dye-sensitized TiO₂ Photoelectrochemical (PEC) Solar Cells: TiO₂-Films Sintered at Different Temperatures" [5]

Note: Inspired by this project, Claudius Chapus carried out his Diplomarbeit (equiv. to Master thesis) on "Entwicklung und Umsetzung eines Konzepts für stabile Chalhopyrit – Dünnschicht solarzellen mit vereinfachtem Aufbau" [6] in the Department SE2 at HMI in Berlin supervised by Marcus Bär (research group of Christian Fischer).

Alex Ogacho, in Berlin in 2003/04, supervisor: Thomas Dittrich

Project (forms part of his PhD project in Nairobi): "Passivation of TiO₂ by ultra-thin Al-oxide" [7] published in peer-reviewed journal!

Robinson Musembi, in Berlin in 2003/04, supervisor: Thomas Dittrich

Project (forms part of his PhD project in Nairobi): "Highly structured TiO₂/In(OH)_xS_y/PbS/PEDOT: PSS for photovoltaic applications" [8] published in peer-reviewed journal!

Robinson Musembi, in Berlin 2004/05, supervisor: Konstantinos Fostiropoulos

Project (forms part of his PhD project in Nairobi): "Organic solarcell on porous substrate"

Note: Funding provided by Konstantinos Fostiropoulos

Sebastian Rönsch, in Nairobi in 2004/05, supervisor: Justus Simiyu

undergraduate project: "TiO₂ dye sensitized photoelectrochemical solar cells prepared by sol gel, pressing and vacuum techniques: A comparative study"

Note: Sebastian Roensch is self-funded.

Possible future

Thomas Dittrich considers the student projects at the University of Nairobi not very suitable as a preparation for a Diplomarbeit (equiv. to Master thesis) at HMI in Berlin. However, the student projects at the University of Nairobi remain popular, for instance, Sebastian Rönsch nevertheless currently carries out one of these projects (see above). Claudius Chapus was maybe not well prepared by his student project but it did inspire him to do his Diplomarbeit on solar cells at HMI in Berlin.

Question to Thomas Dittrich and Bernard Aduda: To make the student projects at the University of Nairobi more beneficial to Berlin students, would you be willing to consult each other in order to define suitable projects for Berlin students?

Thomas Dittrich would like to continue to work with students from Nairobi. He believes that an effective collaboration can best be built, if he continued to work with the students who have already worked with him, namely Alex Ogacho and Robinson Musembi. DAAD in Nairobi offers suitable funding to support Nairobi students in Germany [9]. The application must be prepared one year in advance.

Question to Thomas Dittrich: Apart from working with Alex Ogacho and Robinson Musembi would you or one of your colleagues in principle be willing to work with other Nairobi students, too?

Questions to Bernard Aduda: Would you in principle be willing to send Alex Ogacho and Robinson Musembi again to Berlin? Are there any other students who you consider suitable for sending to Berlin? What are their names? Would you send them to DAAD in Nairobi more than one year in advance to enquire about funding opportunities?

3.2 Visits of senior scientists and research collaboration

Past and present

Thomas Dittrich intends to visit Nairobi from 5 to 8 September 2005. Currently, Thomas Dittrich, Bernard Aduda, and I are preparing an application for a German Science Foundation (DFG) travel grant [10].

Possible future

Scientists (with PhD) could visit HMI in Berlin. DAAD offers suitable funding, especially through the Scientist Exchange Programme [11]. Cay Etzold even sent a letter last year to all public Kenyan universities to encourage applications to the Scientist Exchange Programme. Visits should be between two weeks and three months. Such a visit, just like Thomas Dittrich's intended visit in September 2005, could be used to discuss how best both institutions could collaborate on training and research.

Question to Thomas Dittrich: Would you or a colleague in principle be willing to host a scientist from Nairobi?

Questions to Bernard Aduda and Julius Mwabora: Would you or your colleagues be interested in visiting Berlin under the DAAD Scientist Exchange Programme? Julius Mwabora, you could come prior to 2006/07 to discuss your sabbatical year.

Furthermore, Julius Mwabora's sabbatical year will be 2006/07. He would like to join an ongoing research work at HMI in Berlin related to their efforts in Nairobi.

Question to Thomas Dittrich: Would you or a colleague in principle be willing to host Julius Mwabora in 2006/07?

There is the DFG Research Collaborations with Developing Countries Programme [12]. It supports only cutting edge research. Thomas Dittrich's intended visit to Nairobi and maybe a visit of a scientist to Berlin (Bernard Aduda or Julius Mwabora) funded by the DAAD Scientist Exchange Programme could be used to discuss whether a collaboration in cutting edge research is possible. Julius Mwabora's desired sabbatical year at HMI in Berlin in 2006/07 could then be part of the cutting edge research collaboration funded by DFG.

Question to Bernard Aduda and Thomas Dittrich: Do you have the impression a collaboration in cutting edge research is possible?

3.3 Equipment for Nairobi

Past and present

Thomas Dittrich has collected equipment at HMI in Berlin for solar cells research, which he could donate to the University of Nairobi.

Possible future

In addition to the equipment already at HMI in Berlin, additional equipment could be purchased with a DAAD Equipment Grant [13]. Alex Ogacho and Robinson Musembi are formally eligible to submit an application.

Malte Vogl has offered to produce a detailed catalog of the equipment that Thomas Dittrich has already collected, which will give details about and have pictures of the equipment. Bernard Aduda and his research group could use this catalog to decide what equipment they would really need. It would also be useful to decide what further equipment through a DAAD Equipment Grant should be bought.

Question to Thomas Dittrich and Ferdinand Streicher: Would you be willing to let Malte Vogl visit HMI in Berlin and help him produce such a catalog?

Once we have all the equipment it would need to be shipped to Nairobi. However, I am only willing to ship equipment if we are absolutely certain that the equipment is exempt from custom duties in Kenya. Bernard Aduda knows from experience that it is difficult for the University of Nairobi to obtain such an exemption. Antony Owinoh has therefore discussed this issue with the Kenyan commercial attaché in Berlin. An alternative could be to form an NGO in Kenya, which will be an affiliate of the Berlin-Nairobi Exchange. It is much easier for an NGO in Kenya to obtain exemption than for the University of Nairobi. This NGO could receive our equipment from Berlin and then give it to the University of Nairobi on loan. Joseph Nyagah is currently investigated how best to set up an NGO that is an affiliate of the Berlin-Nairobi Exchange.

Questions to Bernard Aduda: Do you think complete exemption from customs duties is, despite your past experiences, maybe now possible and could be obtained prior to the actual shipment? What do you think of the idea of forming an NGO and would you be willing to be one of its future Top Officials?

4 New partners and Master programme

Jomo Kenyatta University of Agriculture and Technology in Nairobi

Atreju Tauschinsky will be the first German physics student that the Berlin-Nairobi Exchange sends to the Jomo Kenyatta University of Agriculture and Technology (JKUAT) in Nairobi. Maybe JKUAT could become a valuable partner in our activities presented in this document.

Addis Ababa University in Ethiopia

In solar cells research, Bernard Aduda and his research group at the University of Nairobi collaborate with the Addis Ababa University in Ethiopia [4]. Through this link the Addis Ababa University could also benefit from the collaboration between HMI in Berlin and the University of Nairobi. To strengthen the triangle Berlin-Nairobi-Addis Ababa, the Berlin-Nairobi Exchange could send a German physics student to the Addis Ababa University in 2006/07.

Questions to Bernard Aduda: Would you be willing to let the Addis Ababa University benefit from your link to HMI in Berlin by, for instance, letting them use the equipment donated by HMI in Berlin? Would you recommend to the Addis Ababa University to accept a German physics student sent by the Berlin-Nairobi Exchange? Would you be willing to send this document to your contact at Addis Ababa University?

Uppsala University in Sweden

I have noticed that the University of Nairobi and HMI in Berlin both collaborate with Uppsala University in Sweden and I have the impression that Uppsala University does not know of the collaboration between the University of Nairobi and HMI in Berlin.

Question to Thomas Dittrich and Bernard Aduda: Would you be willing to send this document to your respective contacts at Uppsala University so that they at least are aware of our activities?

Master programme, the Norwegian Uni. of Sci. and Tech., and East African universities

Bernard Aduda has expressed his interest in establishing a Master programme on renewable energies at the University of Nairobi. The contacts to German institutions through the Berlin-Nairobi Exchange could assist in establishing such a Master programme. The DAAD Subject-Related Partnerships with Universities in Developing Countries Programme [14] offers funding for exactly such an arrangement. In general, this DAAD programme is designed to help improve training, research, and management at universities in developing countries through collaborations with German institutions. Furthermore, the programme also supports partnerships between universities in developing countries (“south-south” collaborations). This part of the reason why I am interested in JKUAT and the Addis Ababa University (see above) and other universities in East Africa (see below) to be part of the Berlin-Nairobi Exchange.

The following paragraph has been changed slightly but I decided not to call the entire document a new version. This is therefore still version 1 April 2005.

Instead of establishing an entire Master programme the University of Nairobi could at first contribute to and benefit from an effort by the Norwegian University of Science and Technology (NTNU). Åse Sørensen and her colleagues at NTNU are currently looking into the possibility of establishing a regional Master programme on renewable energies. The idea is that students may follow courses on different topics at Universities in Uganda, Tanzania and Kenya. Åse Sørensen approached me to ask whether the Berlin-Nairobi Exchange would be interested in assisting developing such a regional Master programme. Funding could come jointly from Norwegian sources and the DAAD Subject-Related Partnerships with Universities in Developing Countries Programme [14].

A pilot project of this regional Master programme is represented by the summer programme on renewable energies 2005 [15] at which 12 Norwegian and 20 Ugandan students will take part. It is organized jointly by NTNU and Makerere University.

Questions to Bernard Aduda and Romanus Odhiambo: Would you in principle be interested in contributing to such a regional Master programme?

5 The 5% contribution

The Berlin-Nairobi Exchange can hardly ever apply for funds directly. Instead, applications are submitted via individuals or partner organizations. In order to raise funds for the Berlin-Nairobi Exchange, we are now asking for a 5% share of the funds of all individuals and organizations that receive these funds through the assistance of the Berlin-Nairobi Exchange. We will use these contributions to continue to carry out our mission of establishing and fostering collaborations in the sciences with a special emphasis on environmental issues between Berlin, Nairobi and beyond. Since

the Berlin-Nairobi Exchange is an official California nonprofit corporation, financial matters are strictly regulated and monitored.

Individuals who have already agreed to a 5% contribution in case they obtain funding are: Christopher Wollin, Joannes Berque, Thomas Dittrich, Julius Mwabora, and all of next year's Berlin-Nairobi Exchange students in Nairobi.

6 Summary and call for input

The student projects have been very beneficial for our students and it is worthwhile continuing them. Maybe Thomas Dittrich and Bernard Aduda can consult each other before a student project is undertaken to ensure the work is also useful to the student at the home institution.

Mutual visits of scientists seem now timely. Thomas Dittrich intends to visit Nairobi in September 2005 and I hope either Bernard Aduda or Julius Mwabora will visit Berlin soon, funded by the DAAD Scientist Exchange Programme. During these visits it could be discussed how training at the University of Nairobi could be promoted and extended as well as whether a collaboration in cutting edge research on solar cells is possible. If these discussions are fruitful funding from DAAD and DFG, respectively, could be sought. I think, the sabbatical year 2006/07 of Julius Mwabora could play a crucial role in further developments if he spent it at HMI in Berlin.

I hope that we will master the bureaucratic and organizational obstacles to ship equipment for solar cells research from Berlin to Nairobi.

So-called "south-south" collaborations are being encouraged by various authorities. Our activities could therefore be expanded to include other universities. Because the Berlin-Nairobi Exchange students have directly or indirectly initiated our past activities and because the Berlin-Nairobi Exchange has established an effective infrastructure to send students, students could be sent to new partners to initiate the process of involving them. For instance, for the first time a Berlin-Nairobi Exchange student will be sent to JKUAT next year and we could send a student to Addis Ababa University in 2006/07.

Please send me your comments so that I can incorporate them in the next version of this document. I would like this document to be the product of all parties involved so that it can serve as a constantly updated summary of our activities and a guide for all to implement our plans.

Please send your comments to j.theiss@sbcglobal.net.

Acknowledgements

People who contribute to this document will be mentioned here.

References

For your convenience this entire list of references is also online at:

<http://www.berlinnairobi.org/solarcells/document/references/>

[1] Energy project of the Berlin-Nairobi Exchange coordinated by Dr. Joannes Berque:
http://www.berlinnairobi.org/tmp/energy_project.pdf

[2] Website of the Berlin-Nairobi Exchange (not completely up-to-date):
<http://www.berlinnairobi.org/>

[3] Hahn-Meitner Institute in Berlin:
Entire institute: http://www.hmi.de/index_en.html
Division on Solar Energy (SE) Research: http://www.hmi.de/bereiche/SE/index_en.html
Department SE2: http://www.hmi.de/bereiche/SE/SE2/index_en.html

[4] Condensed Matter Research Group at the University of Nairobi (by Julius Mwabora):
http://www.berlinnairobi.org/solarcells/document/references/solarcells_research_uon.pdf

[5] Student project of Claudius Chapus:
http://www.berlinnairobi.org/solarcells/document/references/projekt_claudius.pdf

[6] Diplomarbeit of Claudius Chapus:
<http://www.berlinnairobi.org/solarcells/document/references/Diplomarbeit-2003-ClaudiusChapus.pdf>

[7] Paper of Alex Ogacho:
<http://www.berlinnairobi.org/solarcells/document/references/ApplSurfSci2005Dittrich.pdf>

[8] Paper of Robinson Musembi:
<http://www.berlinnairobi.org/solarcells/document/references/SolMat2005Bayon.pdf>

[9] DAAD Funding: Research grants for doctoral candidates and young academics and scientists:
<http://nairobi.daad.de/academic-sec1.htm>

[10] DFG Funding: Travel Grant:
http://www.dfg.de/forschungsfoerderung/formulare/download/1_07.pdf

[11] DAAD Funding: Research stays for university academics and scientists (this includes the Scientist Exchange Programme):
<http://nairobi.daad.de/academic-sec6.htm>

[12] DFG Funding: Research cooperation with developing countries:
http://www.dfg.de/forschungsfoerderung/formulare/download/1_191.pdf

[13] DAAD Funding: Equipment grant:
http://www.daad.de/en/download/development/merkblatt_sm_en.pdf

[14] DAAD Funding: Subject-related partnerships with universities in developing countries:
http://www.daad.de/en/download/development/instruction_sheet_partnerships.pdf

[15] The Norwegian-Ugandan summer course on renewable energies in 2005
http://www.berlinnairobi.org/solarcells/document/references/summer_course_2005.pdf

Contacts (last names in alphabetical order)

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