Curriculum Vitae

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Date and place of birth: 02.06.1972 in Bochum, Germany
Marital status: married, no children
Citizenship: Canadian

Education

05/1996–present **Queen's University, Kingston, Canada.**

Ph.D. in Experimental Particle Physics on the Sudbury Neutrino Observatory.

Thesis director: Prof. A.L. Hallin.

Topic: Optical calibration of the SNO detector: hardware and software projects with the aim of measuring the spectrum of solar ^{8}B neutrinos.

Bursaries: Ph.D. bursary from the Natural Sciences and Engineering Research Council (NSERC) of Canada (05/1996–05/1998). Ph.D. bursary, Fonds pour les Chercheurs et l'Aide à la Recherche (FCAR) of Quebec (05/1996–05/1999). Thesis completion bursary, Queen's University (09/2000–12/2000).

07/1994–02/1996 **Université de Montréal, Montreal, Canada.**

M.Sc. in Experimental Particle Physics on the proposed long baseline neutrino oscillation experiment E889 at Brookhaven National Laboratory.

Thesis directors: Prof. P. Depommier, Prof. G. Azuelos.

Topic: Monte Carlo and analysis of π^0 events produced by neutral current interactions as a signal of oscillations.

Bursary: M.Sc. bursary from FCAR of Quebec (07/1994–02/1995).

09/1990–04/1994 **École Polytechnique de Montréal, Montreal, Canada.**

B.Eng. in Engineering Physics.

Bursary: Quebec Government bursary for studies in French as a second language.

Work Experience

05/1996–present **Research assistant with the Sudbury Neutrino Observatory**, Queen's University, Kingston, Canada.

- Clean construction of SNO.

- Design and build calibration hardware and develop analysis software, with emphasis on quantifying the optical performance of the detector.

09/1996–04/1999 **Teaching Assistant at Queen's University**, Kingston, Canada.

- Teaching first year physics laboratory (PHYS-113/114, 1996–1997).
- Teaching third year laboratory, and mentoring for second-term student projects (PHYS-350, 1997–1999).

1998–2000 **SNO mini-course for high-school students**. Half-day lecture about the sun, neutrinos and SNO. 1998, 1999, 2000 in Kingston.

1995–1999 **Science Fair Judge**. High-school student science projects. 1995 in Montreal, 1998 and 1999 in Kingston.

1995–1996 **Teaching Assistant at the Université de Montréal**, Montreal, Canada. Laboratory project on Compton scattering in Ge(Li) detectors.

Computing Skills

Systems	UNIX/Linux, Windows, DOS, VMS
Programming	C/C++/ROOT, Fortran/CERNLIB, Perl, HTML
Software	LaTeX, AutoCAD, PAW, word processors, presentation and graphics programs

Languages

English	Mother tongue.
French	Second language. Thirteen years French Immersion at school and six years of university in French in Montreal, Canada (1976–1980, 1981–1996).
German	Fluent spoken, good written. Lived in Bochum, Germany (1972–1976). Attended a German Gymnasium in Bonn, Germany (1980–1981).

Interests and Hobbies

Sports	Squash, Taekwondo, skiing, ultimate frisbee.
Travelling	Regular canoe trips and backcountry camping in Canada. Other recent trips include Germany in 1998 and backpacking to Chile and Easter Island in 1996.
Interests	Photography, cooking, reading.

References For references, please consult the end of the Scientific Curriculum.

Kingston, 3. January, 2001

Scientific Curriculum

Ph.D. Research

My Ph.D. thesis is on the optical calibration of the SNO detector. The goal of this work is to provide position- and direction-dependent corrections to the observed neutrino interactions to obtain a precise spectral shape of solar neutrinos from Boron-8 decay. The heavy and light water and acrylic vessel attenuations, as well as the angular acceptance of the photomultiplier concentrators are essential to the precise correction of event energies needed for a meaningful spectral shape measurement. Presently, thanks mainly to my own efforts, this correction achieves better than 1accuracy everywhere inside the acrylic vessel, as measured by gamma rays from our Nitrogen-16 calibration source.

In addition to this analysis effort, I spent a considerable amount of time designing and building calibration hardware. My primary area has been the light diffusing ball ("laserball") and the special underwater "umbilical" fibre optic cable, which I designed and built at Queen's. The laserball diffusing sphere is used to probe the optical properties of the detector by manipulating it on a system of ropes, and the 30m umbilical is therefore required to be small in diameter, flexible and have slightly negative buoyancy in heavy water. The underwater umbilical cables are radioactively clean and variations on the laserball cable's design are used to supply other sources with radioactive gases (16N, 8Li), electrical signals and power. These cables are essential to the calibration programme at SNO.

Light from a nitrogen-pumped dye laser is diffused quasi-isotropically by the laserball in a reasonable approximation to a point source inside SNO. Figure shows the laserball and the laser just prior to being used for a set of calibration runs. Optical measurements are made by combining data from many source runs with the laserball in many different positions. Taking data at a series of six wavelengths in the detector takes about two weeks and produces a large dataset which I then analyze to extract the optical parameters for the detector model.

The final step in the analysis for my thesis is an extraction of the spectrum of charged-current neutrino interactions on the deuteron. A distortion in the spectral shape over the range of 5-8 MeV would provide a measurement of solar neutrino oscillations which is independent of the total flux. This measurement is made difficult by the small amount of distortion in the most favoured Mikheyev-Smirnov-Wolfenstein solar neutrino oscillation parameters, and by the presence in the data of 6.25 MeV gamma rays from neutron capture on the deuteron. A combined analysis which includes the radial distribution of events in the detector and event direction with respect to the sun completes the spectral measurement of neutrinos from Boron-8 decays in the sun.

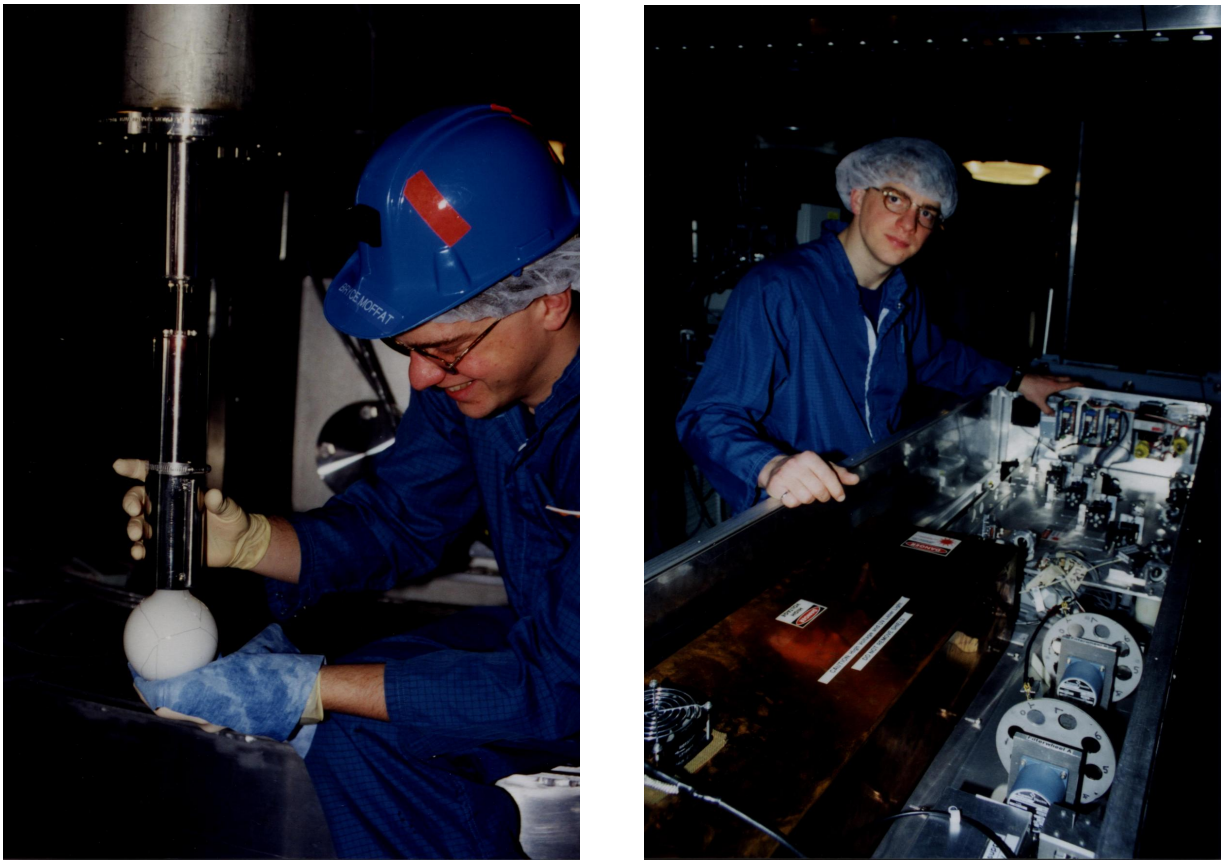

Figure 1: Hard-working graduate student smiling while cleaning the laserball (again!) before insertion in SNO (left). The same student, attractively attired in a SNO suit and beret, tuning the nitrogen/dye laser system (right).

Research Work with SNO

Work connected with SNO was usually closely related to my thesis goals, but not always directly connected with my thesis subject itself.

- Clean construction of the acrylic vessel and cabling of photomultipliers in the bottom half of the detector.
- Develop system for injecting flexible, waterproof and radioactively clean "umbilical" cables with fibre optics, electronic signal connections and gas transport for use with manipulated calibration sources in SNO. Construction and testing of five different source cable types.
- Design and build quasi-isotropic laserball diffusing sphere. Upgrade and maintain fast pulsed nitrogen/dye laser for probing the SNO detector optics.
- Analyze large, complex optical dataset using a suite of specially developed C++/ROOT-based programs which reduce the raw detector data to approximately 30 physical model parameters. The optical data taken over several weeks represents one third of SNO production data taken over one year of normal neutrino running.

Supervision of Students

M. Pickel from the Universität Erlangen on exchange with the International Association for the Exchange of Students for Technical Experience (IAESTE) program, Summer 2000.
Project: Rayleigh Scattering in SNO.

Co-supervision of M. Pereira, A. Miriampillai, C. Van Ouellet from Queen's University, Summer 2000.
Project: Umbilical manufacture and testing.

Co-supervision of T. Rantala (1997), A. Stok and J. Colterman (1998). *Projects: Construction and testing of calibration hardware and software for SNO.*

Refereed Journal Articles

Boger, J., . . . , Moffat, B.A., . . . (200 authors, alphabetical order, The Extended SNO Collaboration), "The Sudbury Neutrino Observatory", Nuclear Instruments and Methods A449, 172–207 (2000).

Boulay, M.G., . . . , Moffat, B.A., . . . (155 authors, alphabetical order, The SNO Collaboration), "First Neutrino Observations from the Sudbury Neutrino Observatory", in preparation. To be submitted to Physical Review D in mid-2001.

Boulay, M.G., . . . , Moffat, B.A., . . . (155 authors, alphabetical order, The SNO Collaboration), "Calibration Devices for the Sudbury Neutrino Observatory", in preparation. To be submitted to Nuclear Instuments and Methods in 2001.

Conference Proceedings

Moffat, B.A. for the SNO Collaboration, "Optical Calibration of SNO", Contributed poster and abstract at Neutrino 2000 Conference, Sudbury, Canada.

Abstract to be published in the Proceedings.

McDonald, A.B. for the SNO Collaboration, "First Neutrino Observations from the Sudbury Neutrino Observatory", Invited paper at Neutrino 2000 Conference, Sudbury, Canada, to be published in the Proceedings.

Technical Reports

B.A. Moffat and A.L. Hallin, "SNO Optics III", Queen's University Internal Report, 28pp., November 2000.

M. Pickel and B.A. Moffat, "Rayleigh Scattering in the SNO Detector", Queen's University Internal Report, 6pp., August 2000.

M. Pickel and B.A. Moffat, "Rayleigh Scattering in Heavy and Light Water", Queen's University Internal Report, 5pp., May 2000.

Boulay, M.G., Dai, Y., Duncan, F.D., Hallin, A.L., Hamer, A.S., Jillings, C.J., Moffat, B.A. and Skensved, P. (= the Queen's Calibration Group), "Optical Analysis", Queen's University Internal Report, 34pp., February 2000.

Boulay, M.G., Hallin, A.L., Jillings, C.J., Moffat, B.A., "Optical Calibration", Queen's University Internal Report, 20pp., October 1999.

Talks

"Le soleil de 2 km sous terre", Université de Montréal, Montreal, Quebec, Canada (2000).

"Le soleil de 2 km sous terre", Université Laval, Laval, Quebec, Canada (2000).

"Optical Calibration of SNO", Queen's University, Kingston, Ontario, Canada (2000).

Organized weekly journal club talks by members of the SNO group in 1998–1999. Each person chooses a recent article to present for discussion.

M.Sc. Research In 1994 there were two proposals for long-baseline neutrino research facilities in the United States: MINOS at Fermilab and E889 at Brookhaven National Laboratory. I participated in the E889 project proposal at Brookhaven, and wrote my thesis on the measurement of neutral current π^0 interactions which were to normalize the number of neutrino interactions as a function of distance.

The four E889 detectors at 1, 3, 20 and 68 km were to be large water-Cherenkov detectors similar to the Kamiokande detector in Japan. A beam of primarily muon neutrinos was to be aimed down Long Island, and the goal was to search for disappearance of muon neutrinos with or without the appearance of electron neutrinos. My thesis demonstrated the impacts of detector granularity and phototube coverage on the ability of the experiment to separately identify muon, electron, and double-ring events.

Supervision of Students

C. Chacon from the Université Clermont-Ferrand in Grenoble, France in Spring, 1995.
Project: Event simulation and reconstruction in E889.

Conference Proceedings

Moffat, B.A., Azuelos, G. and Depommier, P., "Simulated Neutral Current Events in a Water Cherenkov Detector for a Long Baseline Neutrino Oscillation Experiment", Proceedings of the Eleventh Lake Louise Winter Institute (1996), p. 460–471. Editors: Astbury, A. et al. World Scientific, Singapore, 1997.

Technical Reports

E889 Collaboration. "Answers to the second set of Questions from the HEPAP Subpanel on Neutrino Oscillations", Brookhaven National Laboratory, Upton, New York (1995).

E889 Collaboration. "Answers to the Questions from the HEPAP Subpanel on Neutrino Oscillations", Brookhaven National Laboratory, Upton, New York (1995).

E889 Collaboration. "Long Baseline Neutrino Oscillation Experiment at the AGS", Physics Design Report, BNL No. 52459, Brookhaven National Laboratory, Upton, New York (1995).

Talks "Simulated neutral current interactions in a large water Cherenkov counter", Lake Louise Winter Institute, Lake Louise, Alberta, Canada (1996).

"Pattern Recognition and Particle Identification", High Energy Physics Advisory Panel review of BNL-E889, Brookhaven National Laboratory, Upton, New York (1995). Talk at the Department of Energy review of long-baseline neutrino oscillation experiments in the United States.

"Discrimination among Muon, Electron and Background Events in a Large Water Cherenkov Detector", Canadian Association of Physicists (CAP) Annual Congress, Université Laval, Quebec, Canada (1995).

"Genetic Algorithms in HEP", HEP Computing 1995, Universitś de Montréal, Quebec, Canada (1995).

"A Proposal for a Long-Baseline Neutrino Oscillation Experiment", Eastern Regional Nuclear Physics Meeting, Mont Gabriel, Quebec, Canada (1995).

References

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