Kael Dylan HANSON, Ph.D.

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Professional Appointments

Professor. Department of Physics University of Wisconsin, Madison, WI.	09/2014 +
Director. Wisconsin IceCube Particle Astrophysics Center University of Wisconsin, Madison, WI.	09/2014 +
Chief Executive and Director of Research. HK Physics, LLC. Madison, WI. Founder and engineering / research responsible for producer of measurement instruments.	06/2011 – 01/2017
Chargé de cours. Université Libre de Bruxelles, Brussels, Belgium. Assistant professor of astroparticle physics.	01/2009 – 08/2014
Associate Instrumentation Innovator – Research. University of Wisconsin, Madison, WI. Detector operations coordinator and lead of the data acquisition systems.	06/2005 – 01/2009
Assistant Instrumentation Innovator – Research. University of Wisconsin, Madison, WI. Lead scientist of the IceCube In-Ice Detector instrumentation group.	10/2003 – 06/2005
Assistant Researcher. University of Wisconsin, Madison, WI.	04/2002 – 10/2003
Postdoctoral Scientist. University of Pennsylvania, Philadelphia, PA.	04/2000 – 03/2002

Teaching Experience (Université Libre de Bruxelles)

Course Title	Level[1]	Year	Description
PHYS-F101 Laboratory	BA1	2009-2010	Introductory laboratory for students of physics, chemistry, mathematics, and polyvalents. (Assistant)
PHYS-F210 Laboratory	BA2	2009-2014	Intermediate laboratory for students of physics. (Assistant)
PHYS-F205 Laboratory	BA2	2010	Introductory laboratory for students of pharmacy and biology. (Assistant)
PHYS-F311	BA3	2011-2014	Advanced laboratory course for students of physics.
PHYS-F314	BA3	2010-2014	Analog and digital electronics lecture and laboratory.

[1] BA1 = 1st year bachelor cycle, BA2 = 2nd year, &c; MA1/MA2 is 1st / 2nd year of master cycle

PHYS-F467	MA2	2009-2014	Particle astrophysics.

Teaching Experience (University of Wisconsin – Madison)

Course Title	Level	Year	Description
PHYS 623	Master	2015	Electronic Aids to Measurement. Graduate course covering analog and digital electronics.

Other Work History

Software Consultant. The Hospital of the University of Pennsylvania, Philadelphia, PA. 08/2001 – 11/2001
Assisted client in developing a MATLAB-based audio signal processing system and an instrument control framework for a study of human aural perception.

System Developer. The Sentec Corporation, Walled Lake, MI. 08/1993 – 12/1999
Provided hardware design, and embedded and application-level software development services for SBIR-supported research and development firm. The project topics included design of audio and optical signal processing systems, embedded software development for remote autonomous sensor networks, and Windows device driver and graphical application development for medical devices.

Education

Ph.D., Physics (2000). The University of Michigan, Ann Arbor, MI. 09/1991 – 02/2000
Ph.D. Thesis: *A measurement of the neutrino-induced muon flux at the MACRO detector*.

Bachelor of Science, Physics (1991). The University of Michigan, Ann Arbor, MI. 09/1987 – 04/1991

Grants

National Science Foundation (2016-2021)
Co-investigator on PLR-1600823, "Management and Operations of the IceCube Neutrino Observatory".

Fonds de la Recherche Scientifique – FNRS (2011-2014).
Principal investigator for convention no. 4.4501.02 "Study of HE Neutrinos with IceCube."

Fonds de la Recherche Scientifique – FNRS (2010).
Award under bilateral program between F.R.S. – FNRS and JSPS (Japanese Society for the Promotion of Science) to pursue collaborative research between astroparticle physics groups of Université Libre de Bruxelles (K. Hanson, Principal Investigator) and Chiba University (Shigeru Yoshida, Principal Investigator).

Fonds de la Recherche Scientifique – FNRS (2010-2014)
Principal investigator for convention no. 4.4508.10 "Construction du Radio Télescope Askaryan au Pôle Sud, un détecteur de neutrinos de ultra-haute énergie."

Societies

IEEE Member, Nuclear and Plasma Society	2012 – 2015

Committees

Director Search Committee – Wisconsin Institute for Discovery. Member of committee to identify director for University of Wisconsin – Madison multi-disciplinary research center and make recommendation to Vice Chancellor for Research and Graduate Education and Chancellor.	2016
Review Committee for Wisconsin Institute for Discovery Member of committee reviewing mission and future directions for University of Wisconsin multi-disciplinary research center.	2016
Bureau Facultaire pour le Doyen de la Faculté des Sciences ULB Délégué suppléant du corps académique	2013 – 2014
IceCube Resource Coordination Board.	2009 – present
Daya Bay Neutrino Experiment Photomultiplier System Review. Review panel member	12/2007
Graduate School Committee on Academic Staff Issues (GS-CASI). University of Wisconsin – Madison.	2007 – 2008
IceCube Project Management Board.	2005 – 2008
IceCube Trigger Board.	2007 – 2010
IceCube Technical Board.	2003 – 2007
Early Career Scientist Representative to IceCube Collaboration Board. Elected position	2002

Conference Talks

Title	Event	Date
Radio Detection of UHE Neutrinos in the Ice at South Pole	ARENA2016, Groningen, NL	07/2016
IceCube Gen2	MACROS, Penn State University	06/2016
IceCube Gen2	VHEPA 2016, Honolulu, HI	01/2016
IceCube Gen2	VLVnT 2015, Rome, IT	09/2015
Present and Future of the IceCube DAQ and Online Systems	VLVnT 2015, Rome, IT	09/2015

IceCube, DeepCore, and Future Neutrino Observatories at the South Pole	NNN'14, Paris, FR	11/2014
The IceCube Neutrino Observatory DAQ and Online System	Computing in HEP (CHEP2013), Amsterdam, Netherlands	10/2013
The Future of UHE Neutrino Astronomy in the Ice	XV International Workshop on Neutrino Telescopes, Venice, Italy	03/2013
Extending the IceCube DAQ with a Generic High-Speed Sorter	IEEE RT2012 Conference Berkeley, CA, USA	06/2012
The Askar'yan Radio Array	5th International Workshop on Very Large Volume Neutrino Telescopes, Erlangen, Germany.	10/2011
The Askar'yan Radio Array	TAUP 2011, Munich, Germany	09/2011
RF Transient Detection and UHE Muons	4th International Workshop on Acoustic and Radio EeV Neutrino detection Activities (ARENA), Nantes, France	06/2010
A Status Report of the PMm^2 Project	Advances in Neutrino Technology 2009, Honolulu, Hawaii	08/2009
Neutrino Astrophysics with IceCube	12th Marcel Grossman Meeting, Paris, France	06/2009
Status and Future of the IceCube Neutrino Observatory	2nd Workshop on TeV Particle Astrophysics, Madison, WI	08/2006
An Overview of the IceCube Neutrino Observatory	8th International Conference on Advanced Technology and Particle Physics, Como, Italy	10/2003
Recent Results from AMANDA II	International Conference on High Energy Physics, Amsterdam, Netherlands	07/2002
Time Calibration of AMANDA	10th International Conference on Calorimetry in High-Energy Physics, Pasadena, CA	03/2002

Seminars, Symposia, Posters, and Public Expositions

Title	**Event**	**Date**
Multimessenger Astrophysics at the South Pole with Neutrinos	Colloquium at Wichita State University	11/2016
The IceCube HE Neutrino Events	Seminar at Cavendish Laboratories, Cambridge, UK	05/2013
Astroparticle Physics at 90° South	Seminar at University College London	10/2012

Neutrino Astrophysics with IceCube	Seminar at Universidad Granada, Granada, Spain	06/2011
Neutrino Astrophysics with IceCube	Seminar at Radboud Universiteit, Nijmegen, The Netherlands	05/2011
Neutrino Astrophysics at the South Pole	Seminar at Université Catholique de Louvain, Louvain-la-Neuve, Belgium	11/2010
La Physique des astroparticules	Session overview Journées Jeunes Chercheurs, Angers	
Radio Detection of UHE Cosmic Neutrinos at the South Pole	Symposium at Rheinisch Westfâlische Technische Hochschule, Aachen, Germany	06/2009
An IceCube Primer	Seminar at Université Libre de Bruxelles, Brussels, Belgium	06/2008
Detecting Supernova Neutrinos with IceCube	Seminar at University of Wisconsin, Madison, WI	04/2007
News from the South Pole Telescope Arrays	Seminar at University of Michigan, Ann Arbor, MI	03/2006
Design and Production of the IceCube Digital Optical Module	Poster presentation at New Developments in Photodetection 2005, Beaune, France	06/2005
High Energy Cascade Physics at Neutrino Telescopes	RPM Symposium, Lawrence Berkeley National Laboratory, Berkeley, CA	03/2002
Featured guest speaker	Wisconsin Public Radio Ideas Network with Larry Meiller	01/2007

Ph.D. Thesis Committee Memberships

Zigfried Hampel-Arias TBD (04/2017)

Carlos Arguelles "New Physics with Atmospheric Neutrinos" (08/2015)

Ben Riedel "Modelling and Understanding Supernova Signals in the IceCube Neutrino Observatory" (10/2014)

David Docquier "Representing grounding-line dynamics in Antarctic ice-sheet models" (10/2013). Université Libre de Bruxelles, advisor: F. Pattyn

Mathieu Labare "Search for cosmic sources of high-energy neutrinos with the AMANDA-II detector" (01/2010) Université Libre de Bruxelles, advisor: Prof. Daniel Bertrand.

Georges Kohnen "Search for Extra Dimensions with IceCube" (09/2010) Université de Mons, advisor: Prof. Evelyn Daubie.

Selma Conforti di Lorenzo "Développement et caractérisation d'un ASIC de lecture de macro-cellule de photo-détecteurs de grande dimension" (10/2010) Université de Paris XI, advisor: Dr. Jean-Eric Campagne, LAL-Orsay.

Ph.D. Students

- Université Libre de Bruxelles
  - Sabrina Bechet (2012)
  - Thomas Meures (2014)
  - David Heereman (2014)
  - Elisa Pinat (2017, expected)
- University of Wisconsin - Madison
  - Bunheng Ty
  - Benjamin Ross-Fasig

Schools

Journées Jeunes Chercheurs : (2010, Angers, France) Coordinator of astroparticle session.

Belgium, Netherlands, Deutschland (BND) Summer School (2013, Brussels). Instructor for astroparticle sessions.

Workshops

3rd Syd Meshkov Project Science Workshop : (2003, Aspen, CO)

Scientific Collaborations

Askar'yan Radio Array (ARA) (2010 – 2014) The ARA project is aimed at the detection of ultrahigh energy cosmic neutrinos through exploitation of the Askar'yan effect in ice. The EM cascades produced by these neutrinos radiate electromagnetic pulses which are detectable by the proposed array of radio antennas to be deployed in the ice. I am the principal investigator for ULB and was among the founding members of the project having received an award from the Belgian FNRS funding support agency to follow this topic of research prior to the approval of the project in the USA. My group at ULB was responsible for the sensor data communications and time synchronization as well as the South Pole on-site computing for the project.

PMm² (2009 – 2010). The PMm² project was a joint venture between several French national laboratories and universities and the Photonis Corporation, a manufacturer of photomultiplier tubes, to develop an ASIC (application specific integrated circuit) for handling the complete analog and digital signal processing chain for a 4-by-4 array of photomultiplier tubes. This ASIC, called the PARISROC, is targeted to future large underground water Cherenkov or liquid scintillator detectors to solve the problem of scaling the readout electronics to O(100,000) detector photomultiplier channels. My contribution to the project was the data acquisition software.

IceCube / AMANDA (2000 –) I have been a collaborator on the IceCube project since its beginning in 2002 and on AMANDA, its predecessor project, since 2000. The IceCube project objective has been to construct and operate a kilometer-scale neutrino observatory at the South Pole to detect high-energy neutrino point sources and transient neutrino emitters such as GRBs and even supernova explosions. I entered the project charged with evaluation and selection of photomultipliers and development of the testing program to validate the design of the digital optical modules as well as unit post-production ("factory") acceptance, becoming, eventually, the managing physicist in charge of the entire division of the project responsible for design, production, and test of the digital optical modules. As design activities in this area slowed down, in 2005 I moved to lead the data acquisition group for the project, a group of over 25 engineers and scientists spanning 5 institutions in the USA and Europe working to develop the electronics, firmware, and software needed to readout the array of digital optical modules,

and remain the lead during the maintenance phase. In addition, from 2007 to 2009 I served as the lead of the detector operations team responsible for the daily operation and maintenance of the detector systems at the South Pole, including winter-over experiment operators. I have been a member of the higher-level core management body of IceCube both during the construction and operation phase.

Technical Resume

Detector Instrumentation: 15+ year history working with optical detector systems, in particular with photomultiplier tubes and associated electronics (HV bleeders and analog front ends). Long history with Camac and VME acquisition electronics; current work with ATCA next-generation data acquisition electronics; radiofrequency circuits, in particular RF detectors and low-noise systems.

Analog / Digital Design : 15+ year experience with high speed analog and digital circuit design including PCB layout using toolsets from Mentor Graphics and Cadence. 8 years of experience with VHDL firmware programming using Altera and Xilinx tools and devices.

Scientific programming and software development: 25+ year experience with Fortran, C, and C++, 10 years with Java and Python on a multitude of operating systems: DOS, Windows, Unix, VMS. Very proficient with mathematical concepts of numerical methods and use of existing numerical and scientific libraries such as gsl, NumPy and SciPy, and the Apache Commons Math library, and Monte Carlo methods including CERN detector simulation package GEANT4. Collaborative software development experience with CVS/SVN/Git, issue trackers, and unit testing frameworks. Extensive experience with high-throughput network programming, including multi-process, multi-threaded software development. Embedded and real-time programming with PIC and AVR microcontrollers and SoC environments.

Large-scale projects : 14 years of experience with project management (budget and schedule planning and tracking using earned value, risk analysis) of large-scale, complex technical project during development of optical detector systems for the IceCube project and experience with system engineering methodology and reliability engineering in this context as well.

Languages

Language	ILR Scale		CEFR Scale	
	Read/Write	Oral/Spoken	Read/Write	Oral/Spoken
English (mother tongue)	S-5	S-5	C2	C2
French	S-3	S-3	C1	B2
Italian	S-2	S-2	B1	B1
Russian	S-1	S-1	A2	A1
German	S-1	S-1	A1	A1