curriculum vitae *December, 2019*

R. Bruce Vogelaar

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Education:	Ph.D., Physics California Institute of Technology Thesis Advisor: professor Ralph Kavanagh	April 1989
	M.S., Physics California Institute of Technology	June 1984
	B.S., *Magna cum Laude* Physics, Philosophy, minor in Math Hope College, Holland, MI	May 1982
Employment:	Professor, Virginia Tech	2007 +
	Associate Professor, Virginia Tech (tenured in 2001)	1998-2007
	Assistant Professor, Princeton University	1991-1998
	Research Staff, Princeton University	1989-1991
	Head of Cyclotron Operations, Princeton University	1989-1991
	Graduate Research Assistant, Caltech	1982-1989
	Summer Research, Hope College	1980-1982

Current Programs:

Solar Neutrinos – the neutrino program I launched at Virginia Tech (precursing the formation of our Center for Neutrino Physics) helps discover the basic sources and properties of neutrinos, which are among the fundamental building blocks of matter. My research utilizes the world-class Borexino neutrino detector in Italy. The results give us the clearest and most precise picture of how 99% of the solar energy is produced. We are now trying to complete the program by seeing neutrinos from the so-called "CNO cycle", responsible for the remaining 1% of solar energy. While small for the Sun, this cycle could be the leading process for all heavier stars. By virtue of being so pure, stable, and deep underground, Borexino has a globally unique opportunity to measure these ethereal messengers. We have also been studying the feasibility of the next generation solar-neutrino detector called LENS, but the cost is likely prohibitive.

Sterile Neutrino Search – there are several indications sterile neutrinos exist, and two programs are designed to search for them. The first involved placing a strong electron neutrino source under the Borexino detector to observe oscillations into the sterile channel (but this experiment ran into difficulties), and the second is to utilize a "Raghavan Optical Lattice" designed for the LENS detector to search for neutrino oscillations from a nuclear reactor source, called "NuLat".

Dark Matter – the DarkSide collaboration is an international affiliation of universities and labs seeking to directly detect dark matter in the form of weakly interacting massive particles (WIMPs). The collaboration is building a series of noble liquid time projection chambers (TPCs) that are designed to be employed at the Gran Sasso National Laboratory in Assergi, Italy.

Nuclear Energy – this auxiliary program tries to decouple uranium enrichment from nuclear energy generation and reduce nuclear waste. The GEM*STAR concept is based on the integration of accelerators and reactors in a new optimized configuration which has been overlooked by DOE-NE and exiting corporate interests. The program should have a major impact on the nuclear industry, foreign policy, energy security, and green energy. The GEM*STAR acronym is quite descriptive: Green Energy Multiplier: Sub-critical, Thermal-spectrum, Accelerator-driven, Recycling reactors.

Teaching – continuing program to explore and teach the role physics plays in our basic understanding of the world. Teach graduate and undergraduate courses, advise incoming students as well as majors and graduate students.

Completed Programs (in reverse chronological order):

Kimballton Underground Research Facility (KURF) – shepherded this facility into existence. It has hosted research programs in solar neutrinos; neutrinoless double beta decay; fast neutron fluxes at depth; low Ar-39 argon; low-background counting; and reactor monitoring detectors using neutrinos. Groups pursuing cryogenic bolometers and nuclear astrophysics are also interested in using KURF. It is one of only four deep underground research sites in the United States. Since a water incursion in the summer of 2016, operations have been slowly resuming.

Weak Interactions – this program studied correlations in the β-decay of polarized 'ultra-cold' neutrons to study parity non-conservation in fundamental interactions and CKM unitarity. Basic symmetries in nature were probed.

Deep Underground Science and Engineering Laboratory at Kimballton – This was an effort to locate a NSF national laboratory (DUSEL) at Kimballton. It was multi-disciplinary in nature, including research in Physics, Geoscience, Engineering and Biology, and involved directing a team of 150+ members. The facility would have cost somewhere between $200M and $300M. (2003-2005)

Cosmology – Interest in finding signatures of an inhomogeneous big-bang in primordial abundances led me to study two of the determining reactions. These reactions were studied at Caltech ($^{11}B(\alpha,n)^{14}N$), Princeton and Yale ($^{8}Li(\alpha,n)^{11}B$). Our results showed the limitation of a key reaction, preventing the observation of relic nucleosynthesis due to this mechanism. (1990-1992)

Explosive Stellar Hydrogen Burning – In these environments, breakout from the Hot Carbon-Nitrogen-Oxygen burning cycle and subsequent "rapid proton" capture could help us explain the observed isotopic abundances produced, and test models of stars. Studying these rates involved target preparation, detector development, significant improvements to the cyclotron at Princeton, modifications to an isotope separator, and experimental runs at Yale and TUNL. The impact of our work pointed to the need of a Rare-Isotope Accelerator ($600M project) which is now in the Nuclear Science Advisory Committee's long-range plan. (1989-1992)

Isotopic Anomalies in Meteorites – The observation of isotopic correlations involving ^{26}Al and ^{22}Na in meteorites, as well as observations of the inter-stellar 1809-keV gamma line from the decay of ^{26}Al, have direct implications on their production sites. We determined the proton destruction rate of ^{26}Al at stellar temperatures both directly (Caltech – 1989) and indirectly via the (^{3}He,d) transfer reaction (Princeton – 1987). This work, coupled with that of others, is currently being used to help map out stellar distributions within our galaxy. (1984-1989)

Fractionally Charged Particle Search – Reported observation of fractional charges by Fairbank et al., led Caltech to engage in a search using electrostatic elements (for mass independence) and a sputter ion source to look at Niobium as a possible site of free quarks. The experiment set an upper limit which disputed the claims of Fairbank, whose results are now discounted. (1982-1984)

Proton Induced X-Ray Emission – This project involved the analysis of trace elements in optical lenses via standard PIXE methods to help a lens making company identify adhesion problems with its optical coatings. We were able to identify which of their chemical suppliers were creating the difficulties. (1980-1982)

Polarized Ion Source – This project involved the installation and initial testing of a polarized ion source at Notre Dame, IN. (1980)

Funding:	I have been funded by the NSF, DOE and VT $10,194k as PI; $7,156k as co-PI I was also Director for the Kimballton DUSEL program, with an internal VT budget of $1600k. I am currently PI on two NSF grants and lead the GEM*STAR project.
Publications:	In refereed journals: 91 (h-index 50; citations – 9705; per Google Scholar)

Honors & Membership:

Phi Beta Kappa – *honor*
Charles E. Lake Memorial Award – *philosophy*
Sigma Xi Research Award – *physics*
Fellow, American Physical Society
William E. Hassinger Jr. Senior Faculty Fellow of Physics (2016-)

PhDs Advised:

Student	Topic
Michael S. Smith (Yale – 1990)*	$^{20}Ne(^{3}He,t)\,^{20}Na$ to get: $^{19}Ne(p,\gamma)^{20}Na$
Zhiqiang Mao (Drexel – 1992)*	$^{9}Be(\alpha,p)^{12}B$ to get: $^{8}Li(\alpha,n)^{12}B$ and $^{11}B(d,p)^{12}B$
Kevin I. Hahn (Yale-1993)*	$^{20}Ne(p,t)^{18}Ne$ to get: $^{14}O(\alpha,p)^{17}F$
Gaylon Ross (Notre Dame – 1994)*	$^{31}P(^{3}He,d)^{32}S^{*}(\alpha)^{23}Si$ to get: $^{31}P(p,\alpha)^{23}Si$ $^{35}Cl(^{3}He,d)^{36}Ar^{*}(\alpha)^{32}S$ to get: $^{35}Cl(p,\alpha)^{32}S$
Sinan Utku (Yale – 1994)*	$^{19}F(^{3}He,t)^{19}Ne(\alpha)^{15}O$ and $^{19}F(^{3}He,t)^{19}Ne(p)^{18}F$ to get: $^{18}F(p,\alpha)^{15}O$
Mark Makela (VT – 2005)	β-decay of polarized Ultra-Cold Neutrons; Pulsed Laser Deposition Diamond
Henning Back (VT – 2004)	Borexino Solar Neutrino Detector Calibration
Russell Mammei (VT – 2010)	Ultra-Cold Neutron Transport
Steve Hardy (VT – 2010)	Solar Neutrinos: Borexino Calibration
Szymon Manecki (VT – 2013)	Solar Neutrinos: annual oscillations
David Bravo (VT – 2016)	Borexino & SOX
Zachary Yokley (VT – 2016)	LENS
Xinjian Ding (VT – 2018)	NuLat
Ryan Dorrill (UHawaii – 2019)*	NuLat
Michael Borusinski (UHawaii –)*	NuLat

Masters Advised:

Student	Topic
Victor Gehman (VT – 2001)	Borexino Scintillator Purity
Bradley Williams (VT – 2004)	Borexino Calibration
Matt Joyce (VT – 2008)	Borexino Calibration

*on-site advisor

Undergraduate Researchers:
(at VT only)

Jacob Bartel	Burke Greene	Bailey Nelson
Jesse Barber	Matthew Hill	Robert Pattie
Jay Billings	Jacob Hodge	David Richardson
Elizabeth Bonnell	Jonathan Hughes	Alma Robinson
Alexandra Bosh	Anosh Irani	Brian Skinner
Kevin Brannick	Patrick Jaffe	Seth Smith
Brant Campbell	John Janik	Mike Sperry
Paul Chapman-Turner	Ryan Jewesak	Brian Thibodeau
Matthew Church	Nathan Johnson	Nathan Tompkins
Darrell Clark	Matthew Joyce	Devon Triplett
William Clark	Zack Lewis	Tristan Wright
Elizabeth Conwell	Ethan Ludwick	Mark Wallace
Andrew Feneley	Matthew Lynch	Chris Williams
Chris Graziul	Amanda Murray	Laura Wishart
		Chris Wollbrink

Professional Activities:

NSF Site Visit Panels, Career Panels, Nuclear Physics Panels, ad hoc reviews
DOE ad hoc reviews, Panel Reviews
Member of NSF/DOE Neutrino Science Assessment Group (NUSAG)
Member SAWG APS Neutrino Study Group
DUSEL Low-Energy Neutrino Working Group (co-chair) – produced reviewed report
Director, Kimballton DUSEL Team and Kimballton Facility (former)
Senior Scientist for Homestake DUSEL team (former)
numerous Long-Range Planning town meetings

Other Interests: Third World (10 yrs in India and Egypt), religion and science, French, Arabic, tennis, piano, reading, hiking, photography.
Energy production and conversion
Fiber optics and communication systems.