



DEPARTMENT OF  
**Physics**

COLLEGE OF ARTS AND SCIENCES

# NEWSLETTER

## Letter from the DEPARTMENT HEAD

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Well, to say it has been an interesting year is an understatement. You may or may not know that we had to switch all classes and labs to online delivery in the middle of March. It went surprisingly well thanks to the faculty, staff and graduate teaching assistants. I want to give a special shout out to Melissa Edwards, our Undergraduate Lab Coordinator, for handling the most difficult task associated with the Covid transition. Well done, Melissa.

As for the fall semester, we are offering online lectures to our large undergraduate courses, and for the most part, providing in-person lectures in our upper division and graduate courses. Let me tell you, giving 75 minute lectures wearing an N-95 mask and a face shield is an interesting experience. So far, the department has remained healthy and mostly avoided Covid. In terms of research, quite a few of our labs shut down for three months, with a few carefully staying open for business. As of now, we are back up to full productivity.

We've experienced a lot of changes over the past year, with numerous retirements and training by fire of our five new faculty members. Talk about crazy. You can learn more about them and their research by visiting our website. Drs. John Mintmire (former Head of Physics) and Peter Shull retired this past summer. Thank you both for your service and wisdom. In terms of the staff, Charles Hunt retired in January. He was the longtime staff member in charge of the Crystal Growth Laboratory on the 5<sup>th</sup> floor of PS II. Thanks for your service, Charles! Even more shocking is the retirement of Susan Cantrell! She has been the rock of the department for over 30 years. Susan had to make a tough decision between staying with the department or starting a new chapter in her life. Wisely, Susan chose to pursue new and exciting experiences in life. Susan, we will miss you and thank you for helping so many of us over your long career!

Even with all the challenges of Covid, the department is prospering. We will be hiring a new astronomer or planetary scientist to replace Dr. Peter Shull and a theoretical atomic molecular physicist to replace Dr. John Mintmire. We hope to make a third hire next year (delayed by Covid). Our undergraduate and graduate students are doing well and actively involved in the social fabric of the department and research. We continue to recruit the best and brightest students and I am pleased to say that we are succeeding.

I hope all of you are healthy and safe and leading as normal a life as can be expected. Please enjoy what you read in this year's newsletter. We have more exciting news than we can fit into the newsletter. So I recommend you visit our website over the course of the coming year for timely updates. Lastly, I want to thank Beth Bridenstine for putting this newsletter together.

This newsletter brought to you by

*the Office of*

THE DEPARTMENT OF PHYSICS.



@OkstatePhysics @physics145

## FACULTY HIGHLIGHTS

### OSU recognizes Dr. Babu with Eminent Faculty Award



Oklahoma State University President Burns Hargis (left) presents Dr. Kaladi Babu, Regents Professor in the Department of Physics, with the Eminent Faculty Award during the University Awards Convocation Dec. 11

Dr. Kaladi Babu, Regents Professor of physics in the College of Arts and Sciences, and Mary

Bryans, director of Budget and Asset Management and chief budget officer, took top honors as Oklahoma State University recognized the achievements of faculty, staff and administrators at the University Awards Convocation Wednesday at the OSU ConocoPhillips Alumni Center in Stillwater. Babu received the Eminent Faculty

Award, which recognizes the highest level of scholarly achievement at OSU. His research is in theoretical high

energy physics and particle physics phenomenology. He recently received the Distinguished Scholar Award from the Department of Energy and has garnered nearly \$7 million in research grants.

"Dr. Babu is one of the most prolific and highly cited researchers worldwide," said Gary Sandefur, OSU provost and senior vice president. "As a teacher, Dr. Babu has the incredible ability to teach physics in a way that students can understand. As a mentor, he is one of the best. He is generous with his time and helps students obtain their fullest potential."

Full article at: <https://news.okstate.edu/articles/communications/2019/sou-recognizes-babu-bryans-during-fall-2019->

## END OF AN ERA

### Susan Cantrell Retiring



For 30 years, **Susan Cantrell** has been a mainstay in the Department of Physics. She has always been there to answer questions, take

care of a problem, or offer comfort in a time of need.

Susan has had some life changes over the course of the last few months. She is now engaged to be married to her high school sweetheart, Todd Langston and will be moving to Missouri. Now instead of coordinating the office, she will be hunting, traveling, and visiting her children and grandchildren.

We will miss you, Susan. You have been the light of the Physics Department since January 5th, 1989. No one will ever be able to replace you. Congratulations on your retirement, wedding and new life!

## FEATURED PUBLICATION

### Enhanced dissipative sensing in a microresonator with multimode input (experiment)

Rajagopal, Sreekul Raj, Rosenberger, A. T.

In the past few decades, due to their high quality factors and small mode volumes, optical whispering-gallery mode (WGM) microresonators have proven to be an exceptional platform for the advancement of optical sensors. 1 Recently, WGM optical sensors have achieved ultrahigh sensitivity and low limit of detection in detecting changes in various physical quantities.2,3 Optical WGM sensors rely on two sensing principles, dispersive and dissipative sensing.4,5 Dispersive sensing is based on the shift in WGM resonance frequency with a change in the refractive index of the surrounding medium whereas dissipative sensing, in general, depends on the change in linewidth induced by a lossy (absorbing) analyte. In addition to the change in linewidth, the introduction of a lossy analyte into the surrounding environment of an optical WGM sensor will also induce a change in

the resonant throughput dip depth. Hence a comprehensive study on dissipative sensing can be performed by detecting the change in the resonant throughput dip depth of a WGM. Dissipative sensing based on dip depth change can provide a better limit of detection than frequency shift measurements.6,7,8 Recently a novel approach for improving the limit of detection for the dip depth based dissipative sensing was proposed. 9,10 Usually adiabatic tapered fibers11 are used to couple light in and out of the microresonators. Hence a single mode is incident on the microresonator. The proposed scheme for improving the limit of detection depends on having multiple modes incident on the microresonator using a non-adiabatic tapered fiber.

Full publication available at: <https://rosenberger.okstate.edu/publications>

## ALUMNI NEWS

### Razvan and Ramona Gaza join mentors

“The experiences in the (OSU) physics department were literally life-changing. We were fortunate to meet exceptional faculty and staff who helped us learn, discover and pursue our academic interests.” — Dr. Razvan Gaza, technical lead,

Lockheed Martin Radiation Group

OSU alumni Ramona and Razvan Gaza, right, work for Lockheed Martin

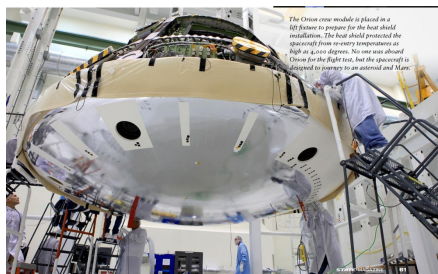


We would like to welcome Razvan and Ramona Gaza as our newest mentors to the Oklahoma State Physics Department. Their knowledge and expertise will be extremely beneficial to our department. The Gazas earned their doctorate degrees in 2004 under Dr. Stephen McKeever, Regents Professor Emeritus.

the Lockheed Martin Orion team and the technical lead of the LM Radiation Group. In 2011, he began characterizing and helping mitigate ionizing radiation effects on the spacecraft’s electronic components. He installed the capsule’s radiation area monitors, prepared by his wife which allow for real-time measurement of radiation levels.

cluding the Space Shuttle, the International Space Station, the NASA Multi-Purpose Crew Vehicle, and the Commercial Crew programs.

For our current students, you may remember the colloquium they gave last year titled: The Ionizing Radiation Environment for Human Space Flight: Risks and Mitigations. They brought with them a contribution to the walls of our department— an Oklahoma State flag, which flew on the Orion spaceshuttle. We look forward to working with the Gazas as our department moves into the future.



The Orion crew module is placed in a 40 ft room to prepare for the final flight certification. The heat shield prevented the spacecraft from reentry temperatures as high as 4,000 degrees. No one was aboard Orion for the flight test, but the spacecraft is prepared to carry to an orbital and Mars.

Dr. Razvan Gaza is a member of

Dr. Ramona Gaza is the Ionizing Radiation and Non-Ionizing Radiation Subject Matter Expert for the NASA/JSC Human Health & Performance contract. Dr. Gaza has been the Lead for the passive radiation flight hardware and associated radiation dosimetry, supporting several NASA programs in-



Portions of this article taken from STATE Magazine, Spring 2015

### Dr. Sandip Kaledhonkar Joins a Premium Research Institute in India as a Faculty Member

Becoming a faculty member in a premium research institute is a dream for many graduate students. Recently such a dream became true for Dr. Sandip Kaledhonkar, an OSU Physics PhD in the field of biophysics.

Dr. Kaledhonkar did his postdoctoral research at Columbia University in the Laboratory of Professor Joachim Frank, a 2017 Nobel Laureate in Chemistry (for developing CryoEM Technology). After completing his PhD study in *time-resolved infrared structural biology* in the Biophysics Research Group of Professor Aihua Xie, Dr. Kaledhonkar was hired by Profes-

or Frank to develop the cutting-edge technology of *time-resolved Cryo-electron microscopy* (CryoEM).

This year (2019), Dr. Kaledhonkar published a first authored paper in *Nature* and a co-authored paper in *Nature Communications*, both using *time-resolved CryoEM*. Such outstanding accomplishments led him to receive an offer for a faculty position as an assistant professor at the Indian Institute of Technology (the renowned IIT) in Bombay, which is one of the best universities in India.

While at OSU, Dr. Kaledhonkar was honored as an outstanding Teaching Assistant in 2011, and outstanding Research Assistant in 2012. His PhD research on “Structural Dynamics of Photoactive Yellow Protein” made significant contributions to the field of photoactive yellow protein for biological signaling, to the classic Hofmeister series, on protein structure and dynamics, and on the emerging technology of time-resolved infrared structural biology.



Dr., Kaledhonkar with his postdoctoral advisor Professor Joachim Frank at Columbia.

Dr. Kaledhonkar is preparing to establish a structural biology lab with the cryo-EM facility (for multiple research institutes around Mumbai). In addition, he will teach students pursuing undergraduate and graduate degrees in sciences and engineering.



Dr. Kaledhonkar with his lab-mates and PhD advisor Professor Aihua Xie at Oklahoma State University.

## DEPARTMENT NEWS

### Celebrating Undergraduate Research, Scholarship, and Creativity



Three undergraduate physics students attended dinner with President Hargis. The students, along with their research mentors were invited to the President's house for dinner and a reception for undergraduate researchers. Pictured from left: Lee Repa (Niblack Research Scholar in the Borunda research group), Dr. Mario Borunda (Undergraduate Research Coordinator for Physics and Lee's mentor), First Cowgirl Ann Hargis, President Hargis, Aaron Austin (Niblack Research Scholar in the McIlroy research group), and Zach Alegria (McNair Research Scholar in the Haley research

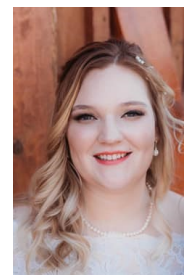
group). The McNair program is a federal program established in memory of physicist and Challenger Astronaut, Dr. Ronald E. McNair. The Niblack Research Scholars program is funded by OSU alumnus Dr. John Niblack and his wife, Heidi Niblack. Both programs provide undergraduates with opportunities to participate in academic year and summer research activities. Zach has completed his Undergraduate degree. Aaron and Lee will be fulltime researchers during the summer semester thanks to the support of the Niblack fellowship.

## Office Updates

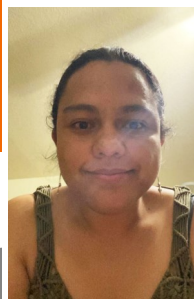


If you have been by the office lately you may have noticed some changes. Alisha has moved on to be an Accounting Specialist in the College of Arts and Science Business Office.

Megan Treanor has joined us from the Instrument Shop to become our new Financial Assistant. She has several years of experience doing accounting work and will be a great asset to the office.



Charles Hunt has retired. We now have Elena Echeverria



managing the Crystal Growth Lab. Elena arrived in Stillwater as Dr. McIlroy's postdoc. She is doing a wonderful job overseeing the revamping of this space.

The office itself saw some changes along with the conference room. They received a much needed facelift with new carpet and paint.

The Ambassador Program is a series of courses designed to enhance the knowledge and skills for these people on the frontline. Beth



Bridenstine recently completed this program and was awarded a Certificate of Achievement for her efforts.



The Department poses for a group picture as we celebrate Alisha's promotion to the college.

## FACULTY RETIRING THIS YEAR

### Dr. John Mintmire retired this

past June 2020 from OSU where he served as a Regents Professor of Physics. He received his Ph. D. degree as a member of the Quantum Theory



Project at the University of Florida in 1980, and went from there to work for twenty years at the Naval Research Laboratory in Washington, DC as a postdoctoral associate and as a staff research physicist in the Theoretical Chemistry Section. He moved to Oklahoma State University in 2001 as the Head of the Department of Physics, and served for five years in administrative positions as head of department and as associate dean of research for the College of Arts & Sciences before returning to regular faculty status. Most recently he has served as department head from 2010-2016, and spent a sabbatical year at the Center for Nanoscale Materials Sciences at the Oak Ridge National Laboratory in Tennessee during the 2016-2017 academic year. He has served on a broad range of review panels for DoD, DOE, and NSF funding agencies, as well as



having served as program officer for the Condensed Matter and Materials Theory program at NSF. He was elected a Fellow of the American Physical Society in 2000, and is also a Fellow of the International Union of Pure and Applied Chemistry.

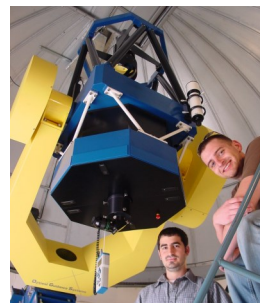
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### From Dr. Peter O. Shull



I "officially retired" in July, after a gratifyingly linear career as an astronomer. My Ph.D. in Space Physics and Astronomy from Rice University led directly to postdoctoral positions at the Max-Planck-Institute for Astronomy (1982) and Arizona State University (1984). These were followed in August 1984 by a faculty position as only the third astronomer in OSU's history. It is now time to set our sights higher! The Department should aim to have two tenure-line astronomers simultaneously. That will facilitate their success in external research funding (government agencies are leery of physics departments that have just one astronomer). That will enable the creation of undergraduate and graduate astronomy degree programs that will invigorate the Department. I urge the Department to build on two of my career accomplishments:

OSU's first observatory, and its USAF-funded research telescope, the largest in the state. I will continue to be available to help the Department and its students achieve those goals.



*Undergraduates in the dome in 2007 with the new research telescope.*

## OBSERVATORY NEWS

### Mendenhall Observatory Dash to the Finish

First, I want to thank those of you who have contributed to the Friends of the Observatory fund for the construction of the Physics Mendenhall Observatory. It has been a 20+ year endeavor by Prof. Peter Shull. The history behind the observatory can be found on our website. Well, Peter has retired, but isn't gone, and he and I would love to see the observatory operating at full capacity. We have everything completed except for a new drive system for the 24-inch telescope housed in the dome. As is the case with many instruments, the hardware (scope) is in great shape and fully operational but the tracking system software is outdated and runs on an obsolete operating system. Furthermore, the computers running the software died quite some time ago and the company that built the tracking system and wrote the software has gone out of business. This leaves us with a great piece of hardware and no way to use it! Fortunately, there is a solution. There are two companies that specialize in re-outfitting telescope tracking systems. We are scheduling/paying for a visit by one of them to look over the telescope and come up with a finalized quote for retrofitting the tracking system (hardware, electronics, software, etc.). Currently we have about a third of the funds we need for the retrofit, where we estimate we need another \$35,000. So I am asking for your help to raise this money. I have contributed \$500 to the cause and challenge you, our alumni, to match or better my donation or simply give what you can. While Prof. Shull has retired, he is still working on completing the project.

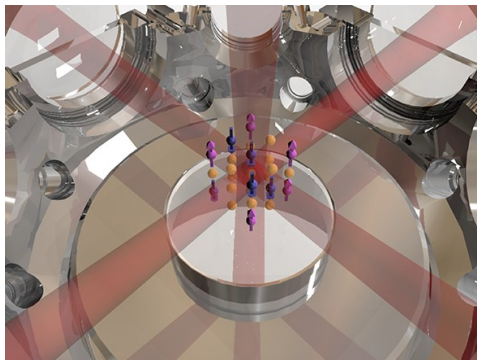
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## FACULTY RESEARCH PROJECTS

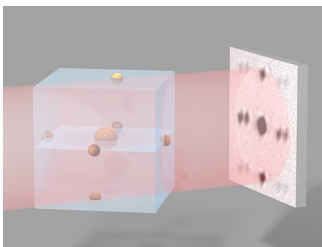
### Quantum Quench and Few-body Non-equilibrium Dynamics

Physicists in Dr. Yingmei Liu's research group at Oklahoma State University have made the first experimental observations of few-body non-equilibrium spin dynamics in an ultra-cold spinor Bose-Einstein condensate (BEC) confined by cubic optical lattices.

This research, published on September 10 in the journal *Physical Review Letters* (PRL), offers a crucial bridge between the well-studied realms of two-body and many-body interactions. Understanding the transition between these realms is not only important fundamentally but also vital for future applications like quantum information science. *Zihe Chen*, the lead author of this PRL paper and a Ph.D. candidate in OSU physics department, and his colleagues have experimen-



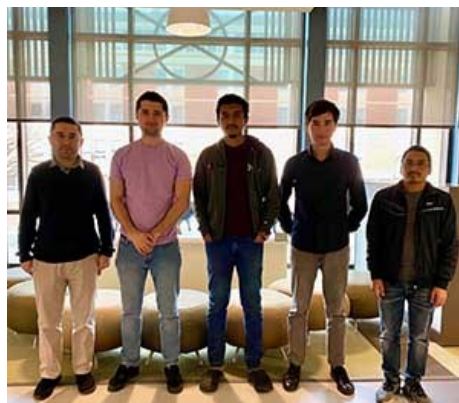
tally demonstrated that lattice-confined spinor BECs provide a perfect platform to understand this complicated transition. Their experiments have been performed in a quantum



quench scenario, in which they drive a BEC out of equilibrium by rapidly changing one experimental parameter. They have observed non-equilibrium dynamics consisting of spin-mixing oscillations at multiple frequencies after distinct quantum quench sequences.

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### Turgut Research Group Receives Grants from National Science Foundation and NASA



Dr. Turgut's research group has received a 2-year award from the National Science Foundation (NSF) and a half-year NASA Research Initiation Grant. Among two, the NSF award will support the experimental study of non-reciprocal spin-wave engineering in chiral magnets, which will be conducted by a joined effort between Oklahoma State University and Nanoscale Spin Dynamics group at NIST, Boulder. Particularly, Dr. Turgut's research will study asymmetric spin-wave propagation in various magnetic materials, which is promising for creating microwave circulators and diodes based on spin waves. The demonstration of configurable, power-efficient, and versatile microwave components will pave the way towards new high-frequency communication devices, which can be used in various applications, including entertainment, security, and remote patient treatment. Secondly, NASA Initiation Award will allow Dr. Turgut's group to develop miniature magnetometry sensors based on atomic defects, which is a great interest of NASA for various planetary missions. In particular, many chemical and physical properties of planets have consequences on their complex magnetic fields, which have been used to understand these properties.

-Cont. from page 5—Mendenhall

Furthermore, the university has authorized the department to hire a new astronomer. It would be great to help Prof. Shull see his project to completion and to hand a new astronomer a fully functional observatory and open it up for business (stargazing parties, undergraduate research, outreach functions, etc.)



The Mendenhall Observatory, named after OSU's first astronomer, and its new control building in 2019 (photo © Trace Jobe).

You can give to the fund by following this link:

[\*\*Astronomical Observatory Fund\*\*](#)

Alternatively, send a check to the OSU Foundation (Oklahoma State University Foundation P.O. Box 1749, Stillwater, OK 74076-1749) and in the memo line put **Astronomical Observatory Fund 22-40400**.

Cont. from pg 6—Quantum Quench and Few-body Non-equilibrium Dynamics

By identifying oscillation signatures of up to six atoms in a lattice site, they have confirmed that the observed dynamics can reveal atom number distributions of an inhomogeneous system and enable precise measurements of two important parameters determining the spinor physics. This research has been generously supported by the Department of Defense, the National Science Foundation, the Noble Foundation, the Oklahoma Center for the Advancement of Science and Technology, and Oklahoma State University.

## SOCIETY OF PHYSICS STUDENTS



Oklahoma State Society of Physics Students continued on the tradition of the Physics department picnic this year. Every semester we look forward to being able to service an event where all the staff, faculty, and students in our department are able to eat great food and socialize. We were also able to host the second annual Spooky Lab Night where our professors generously open their labs for spooky science centered Halloween games and presentations. We hope that this also becomes a tradition and an event people look forward to every year.

## STUDENT AWARDS

### Evan Van de Wall receives DOE Scholarship at Argonne Lab



HEP Graduate Student, **Evan Van de Wall**, was awarded the Office of Science Graduate Student Research scholarship.

He is one of 49 new SCGSR awardees from 39 different universities across the nation. The SCGSR program provides supplemental funds for graduate awardees to conduct part of their thesis research at a host DOE laboratory/facility in collaboration with a DOE laboratory scientist within a defined award period. Van de Wall will be working at Argonne National Laboratory in Chicago, IL on Advanced Technology Research and Development in High Energy Physics.

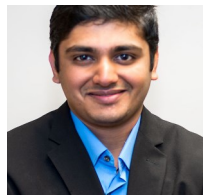
*Cont. from pg 5—Mintmire*

His research program has focused on computational materials physics of nanostructured materials, with particular emphasis on large-scale atomistic simulations of the electronic and structural properties of low-dimensional materials with potential application to photovoltaic materials and other energy-related applications. He and his wife plan to remain residents in Stillwater for the indefinite future, where he looks forward to his new role as an emeritus professor in the department.

### Graduate Students Receive High Honors

#### Sreekul

**Rajagopal** received several awards in the past year. He is the winner of the GPSGA 2020 Phoenix Award. He was also the 2020 recipient of the Robberson Summer Dissertation Fellowship and the Graduate Dean's Certificate for 360° Critical Skills for Career Success. Congratulations Raj!



**Sudip Jana** has won The Graduate Research Excellence Award which

recognizes outstanding research accomplishments as reflected in the thesis or dissertation. This is OSU's highest public recognition of the research conducted by the institution's most talented graduate students.

## PHYSICS BANQUET

**The Physics Banquet** was unfortunately canceled due to the pandemic. The following is a list of the students awarded and degrees received for the 2020 Academic Year.

### Awards Recipients

Outstanding Senior -  
*Dylan Chapman*

Department Outstanding Senior - *Perry Hurd*

Undergrad Research Award -  
*Aaron Austin*

Outstanding Graduate R.A. -  
*Sreekul Rajagopal*

Daniel Stevans Scholarships -  
*Derrick Allen, Reagan Anderson, Aaron Jackson, Jacob Maisch, James Mantooth, Chasen McPherson, Jonathan Winegarten*

Earl Lafon Scholarships -  
*Aaron Austin, Eric Werline*

Elton Kohnke Scholarships -  
*Sofia Gomez, Luke Vaughan*

Paul Westhaus Scholarships -  
*James Mantooth, Luke Vaughan*

### Degrees Granted

#### PhD Degrees

Nishan Shrestha	Spring 2020
Bryan Hayes	Summer 2020
Thilak Madugoda	Summer 2020

#### Bachelor's Degrees

Bryce Brown	Fall 2019
Kelsey Matthews	Fall 2019
Zackary Alegria	Spring 2020
Brandon Cannon	Spring 2020
Dylan Chapman	Spring 2020
Mickie Eikenberry	Spring 2020
Perry Hurd	Spring 2020

OKLAHOMA STATE UNIVERSITY  
**DEPARTMENT OF PHYSICS**

145 Physical Sciences  
Stillwater, OK 74078-3072



# NEWSLETTER



## ALUMNI INFORMATION **REQUESTED**

The department is currently updating information from alumni. Please take a moment to complete the questionnaire and return to the address above or email at [physics@okstate.edu](mailto:physics@okstate.edu).

### ACHIEVEMENTS AND AWARDS

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### ADDITIONAL EDUCATION/DEGREES

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### AREAS OF DISTINCTION

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NAME

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HOME ADDRESS

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EMAIL

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CURRENT PROFESSIONAL POSITION