

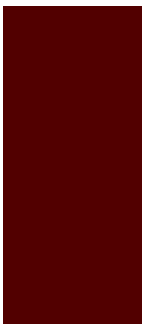


# COLLABORATIVE RESEARCH

## INTERFACIAL BUBBLES

A COLLABORATION CASE STUDY SERIES

AUGUST 2015



## COMMITMENT TO COLLABORATION

As a pioneer consortium in higher education, 4-VA is committed to fostering collaboration across the Commonwealth.

We are also committed to measuring, learning from, and sharing the outcomes of our work. We believe in the importance of assessment and evaluation. When possible, we seek to measure our impact using verified research methods.

Case studies are a research design that involves an intensive study of one or more cases with multiple sources of evidence. Each 4-VA member institution selected a signature 4-VA project, not an entire initiative, for their case study. An analysis on collaborating across universities will be the unifying theme across cases.

The goal of these reports is to share what we have learned through our work across universities and to inform our stakeholders within the Commonwealth about 4-VA initiatives. This work will provide information to (1) promote enhanced processes; (2) share knowledge and best practices; and (3) advance collaboration.

4-VA was launched with leadership support from the Secretary of Education, the Governor, four university presidents, and an industry partner, Cisco Systems Inc. – the first collaborative of its kind in Virginia. The Collaborative is designed to help universities work together to achieve Virginia’s goals for higher education.

**Kelsey Kirland**  
4-VA Assessment Coordinator



# VT & JMU COLLABORATION

## EXECUTIVE SUMMARY

A 4-VA funded symposium brought together soft matter researchers to develop a community in Virginia that would share ideas, techniques, and expertise in the field. The symposium strengthened the relationship between Dr. Shengfeng Cheng from Virginia Tech and Dr. Klebert Feitosa from James Madison University. Their ambitions to develop a new model in the field of physics could not be realized without their complementary skills and expertise. Their interfacial bubble research is strengthened by their collaboration.

Both faculty believe that 4-VA funding was instrumental to advancing their research. The nontraditional 4-VA grant funds address gaps that other traditional sources of funding

do not. As a result, four undergraduate student researchers and a graduate student were involved in their summer research. The research team plans to present and publish their work in fall 2015.

Cheng and Feitosa aim to develop this research project in order to build a strong case for external funding agencies. Seeking continued support is one of their goals in addition to disseminating knowledge to the public on interfacial bubbles and associated research techniques through a website they have created.

**Collaborative research creates and strengthens cross-institutional partnerships in Virginia.**

## ACHIEVEING 4-VA GOALS

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- 1 Define instructional models, including a clear definition of instructional costs;
- 2 **Significantly expand access for all Virginians to programs, preparing them for rewarding careers;**
- 3 **Increase the research competitiveness of the partner universities; and**
- 4 **Increase opportunities and enhance the success of students in science, technology, engineering, and mathematics (STEM) courses and programs.**

## REACHING AIMS WITH EXCELLENT RESEARCHERS

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### COLLABORATIVE RESEARCH INITIATIVE

#### Aims to:

Increase prevalence and intensity of research collaboration

Increase funding awarded to Virginia faculty and universities

Increase scholarly impact of Virginia faculty and universities

Increase student participation in original scholarship

### CHENG & FEITOSA GRANT

#### Reaching aims by:

✓ VT and JMU research collaboration

✓ One grant proposal submitted to NSF; hoping to submit another

✓ Currently writing presentation proposals for fall; will submit for publication in the next six months

✓ Graduate and undergraduate students involved in writing, analyzing, and conducting research

## THE NUMBERS

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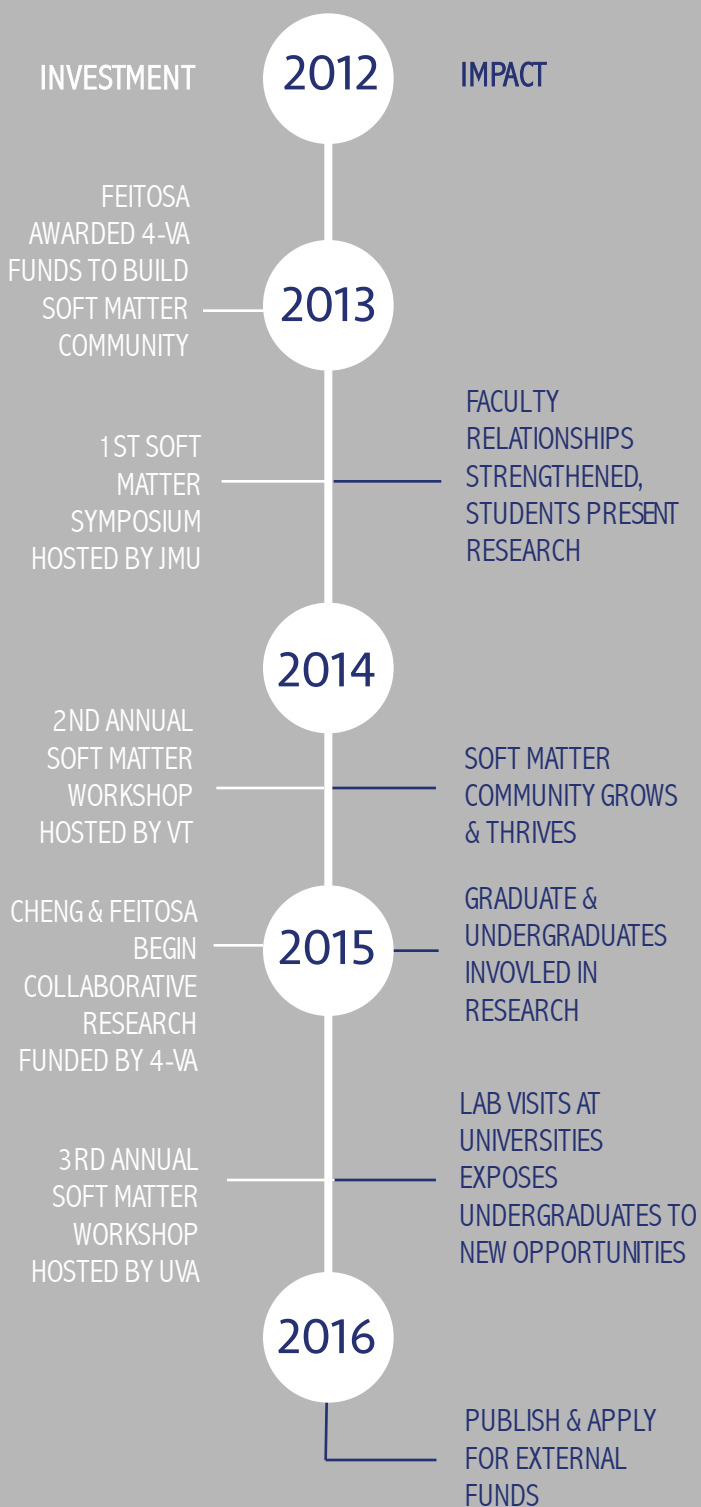
2  
FACULTY

1  
GRADUATE  
STUDENT  
RESEARCHER

4  
UNDERGRADUATE  
STUDENT  
RESEARCHERS

\$40K  
4-VA  
RESEARCH  
FUNDS

# COLLABORATION TIMELINE



## MAKING CONNECTIONS

Dr. Feitosa knew only a handful of colleagues in Virginia who were interested in soft matter. After applying and receiving a 4-VA grant at JMU to host a soft matter symposium, the collaboration amongst soft matter colleagues started to grow and thrive.

**“The goal of this workshop is to form an interdisciplinary community of researchers from the institutions of the 4-VA consortium where ideas, techniques, and expertise will be shared for the advancement of soft matter research in Virginia.”** -An excerpt from the symposium workshop proposal

Dr. Cheng and Feitosa met prior to the soft matter workshop at a professional conference in their field. They discussed shared interests in building a soft matter community, but it wasn't until the symposium that their relationship was strengthened. By the end of the workshop, each faculty member had a better understanding of one another's complementary research skills.

Feitosa explains that, **“you cannot do research alone” and “having a community you can talk with is essential, so that your research can grow strong.”**

Momentum and energy around the soft matter community continued after the first symposium. Cheng hosted the second symposium at VT. The workshop prepares students for professional conferences and gives them the skills to succeed. Faculty members are able to network and connect with colleagues who share similar research interests and complementary expertise.

The second annual symposium on soft matter saw an increase in participation. The hosting location rotates to provide faculty more opportunities to learn about different labs and to connect students to a larger research network. The University of Virginia hosted the third soft matter workshop in 2015.



# FACULTY STORY



**SHENGFENG CHENG**

Assistant Professor  
Department of Physics  
Virginia Tech

“**The grant is crucial for my group to start research in the new direction of bubble physics and seeds what I believe will be a long-term, productive collaboration between my group and Feitosa’s group at JMU.**”

The VT professor explained that without this grant award he would not be able to (1) recruit two undergraduate students to work with him this summer on this project and (2) support his graduate student this summer. Cheng said that, “Both undergraduate students have obtained precious experience by participating in cutting edge research.”

Cheng also noted an exciting and unanticipated outcome of this work, “One of the undergraduate researchers developed an advanced understanding of a model that can lead to another interesting research direction” (excerpt from grant report).



**KLEBERT FEITOSA**

Assistant Professor  
Department of Physics  
James Madison University

“**Our collaboration with Dr. Cheng from VTech has been vital to strengthen the investigations of soft materials at JMU.**”

The JMU professor noted that the joint research effort is a direct outcome of the fruitful interactions between himself and Cheng during the Soft Matter Workshop. Feitosa explained that, “We anticipate a long and fruitful research collaboration through 4-VA in the area of soft matter for the foreseeable future.”

Feitosa also believes that this collaboration was a good opportunity for his undergraduate students to be exposed to a graduate program at Virginia Tech, which will hopefully motivate them to pursue an advanced degree in the sciences.

## INTERFACIAL BUBBLE RESEARCH

Dr. Cheng and Dr. Feitosa have a shared interest in physics with complementary research skills and approaches.

**“We are working to develop a new model for understanding interfacial bubbles in the field of physics”** -an excerpt from Cheng’s proposal.

JMU focuses on the experimental work of the research project; meaning that they take high resolution images of gas bubbles floating at an air-water interface. With the assistance of Feitosa, two undergraduate research assistants developed a technique to obtain high quality profile images of the bubbles needed for the research.

JMU conducts some preliminary analysis on the images before sending the data to VT. Cheng’s research proceeds with the analysis by performing simulations and computational models. Cheng is assisted by one graduate student and two undergraduate researchers who set up simulations and run the high performance programs and computational models.

Cheng and Feitosa communicate daily during the summer to advance their research. The Cisco TelePresence rooms have been used for research meetings between JMU and VT research teams. They prefer TelePresence meetings to phone calls or Skype because the visual component is so essential to this research. Being able to discuss the videos and photos over TelePresence has made for seamless communication between the two teams. **Students said that TelePresence makes the meeting more realistic while providing good direct communication.**

As part of the grant, Cheng and an undergraduate research assistant are creating a website that will act as a repository for their research data. The website also benefits the public by housing general knowledge and technical support for individuals interested in bubble science. This element of outreach is important to Cheng and Feitosa.

## PROJECT OVERVIEW



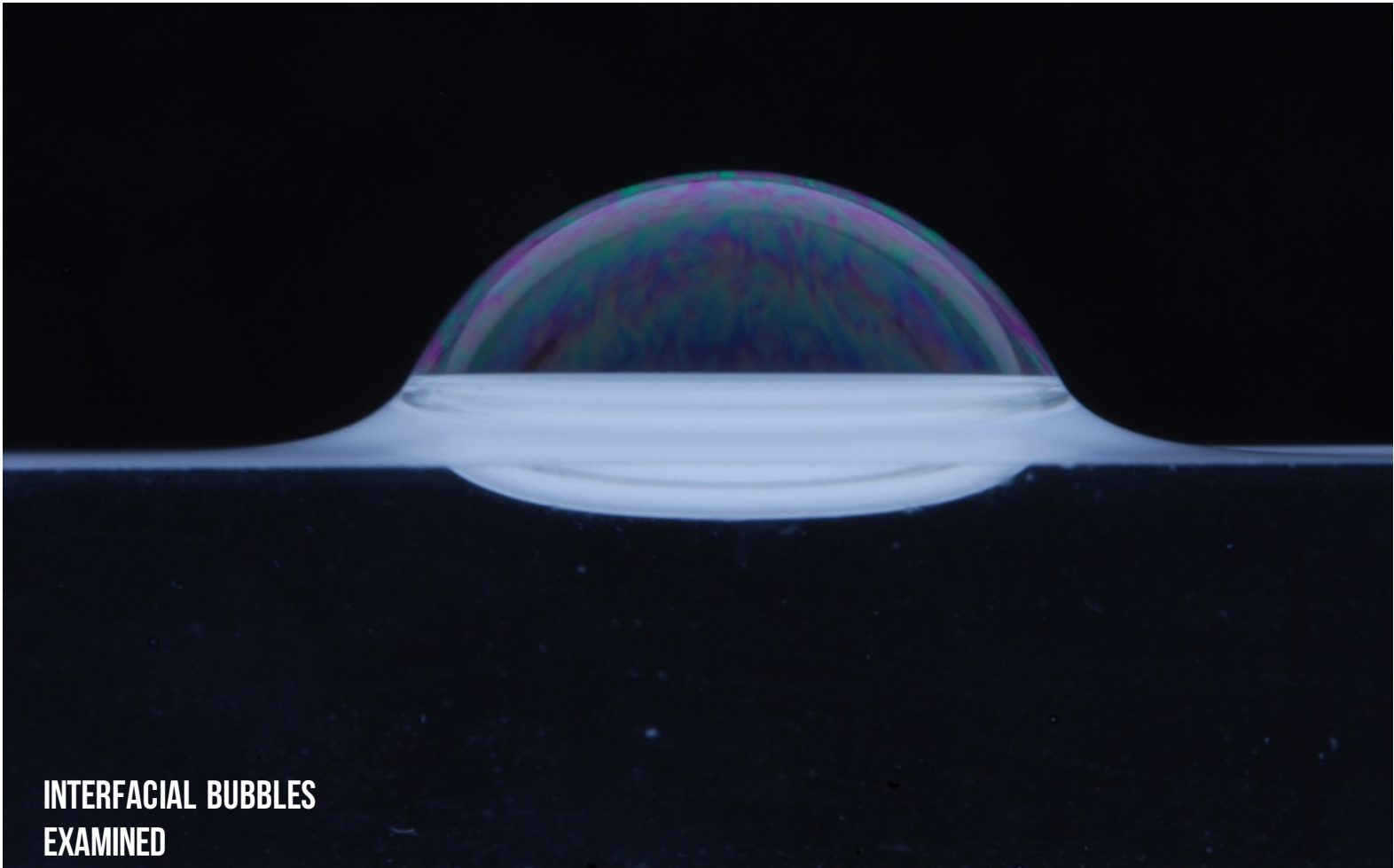
EXPERIMENT



ANALYSIS



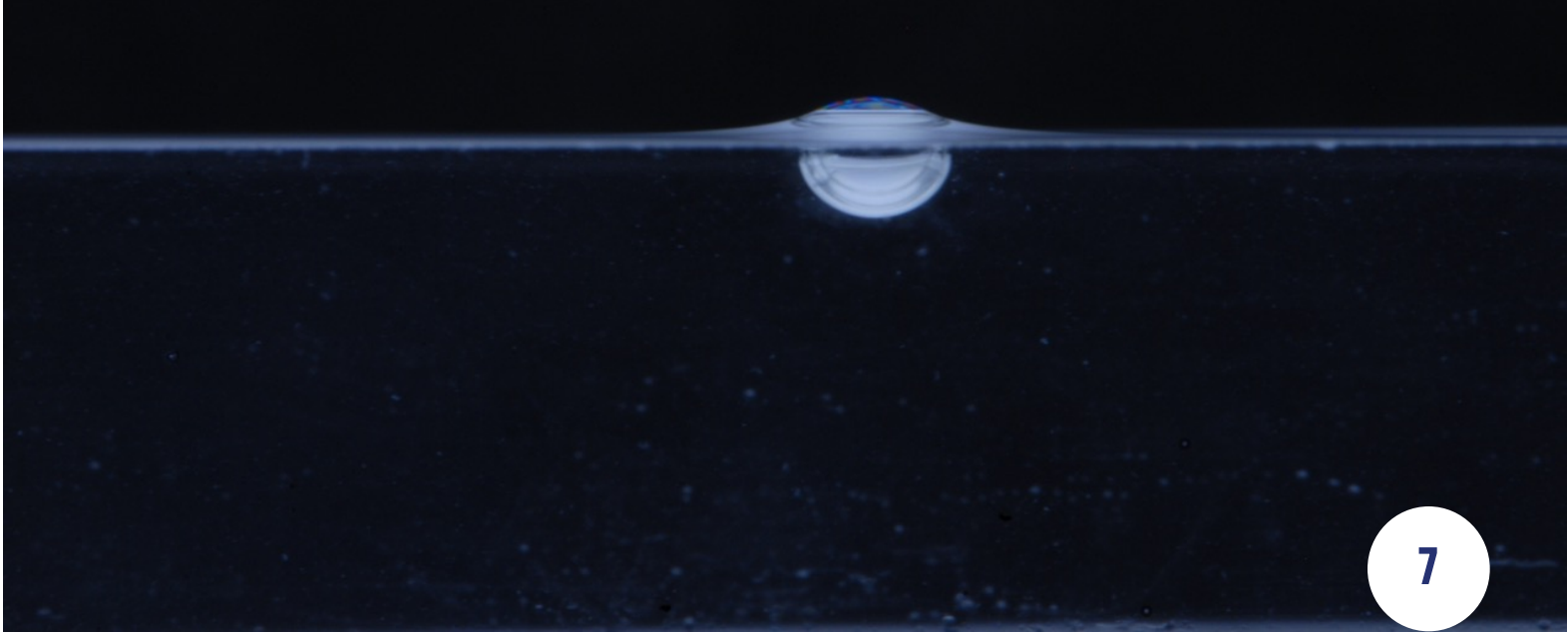
RESEARCH  
STRENGTHENED BY  
COLLABORATION



## INTERFACIAL BUBBLES EXAMINED

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These photos are examples of the high resolution images of gas bubbles floating at an air-water interface carefully captured by Feitosa and his students.





# MOVING BEYOND THE SCIENCE

MAKING AN IMPACT ON MANY

## UNDERGRADUATE STUDENTS

**4-VA's nontraditional funding addresses gaps that other traditional sources of funding do not**

Dr. Cheng explains, "The support from 4-VA has been very nice." These funds provide support over the summer to continue his research with the assistance of undergraduate students. Without this funding, Cheng and Feitosa would not have been able to provide these opportunities to undergraduate researchers.

## GRADUATE STUDENTS & DEPARTMENT

**4-VA funding is critical to Cheng and the Physics Department**

The physics department at VT does not have enough funds to support their graduate teaching assistants over the summer. 4-VA funding has created an opportunity for a graduate student to be involved in research over the summer and make stable progress on his thesis.

## FACULTY

**Small funds provided by 4-VA create big impact**

"Summertime is when we have the most research activity...and its ideal to have students during this busy time," explains Feitosa. Their 4-VA funds are used for research activity over the summer, which provides a nice balance to other grants that are active in the during the academic year. This balance fosters a strong research trajectory that supports faculty.

## RESEARCH

**4-VA funding strengthens research proposals to external granting agencies**

Cheng and Feitosa are working on this research project in order to write a National Science Foundation (NSF) proposal. "This project is essential to developing preliminary data for NSF," says Cheng. As both faculty members are approaching their tenure review in the coming years, receiving external funding is critical to their professional goals and advancement.

## ADVANCING RESEARCH HAS MANY BENEFITS FOR STUDENTS

Students at VT were attracted to this new field of research in physics and to the new model Dr. Cheng and Dr. Feitosa are creating. Students found the collaboration with JMU and VT to be very beneficial and they find that the cross-institutional relationship gives great context to their research.

One student explained that, **“The combined knowledge is advancing our work. They are able to think about the same thing in different ways which benefits the research team overall.”**

An undergraduate student researcher at VT was able to present the research information in multiple mediums and as a result developed web design skills. Additionally, students are learning about simulations and high performance programming. **Cheng explains that both are very powerful tools that are useful skills in industry as well as graduate programs.** The graduate researcher at VT highlighted the value of learning how to set up experiments through trial and error.



An upcoming freshman at JMU, wanted to do something over the summer that was career oriented. When asked to describe his research experience with Feitosa research team, he explained that **he used creative thinking to find answers and solve problems in the lab.** As a result of working on research in the lab, students are given scientific context and relevance for the skills and techniques learned during experimentation.



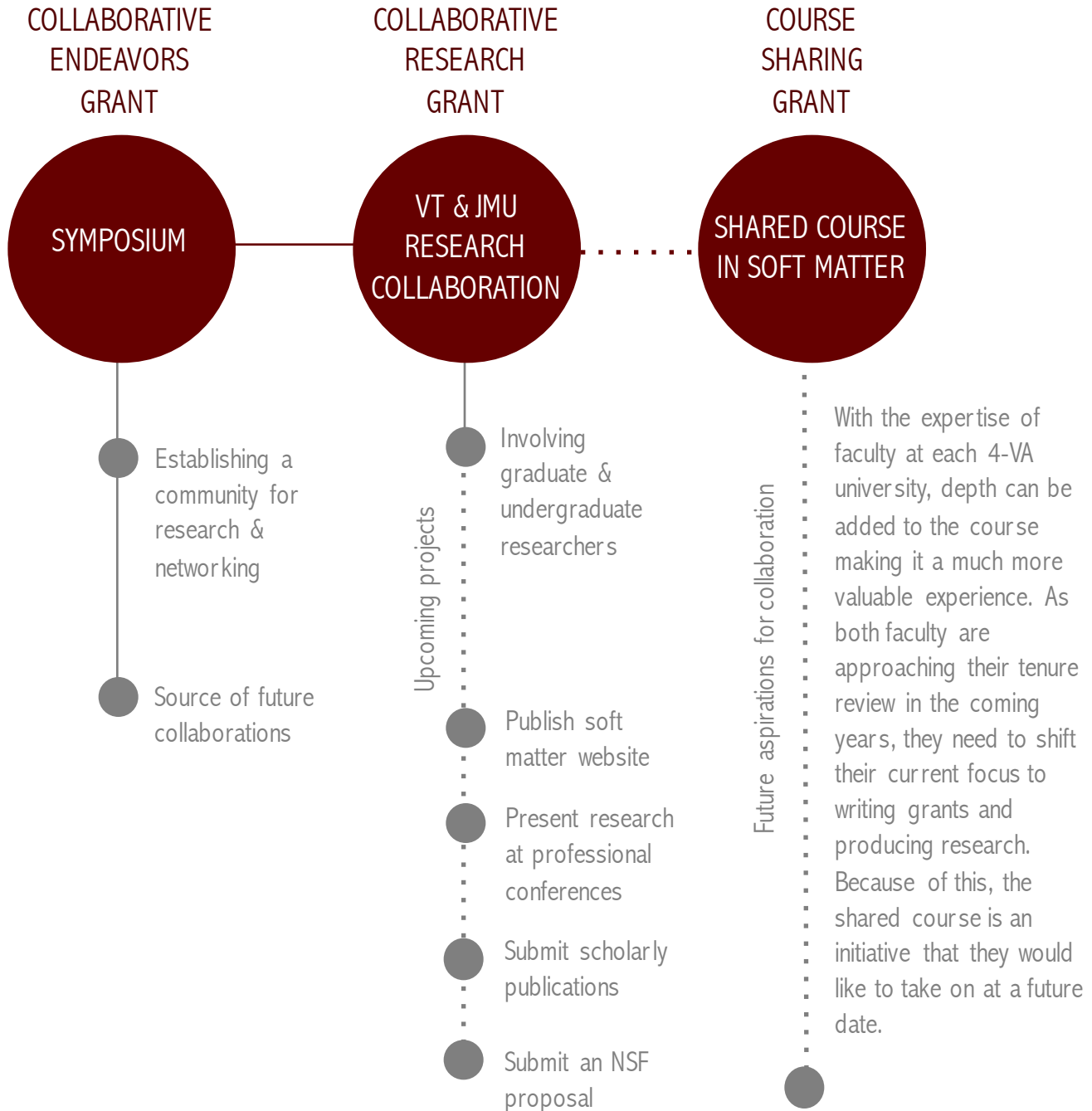
Students at both universities working on this project mentioned the access they have to the faculty leading the research. **They collect and analyze information with feedback from their professor.** The close interaction between faculty and student researchers on this project has helped students personally to further convey and refine their own work. Students plan to submit their research for a conference presentation or publication with assistance from the faculty researchers.



**Cheng strives to have 100% of this undergraduate student researchers involved in a publication before they graduate from VT. Feitosa also works closely with his research assistants and encourages them to present their research.**

## ONE SYMPOSIUM SPARKED MANY OPPORTUNITIES FOR COLLABORATION

The soft matter symposium kick-started a strong relationship between two faculty at VT and JMU. As their collaborative research is underway and the soft matter community continues to grow, these faculty are excited about the possibility for another collaboration through course sharing. Both faculty members have interest and aspirations to create an upper level shared course in soft matter. The proposed plan is to combine expertise from within the soft matter community built across the Commonwealth to teach a new course on soft matter in Physics.



## IN CONCLUSION

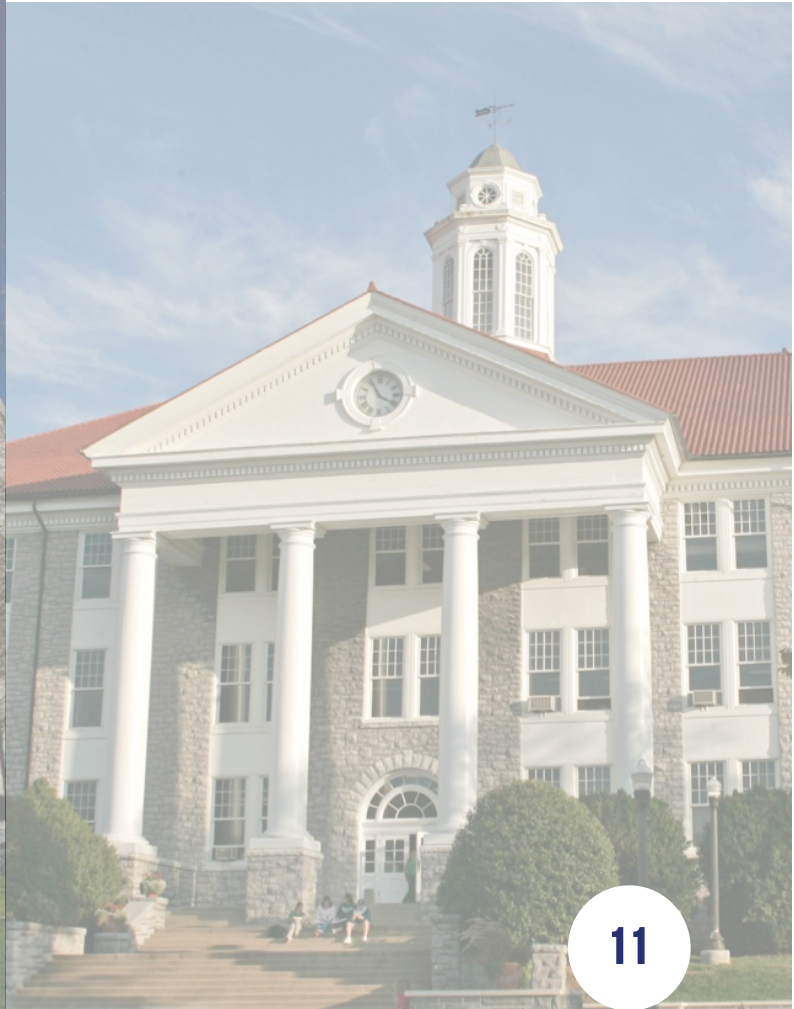
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Two faculty members at VT and JMU leveraged 4-VA opportunities to advance their research teams and to develop a research community of their own within the Commonwealth.

As relationships among soft matter faculty grow, there is **interest in pursuing another 4-VA initiative to offer a shared course** in soft matter by combining expertise from across Virginia.

4-VA has provided a series of opportunities to faculty, such as Dr. Cheng and Dr. Feitosa, to **develop relationships that can lead to a multitude of benefits** for students, faculty, and universities.

Cheng and Feitosa developed a strong cross-institutional relationship and enjoy working together. With collaborative research at the forefront of their work, the two faculty members are looking forward to presenting and publishing their original research alongside the graduate and undergraduate research assistants. Both faculty are hopeful that this **pilot research project will increase the competitiveness** of their submission to national research granting agencies.



#### Image credits

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#### **Mission**

4-VA's mission is to promote inter-university collaborations that leverage the strengths of each partner university in order to accomplish much more than any individual university could achieve alone.

Website: [www.4-va.org](http://www.4-va.org)

