



An Exemplary Collaboration Between the University of Florida and France

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Ranga Narayanan is a Distinguished Professor and Distinguished Teacher-Scholar at the University of Florida, Gainesville, Florida. His research is in the area of pattern formation. This field has applications ranging from earth science, to the fabrication of materials in outer space and on earth, to biomedical science and even to cell biology. As an engineer, Professor Narayanan is concerned with science questions as to how length and time scales compete to form patterns and what fundamental connections can be made between the various physical situations that generate patterns. Applications of his research include ways to “tune” patterns to create better and useful products such as better drug delivery systems and better semiconductor and energy efficient devices.

In 2010, Dr. Ranga Narayanan obtained a [Partnerships for International Research and Education \(PIRE\)](#) [1] award of 3.2 million USD from the NSF, for a project that will lead to the creation of an International center for Complex and Inter-phase Fluid Systems.

Interview with Dr. Ranga Narayanan

Can you explain how this collaboration started ?

RN: The original project was funded by the [Partner University Fund \(PUF\)](#) of the French Embassy in the United States in 2008. The research area was fluid mechanics, and aimed to understand how liquids and gases interact in motion. It had several applications such as space, biomedical, pharmaceutical and food technology. However, in order to encourage students’ mobility, we had to focus on one subject, we chose thermofluids research which studies heat flow and fluids flow with applications in chemical and aerospace engineering.

Besides doing research, this PUF funding allowed us to organize different workshops for the professors and to encourage MSc students to continue for a PhD. It also supported PhD student exchanges and the creation of dual programs with universities such as the University of Lille, Paris-Sud University and Aix-Marseille University. Due to the success of the PUF project, in 2010 we decided to apply to the NSF’s PIRE program. The PIRE project has successfully involved several doctoral students and will expand the collaboration to several areas including microgravity research, energy research and also food preservation.

Can you describe this project ?

RN: One of the fundamental aspects of this project is understanding pattern formation in fluid flow: flowing fluids create patterns in nature and in laboratories. We try to understand the science behind these patterns and if we can improve fluid-based devices by understanding this science. Fluid patterns are affected by forces such as gravity and surface tension. To eliminate the effect of gravity we decided to study the patterns in microgravity. The knowledge gained from such studies would have several applications, including biomedical sensing and pathogen sensing for food preservation. To do so we have collaborated with French team members over several parabolic flight campaigns that took place in Bordeaux, France. The latest campaign occurred in April 2017.

What are the different organizations involved in this research ?

RN: At the start, we were 3 teams for the PUF project and then added more collaborators from the US, France and Japan for the PIRE project. The team now consists of 6 organisations from Japan and 7 from France. Among these, there are three key French laboratories:

- **FAST lab** (Fluides, Automatique et Systèmes Thermiques) from the CNRS and Paris-Sud University;
- **IUSTI** (Institut Universitaire des Systèmes Thermiques Industriels) of Aix-Marseille University;
- **IEMN** (Institut d'Electronique, de Microélectronique et de Nanotechnologie) of the University of Lille.

What do you believe is the key to a good working collaboration ?

RN: To have a good working collaboration, you must have joint responsibility on the project. Joint supervision of the student and joint ownership of research are keys for good collaboration. Moreover, an undeniable asset for the collaboration is the **Chateaubriand Fellowship**. This grant helped a lot: without it we wouldn't have gone so far. It encourages the students, advertises for PhDs and adds to the current collaborations and leverages the work.

What is the next step of the project ?

RN: There is going to be a workshop organized in April 2018 in Florida. The topic will be Dynamics of Interfaces (which is the spatial region between two fluids). It is already very promising, indeed a lot of nations will attend like France, Japan, United Kingdom, India and Israel.



Footnotes

[1] The French National Research Agency (ANR) has joined up with the National Science Foundation (NSF) to fund French teams jointly selected by France and the US under the NSF's **Partnerships for International Research and Education** (PIRE) call for proposals. The multidisciplinary PIRE programme backs American researchers in their commitments to global collaborations whose scientific excellence enables the combined promotion of research and education.