# Interview of the Month May 2015

## Guest: Dr. Mehdi Benna

**Dr. Mehdi Benna** is a senior planetary research scientist and engineer at NASA's Goddard Space Flight Center, and a professor at the University of Maryland. Dr. Benna received a degree in electrical engineering from the Engineering School of Tunis (ENIT), a M.Sc. in radio-wave telecommunication from the University of Tunis, and a Ph.D. in space science from the University of Toulouse.

Dr. Benna specializes in plasma physics, and in the dynamics of planetary magnetospheres. He is also an expert in the development of spaceborne mass-spectrometers. Dr. Benna is a co-investigator on several past and ongoing NASA and ESA missions such as the Mars Science Laboratory Rover, the MAVEN mission at Mars, the MESSENGER mission at Mercury, the LADEE mission at the Moon, and the ROSETTA mission at comet 67P/Churyumov-Gerasimenko.

Dr. Benna's publications include scientific papers on the modeling of planetary magnetospheres and exospheres, comets, and icy moons. He is the recipient of numerous NASA distinctions and awards among which the 2014 NASA Exceptional Achievement in Engineering Medal.

1. **Please explain to us your expertise which is plasma physics and planetary magnetospheres dynamics.**

   As a research scientist I study the interaction of the solar wind (very fast stream of charged particles that are being continuously emitted by the Sun) with the surfaces, the atmospheres, and in some cases, the magnetized environments of various objects of the solar system (e.g. planets, moons, asteroids, and comets). As an engineer, I specialize in designing and building mass spectrometers that help characterize the environments targeted by NASA's space probes.

2. **What are the reforms that you see as priorities in engineering programs in Tunisia in order to gain more visibility and leverage their standards to international levels? What are the techniques, technologies and processes that we can implement in Tunisian engineering programs that could lift the scientific orientation of young Tunisian researchers?**

The engineering program in Tunisia suffers from the same chronic conditions that are ailing the system of higher education as a whole, namely, a lack of purpose, an outdated and archaic implementation, and an underperforming primary and secondary educational stages. If the Tunisian higher education system was compared to a factory that aimed to turn raw material to high commodity goods, one would say that this factory is producing out-of-fashion products that the market doesn't seem to need, using poor quality material, and obsolete manufacturing techniques. Your do not need an expert to recognize that this factory is failing and that restructuring is badly need.

But beyond the grim diagnosis, there is an unprecedented opportunity for rebirth, growth, and success, if Tunisian lawmakers and administrators recognize the opportunity at hand, show vision, and roll out the necessary reforms. Reforms will have to begin by placing innovation and entrepreneurship at the core of the engineering education. In addition to having a solid base of technical knowledge, new Tunisian engineers need to become flexible, resilient, creative, empathetic, and have the ability to recognize and seize opportunities. These skills can only be enabled by an academic environment where creative thinking and practical problem solving are mandated, fostered, and rewarded. Additionally, serious reforms to the primary and secondary educational stages are required in order to inspire young students to pursue technical careers, and to prepare them to the academic requirements of modern engineering programs.

3. **How would you describe, to an Electric Engineering student in Tunisia, what extra curriculum knowledge and tools are needed to become space engineers in NASA or comparable high-tech level?**

As in most high-skill technical professions, a lot of experience and expertise are gained through on-the-job trainings. Space engineering is not an exception, and as such, the prospective engineer is required to peruse early training in the field by accomplishing a succession of well-planned internships in relevant space technology institutions. To cite my example, I completed all the internships required by my engineering school in the research laboratories of the French Space Agency and the Midi-Pyrenees Observatory. Those internships provided me with the basic skills necessary to pursue a career in space science.

4. **Comparing the Tunisian engineering system to the French and US systems, please address the strengths and weaknesses and elaborate on the implications of adopting aspects of the French education system in Tunisia.**

   As you know, the Tunisian engineering education system is heavily inspired from its French counterpart. Both systems put more emphasis on general engineering subjects, and less on specialized professional training. Today, this approach to engineering education is struggling to cope with a global economy that is being driven by high tech and innovation, and where the life span of a product or a technique is often measured in months not in years. The engineering education system of the United-States, while far from being efficient, is more robust and adaptable to the need of the global markets thanks to a stronger primary and secondary education backbone, customized job-oriented curricula, and an emphasis on continuing education that adapts the skills of the workforce to the need of the changing economic environment. However, affordability and accessibility remain the Achilles heel of the science and engineering education system in America, and may threaten the country's position as the world's leader in technical innovation unless addressed urgently.

5. **How did your combined academic background affect your career path from student life to your professional career?**

   Early on in my career, I understood that the formal and general engineering education that I acquired in Tunisia, while sound, was not sufficient for the highly technical field of engineering I have chosen. That gap was bridged through the completion of several internships, and by spending long hours in libraries educating myself in novel space engineering techniques. I was also very fortunate to have had mentors and supervisors who agreed to trade my lack of formal training in space science with my abundant enthusiasm and hard work.

6. **What kind of collaborative research projects we can build between US and Tunisia in the astronomy field? What do you think of using, for instance, social media to increase coverage and reach of seminars and educational programs?**

Space science is inherently based on collaborative research. It is also one of the rare fields of science where data collected by costly and sophisticated assets are made available in a record time to the international science community. As an example, data collected by NASA's space probes are generally available in the public domain, free of charge, within 6 months of their acquisition. That obviously provides opportunities to scientists from developing countries, such as Tunisia, to conduct meaningful research in space science without incurring the high cost of a fully developed space program.

7. **What did you discover across the space projects that could affect humanity and the planet Earth?**

   A large part of the planetary research I conduct has to do with understanding how planet Earth has developed the habitable conditions that led to the emergence of life where other objects of the solar system did not. For example, we currently study with the MAVEN spacecraft how a planet like Mars that was warm and wet 3 billion years ago lost a substantial portion of its atmosphere and became the cold and dry planet that we know today. Understanding the loss processes that acted on the atmosphere of Mars will inform us on the level of vulnerability of the atmosphere of our own Earth.

8. **At what point in your early life have you decided to become a space engineer? Can you describe your experience and contributions in NASA and how could it inspire young Tunisians that might be interested about pursuing your field?**

   As far back as I can remember, I always wanted to be a space scientist AND a space engineer. The "AND" is important, because, while I knew that the two professions were quite different and required distinct sets of skills, I couldn't get myself to consider being one and not the other. Today, I feel very fortunate to be able to work in both capacities. As an engineer at NASA I helped design missions and scientific instruments that visited a multitude of planets, moon, and comets of our solar system. As a scientist I studied exotic worlds that ranged from the hot surface of Mercury to the cold ice shell of Jupiter's moon Europa. While I have been involved professionally in this field for nearly two decades, I am still driven by the curiosity and the passion of my childhood.