



When we are young, we all ask our parents the classic “impossible questions.” Things like: why is the sky blue? Why can I throw a ball farther than a feather? What are those ripples in the pond when I throw a rock in? These are questions which are natural for children—questions that we can ask about observable phenomena. And although they may seem difficult for our parents to answer, they are not impossible. They are not beyond known science.

Children are filled with an innate curiosity that pushes them toward these tough puzzles. As we get older, we are taught that we should only investigate those things that we know can have tangible answers. We learn that we “can’t do” something, or that we cannot figure something out, and instead of remaining innocently undaunted in the face of this quandary, we give up. We stop trying to solve the unsolvable problems.

Not Teymour Darkhosh and Katsunori Mita. They have maintained a passion for the theoretical—problems and ideas that we can investigate theoretically, but whose answers are mostly intangible. The Physics Department here at St. Mary’s has been blessed with two theoretical physicists, an unusual number considering that the entire department is composed of only four professors. Most physics departments contain more experimental than theoretical physicists.

Einstein was a theoretical physicist. He considered problems and equations that are, to this day, beyond the scope of many normal, functioning, even highly intelligent human beings. He was not concerned as much with experimental physics, where we can see the results of attempted problems, but with the world of the unknown—the world behind the world, so to speak. The research of both Darkhosh and Mita stems from some of the same theoretical phenomena Einstein encountered.

Katsunori Mita’s research on the foundation of quantum mechanics expands on an idea that was originally brought up in Einstein’s lesser-known third paper—the idea of Brownian motion, which is an analysis of the random motion of pollen on the surface of water. Mita points out that, in quantum mechanics, a particle is analyzed in terms of a wave, something called “wave functions.” In the standard view of quantum mechanics, the wave aspect of the wave-particle duality dominates. But Mita is developing a version of quantum mechanics in which a particle may be viewed as a particle. He says, “This may sound odd to you since in our ordinary, macroscopic world, a particle is a particle and it cannot be viewed as a wave. But in the quantum world, it is as if the particle disappears.” Mita says that a quantum particle moves with “jitters” and this gives rise to the uncertainty of position of the particle as well as the uncertainty of its velocity.

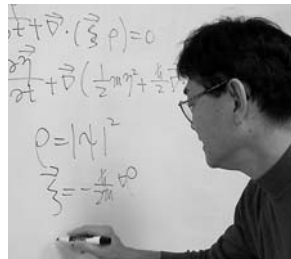
Asking the Impossible Questions

Theoretical Physicists Grapple with the Unanswered

by Wrenn Heisler '99, Editor of River Gazette



Photos by Karyn Søilstad '07



Teymour Darkhosh and Katsunori Mita, professors of physics, constitute the theoretical branch of the St. Mary’s Physics Department. The department is unusual because it has such a high percentage of theoreticians within its ranks.

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Mita realizes that his research, presenting the particle aspect of the wave-particle duality in quantum mechanics, may be controversial in the physics community. He says, “I recognize that my view is controversial and that might make me somewhat ‘heretical’ in the physics community... though I would not be the first one to present an idea of this sort, I think that my paper will contain a concept never discussed in this manner before.”

Teymour Darkhosh, Mita’s colleague,

also studies quantum physics, the physical laws that apply on atomic and sub-atomic levels. He is focusing on a problem in quantum field theory, a theory of elementary particles, the smallest constituents of matter.

The problem is an inconsistency in the current formulation of spin 3/2 particles. On one hand, spin 3/2 particles under the influence of an electromagnetic field propagate faster than the speed of light, thus violating Einstein’s special theory of relativity. On the other hand, it has been shown

that this effect disappears when spin 3/2 particles are viewed in the context of supergravity. Currently, Darkhosh is seeking to understand the source of this theoretical inconsistency and perhaps to develop a sound theory of spin 3/2 particles. Once again, a theory—something which is intangible and may be unsolvable.

Although Teymour Darkhosh is not able to work on this research with his students because it is too advanced for undergraduates, he sometimes talks about it with very advanced classes. He says, “I make it a priority to let them know what is going on in the forefront of the field” of quantum physics.

Darkhosh has retained the questioning nature that so many of us lose after childhood. He loves the idea that when “you find something you can’t do, you have to keep trying.” Darkhosh’s passion for his research certainly embodies this principle and he conveys it to his students. For Darkhosh, St. Mary’s has been the perfect place, enabling him to find the balance of a hands-on teaching environment and an environment where he is free to research whatever he pleases.

Though Teymour Darkhosh and Katsunori Mita research different topics, and may even disagree on some questions within their own fields, they share an inspirational passion for questioning. Both men find a perfect fit at St. Mary’s because it allows them to do their own thinking, not to be pushed by the world of academic publishing into research that they are not truly interested in. As Mita says, “I could not develop my ideas in a research environment where I would have to publish a lot of papers along the line of what is fashionable at the time. Since, at college like this, my life does not really depend on my publications (it depends more on my teaching), I can be free to think and do research of my own choosing. Also, I can involve my students in my research since I can make it accessible to good undergraduate physics majors.”

Nobel Prize-winning physicist Richard Feynman once offered a piece of advice to theoretical physicists: “I think I can safely say that no one understands quantum mechanics... Do not keep saying to yourself, if you can possibly avoid it, ‘But how can it be like that?’ because you will get ‘down the drain’ into a blind alley from which nobody has yet escaped. Nobody knows how it can be like that.” But these two gentlemen are asking. They are on a quest in which the answers may be unknowable, and while many would turn to something else, they are constantly compelled by the very mystery that surrounds them. Mita says, “I have to ask,” and Darkhosh says, “I have to keep trying.” Perhaps the poetry of their work is in the quest rather than in the answer.

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Please check our Web site for a list of employers attending and for details on their hiring needs:

http://www.smcm.edu/careercenter/template-careerctr.cfm?doc_id=3094

Employers can still register to attend this job fair. For registration details, call 240-895-4203 or download a registration form from the Career Services Web site: Go to Services for Employers and from there to Career Day 2005. You can then fill it out and fax it to us at 240-895-4378.