



Arlie Petters Interview



Photo courtesy of Arlie Petters.

Arlie Petters is Benjamin Powell Professor and professor of mathematics, physics, and business administration at Duke University. Petters is a pioneer in the mathematical theory of gravitational lensing.

Diaz-Lopez: When did you know you wanted to be a mathematician?

Petters: I can recall when I first learned in high school about planetary motion. I was gripped by how geometry captures the paths of planets. It fueled my insatiable thirst for the interplay of mathematics and cosmic mysteries.

Diaz-Lopez: Who encouraged or inspired you?

Petters: My grandmother instilled in me the kind of dogged determination and resiliency it takes to pursue mathematical work over the long haul. Alhazen, Kepler, Newton, and Einstein deeply inspired me scientifically and mathematically.

Diaz-Lopez: How would you describe your research to a graduate student?

Petters: I study how gravity acts on light, particularly in the context of black holes and extra dimensions, and dark matter on galactic scales. The mathematical modeling invokes tools from differential geometry, singularities of functions, and probability theory. I also collaborate with astronomers, which involves running simulations, fitting data, and developing models that produce predictions that are testable with near-future instrumentation.

Diaz-Lopez: What theorem are you most proud of and what was the most important idea that led to this breakthrough?

Petters: Well, I won't single out just one theorem; it could cause the others to feel bad. [smiles] To mention a few, I feel a sense of pride by the image-counting theorems I did in gravitational microlensing, the theorem on the link between the opacity of a lens and the geometry of its caustic curves, and the magnification-invariant theorems with Aazami. These results are difficult to infer on physical or intuitive grounds. I should add that as an applied mathematician working on problems in astronomy and cosmology, my priority is to develop and explore mathematical models that fit with the physical problem. Theorems then emerge as a consequence of that activity, but it is the model and its predictions that I am really after. Along those lines, I also feel proud of the mathematical model Keeton (astronomer) and I developed for gravitational lensing by microscopic braneworld black holes in the semiclassical wave optics limit.

Diaz-Lopez: What advice do you have for graduate students?

Petters: Work on something you care about and aim for high intellectual impact, but balance intellectual courage against the practicality of completing your thesis within a reasonable time. Don't be intimidated by anyone

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intellectually, especially by insecure showoffs. Rather, focus on being the best at what you do. Choose an adviser who will take the time to help you develop and flourish.

Diaz-Lopez: All mathematicians feel discouraged occasionally. How do you deal with discouragement?

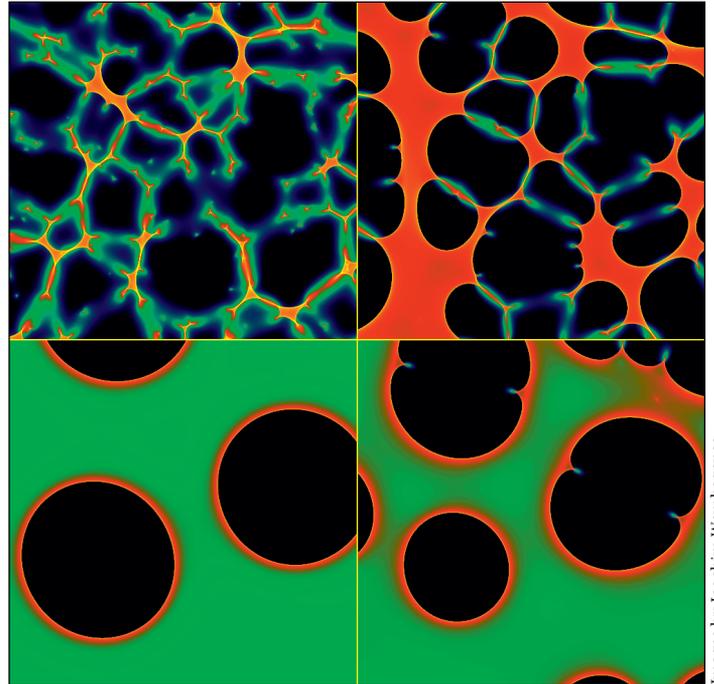
Petters: I actually maintain a sharp separation between my sense of self and my work as a mathematician. This means I take a very clinical approach to the activity. I never, never let what I think or feel about me get polluted by the work. For example, if I make a mistake, I don't view it like something is innately wrong with me. I am human and will make mistakes. If there is a beautiful and deep mathematical result that I was hoping to apply to get a breakthrough in a physical problem and the result turns out to be unphysical or too idealized to be practically relevant, I would immediately do a postmortem to understand thoroughly why it didn't work and then start over again. In a nutshell, I try my best to keep my emotions out of the activity.

Diaz-Lopez: If you were not a mathematician, what would you be?

Petters: I would likely become a builder. I love the synergies among design, engineering, logistics, financial planning, and interpersonal skills that come with being a successful builder.

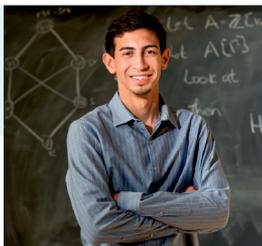
Diaz-Lopez: If you could recommend one book to graduate students, what would it be?

Petters: "Emotional Intelligence", by Daniel Goleman.



Images by Joachim Wambsgans.

Examples of the caustic curves and shadow patterns due to gravitational lensing by stars with a background shear and smooth distribution of dark matter. The geometry of the caustic curves is connected with topological invariants of the lens.



Alexander Diaz-Lopez is a PhD student at the University of Notre Dame. Diaz-Lopez is the first graduate student member of the *Notices* Editorial Board.