



AMERICAN ASTRONOMICAL SOCIETY

Enhancing and sharing humanity's scientific understanding of the universe since 1899.

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The State of the Universe

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From Galileo's first glimpse through a telescope to the advanced satellite imaging technology of today, the numerous **direct** applications of astronomy research have been well documented. But I'd like to talk for a few moments about the **indirect** benefits that can come from a science education in astronomy, using myself an example.

When I was 6 years old, I was fascinated by the nighttime sky, and I read two books in first grade, one called "What's Up There?" and the other simply called "Astronomy" by Isaac Asimov. That was when I first decided I wanted to be (as my 4-year old son says) "a scientist who studies the stars." My parents and grandparents were not scientists, just regular working-class people, but they instilled in me a deep admiration for science as the noblest of human pursuits – our quest to answer the basic questions of nature. And I wanted to work on the biggest questions of all – understanding the structure and evolution of our Universe.

I followed that passion for about 25 years. From the Bronx High School of Science in New York City, to majoring in Physics at Stanford, to a PhD in Astronomy at Columbia, to postdoctoral research in Astrophysics at Caltech. As an astrophysicist, my NSF-funded research included building computer simulations to test theories about the expansion of the Universe, and analyzing data collected from radio and visible light telescopes that was used to search for new planets and to map the echoes of the Big Bang. I was quite happy following my first intellectual love.

But of course we don't always end up with our first love, and while I was at Caltech, I started to get interested in the world of Business. In 2001, I joined the management consulting firm of McKinsey & Company, where I learned a whole new set of skills relevant to the business world, but I also discovered that the skills I had learned in astronomy were both incredibly rare in business, and incredibly valuable.

Our clients, some of the largest companies in the global economy, were asking questions like "Which segments of the marketplace are most attractive for our brands?" or "How can we predict the value of a new customer?" or "How much money should we spend on different kinds of advertising?" The skills I had learned in my astronomy education – computer programming, statistics, and data analysis – uniquely enabled me to tackle those kinds of problems in new and powerful ways.



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I was particularly intrigued by the application of scientific methodologies to the area of marketing. In 2005, I became a partner at a small marketing firm called Rosetta – which focused on using advanced data analysis to devise business strategy, improve product development, and optimize marketing programs for Fortune 500 companies. When I joined Rosetta in 2005 there were about 40 employees. When I left in 2008 there were over 600, and in 2011, Rosetta was acquired by global advertising company Publicis for \$575 million.

In 2008, I joined a small company of about 15 employees called MediaMath. Advertising exchanges had recently come onto the scene – these were exchanges where digital ads could be bought and sold in a real-time auction, not unlike how stocks are traded in stock markets. MediaMath's vision was to become a technology platform that enabled real-time trading of digital ads.

My first order of business at MediaMath was to build technology and software to execute that trading in an optimal fashion. The challenge was doing that for well over 1 million potential transactions per second (roughly 7 times the volume of the NYSE), all in real-time. There were no off-the-shelf technologies that could handle this massive amount data, so instead I had to bring my astronomy training in math, computer programming, and analysis to bear in developing algorithms to solve this problem.

Those algorithms became the engine for MediaMath's global technology infrastructure that now optimizes hundreds of millions of dollars in annual advertising spending to improve results for thousands of businesses globally, including many Fortune 100 companies. MediaMath now has over 300 employees, and does business in the US, Canada, Europe, Asia, and Latin America.

Science PhDs bring invaluable new skills to the business arena, which simply cannot be sourced elsewhere. Not just the strong quantitative, problem-solving, and technical skills that come from advanced math, physics, and computer training. Not just the objectivity and analytic rigor that comes from learning the scientific method. And not just the strong communication and collaboration skills that come from working in research groups and presenting findings to the community.

Science education brings entirely new ways of looking at problems, like understanding that the methods used to predict the decay of a subatomic particle can be applied to predict the next purchase of a consumer.

Science education brings a “big-picture” perspective and a longer-term view than one typically finds in the business world. A perspective that comes from thinking deeply about a problem and looking to understand the entire solution, not just the most obvious and immediate parts.

Science education brings a creativity and a curiosity that is at the heart of the scientific mind, that continually drives us not only to seek the best result for the bottom line, but to understand why results are what they are, and how they can be reproduced.



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I've seen first-hand how the application of the skills and training derived from an astronomy education can deliver real-world impact for business, and why the *Harvard Business Review* called "Data Scientist" the sexiest job of the 21st Century.

But the skills alone are not enough. Students need to be provided with the **motivation** to build those skills in the first place. Balance sheets and bar codes simply cannot ignite the imagination the way that new planets, exploding stars, and distant galaxies can – the kinds of images we just saw Dr. Helfand present. Whether students go on to pursue careers in science or not, astronomy and astrophysics are unique in that they open minds—literally—to an entire Universe of possibility and provide a gateway to the acquisition of knowledge and skills that can later be applied in countless other arenas.

Ultimately, it's about connecting with a young mind through a passion for ideas, which is why 6-year olds who look up at the night sky, get excited about studying astronomy.

