

A Liberal Dose of Stardust

Dale W. Smith
Professor & Planetarium Director, BGSU Physics & Astronomy
Address at the Phi Beta Kappa Initiation
Bryan Recital Hall
Bowling Green State University
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The scale of the cosmos

Think for a moment about where you are. You are in Bryan Recital Hall, in the Moore Musical Arts Center, on the campus of BGSU, in the city of Bowling Green, in Wood County, in Ohio, in the USA, in North America, on the Earth, third planet from the Sun in the Solar System, in the Orion Arm of the Milky Way Galaxy, at one end of the Local Group of galaxies, in the outskirts of the Local Supercluster of galaxies, somewhere in the visible universe that is about 15 billion light-years across—that's about 10 sextillion miles—and that in turn is part of a whole universe that is at least a thousand times farther across than the mere 15 billion light-years we can see out to. Within this incomprehensibly huge cosmos, you are on the surface of a planet whose interior you can't get to and whose atmosphere is so thin that if you go up more than 5 or 6 miles from the surface, you will die.

This universe you are in is almost completely empty and its stars are unbelievably far apart. If you reduced the Sun to the size of a grape and put it *here*, the Earth would be a grain of sand in the front row; the orbit of Pluto, the most distant planet, would roughly be a circle around the perimeter of the building; and the grape for the next nearest star would roughly be in ... in Severance Hall in

Cleveland. The brain that has brought you here lives in a tiny microcosm of a body in a vast, vast universe.

Stardust

This universe is populated with stars. Like the Sun, most of these stars shine. They shine because they are hot, and they are hot because they are big. If the Earth were a basketball, the Sun would fill this room. Stars are born in huge clouds of interstellar gas and they churn out their energy by the power of nuclear reactions. In the first of these reactions, they convert the hydrogen they are made of into helium, as the Sun is doing today. Later in life, they ignite reactions that convert the helium into atoms of carbon, nitrogen, and oxygen. You are made of carbon, nitrogen, and oxygen. Can you guess where your atoms came from? Still later in life, some stars convert their carbon, nitrogen, and oxygen into atoms of metals, light and heavy metals. Planets like Earth are made of oxygen and of light and heavy metals, sometimes mixed together into rocks and minerals.

After stars make the atoms for life and atoms for planets, they recycle these atoms to space. Some stars explode; some stars puff their atoms away more gently. However they do it, they recycle their atoms to space. These atoms mix in with the gas of the interstellar clouds, and the clouds give birth to the next generation of stars, stars made from clouds enriched in atoms for planets and atoms for life. So around these newborn stars, planets form, and on at least one planet around one star, eventually, living creatures arose. That's you. You are made of stardust—atoms made in distant stars—you and your planet and everything around you. That is a liberal dose of stardust.

Alone in space

Now as astronomers look out into space, we see wondrous things—a planet Mars with volcanoes bigger than Ohio, a planet Jupiter filled with liquid hydrogen, and a planet Pluto packed with steel-hard ice. We see stars that would dwarf the Sun, we see the tortured remains of former stars, we see great galaxies that hold a trillion stars or more, we see the afterglow from the day our universe began. We see the stuff of science and the stuff of science fiction. We see a host of cosmic puzzles that perplex the minds of astronomers and inspire them in their work. Now we have even found some planets around other stars.

We are hopeful that the universe is blessed with an abundance of planets with life. We hope that somewhere in the vast darkness there may lurk our cosmic cousins, made of stardust as we are, peering into space as we peer, and questing as we quest for understanding and living as we do a rich life of the mind in a way that makes us human. But so far we have not found our cosmic kin. All that we see in space—planets, stars, whatever—is inanimate, unconscious, unknowing assemblies of atoms. As optimistic as we are in the hope for cosmic kin, so far at least, we are it. We and the other sentient species on planet Earth. We do not know of any other stardust that thinks, that looks outward and inward with curiosity, that seeks to understand itself and the world and universe around itself. So we are it, and our cosmic cousins, if they exist at all, are very very far away. We may well be alone, or at the very best, rather lonesome in this cosmos.

The responsibility for liberal learning and inquiry

And that, I think, places an enormous burden on us. We are the one known part of the physical universe that inquires, that thinks beyond itself, that can seek to look at the world in a curious, liberal, and integrating way. We humans are the eyes of the Universe on itself, and we must not fail that responsibility. And *we*, as members of Phi Beta Kappa, bear a disproportionate share of that responsibility. The 1400 cm³ of gray stardust inside your head is a central tool of yours to think and to inquire in a curious, liberal, and integrating way. If you don't do it, few others will.

By accepting membership in Phi Beta Kappa, you accept a well-deserved honor for your achievements. But you also accept a responsibility to use your insight, your power of thought, your capacity for work, and your moral compass not only in your studies and, later, your profession, but also to examine the world in this curious, liberal, and integrating way, to seek the company of others who do the same, and to support them. The honor will accompany you for the rest of your life, and so should the awesome responsibility. I hope that you will find the sense of responsibility to be much greater than the sense of honor. If you do, you will join the ranks of those who have carried forward the cause of liberal inquiry espoused by our society since it was founded in the year of our nation's independence. Now, you are one of the custodians of this cause. Now, you bear responsibility for it, and its future lies in part in your hands.

P&R and Great Ideas

This is not an easy cause to carry, but it can yield unexpected dividends. An example. When I was a college freshman ready to major in the tongue-twisting discipline of astrogeophysics, I took a year of philosophy and religion, or as we all called it, P&R. Why? Surely I didn't need it for my science major. How would it help me to solve an equation or to measure a voltage? But it was a requirement, and I bore with it, not always cheerfully, but absorbing tomes by Kirkegaard, Niebuhr, Hartshorne, and others that alternately authenticated, challenged, stretched, matured, and in some cases modified the beliefs I brought into the class. I saw earnest conversations between my science profs and my philosophy profs. I began to understand that there were connections between these seemingly disparate fields. Later, I came to see that some of the best scientists were ones whose undergraduate education was a liberal one, not a technical one.

What I could never have guessed as a freshman in P&R was that a couple decades later, I would be *teaching* a course like this one, a section of Great Ideas here at BGSU. Was I scared going into it? You bet I was, though not as scared as the night before my freshman year-end P&R final when a once-in-a-generation huge blazing red aurora wrapped around the entire sky, for hours, filling it with wrathful fire! We all knew that it was a message from God to study for that final, or else! But back to the Great Ideas course here—of course I was scared to be teaching it—it was so far outside my area of expertise. But that was also the attraction, and a chance to authenticate and to repay the lessons that had begun to seep inside me a generation earlier. And, in retrospect, agreeing to teach this most liberal of courses that cuts across the disciplinary

boundaries was perhaps a necessary responsibility of the science student who had been entrusted with a Phi Beta Kappa membership years before. And for the record, the reward in teaching this course was in the experience, not in the paycheck: I taught it as 3-credit unpaid overload.

Challenges

A central aspect of liberal inquiry is to maintain interests that, like the Great Ideas course, bridge across disciplinary boundaries and to maintain a lifelong attitude of learning that embraces this breadth. This is very difficult to do, even in an academic community, where we espouse this but do not always practice it.

To the student initiates, consider your invitation to Phi Beta Kappa as a challenge to view those area requirements not as something ancillary to your real education, but as an integral part of your education as the courses in your major area. Consider it as a challenge to attend campus lectures and cultural events—including those offered by Music, Theater, the Planetarium, and others—that lie beyond your area of major interest. Consider it as a challenge, indeed an obligation, to practice a broadening culture of learning wherever you go. Just as what we informally call Graduation is really a Commencement, a beginning, consider this little ceremony today not so much an endorsement of your achievements as an invitation to a lifetime of learning and liberal inquiry.

To my faculty colleagues, do we practice what we espouse? Do you occasionally attend a colloquium outside your own discipline? When I went to one recently, someone asked me why I was there. Have you actively supported, by your own annual attendance, the interdisciplinary public programming—if I may be forgiven a close-to-home example—that gives our planetarium its distinctive style, a style very much informed by the liberal education I had as an undergraduate and in high school. Have you supported our student musicians by perhaps going to a recital once a year? At one I attended a few months ago, a conversation led to arrangements for a choir concert in the Planetarium that will take place this very afternoon: the BG High School Madrigal Singers perform a couple hours from now. Heretical—a music event in a science room! Science is, I think, almost surely seen as the most remote and inaccessible of external disciplines, and seen as sufficiently intractable to outsiders that one may be excused for passing over it in one's own quest for lifetime learning. Thus I can tell you that the job of running a public science facility is often a more lonesome and frustrating one than you would probably imagine. We faculty face enormous challenges on our time, energy, and focus, but we too must remain lifetime learners across disciplines, supporting our colleagues, and teaching our students by example, learning with them and from them, sometimes in the most unexpected of ways.

Jagath

Consider, finally, an example of unexpected learning that I think sets a model and challenge for us all, and which needs an introduction.

I recently had the privilege of serving as President of the International Planetarium Society, a role that meant, in two years, one hundred boarding passes, 200,000 flight miles, an astronomical number of airline meals (the best—Thai Airways International), and, most rewarding of all, energizing contacts with colleagues and friends around the world. The world has about 2000 planetariums, roughly one for each star you can see in the night sky. Half of these planetariums are in the United States, about a fifth are in Europe, a fifth in Japan, and a fifteenth in China. The remaining 5% are scattered over all the rest of the world. In contrast to the 40 domes in schools, universities, and museums in Ohio, there are (or at least there were) three in Iraq, and in the developing nation of Sri Lanka, exactly one to serve its nearly 20 million people. Just one, and it is filled to capacity nearly every day of the year. In this small developing country where the per capita income is 1/25th of what it is in the US, the literacy rate is nearly 90%, one of the highest in Asia, a sign of that country's investment for the future in education.

In February, 2000, I spent nearly a week in Sri Lanka to help organize a year 2001 conference that would bring planetarium people from five continents together to work with Sri Lankan astronomy teachers and students—teachers and students who unwittingly inspired us far beyond whatever we could have shared with them. On one of the days on my planning trip, I found myself seated beside Sir Arthur C. Clarke in the planetarium helping to hand out prizes to winners of the national astronomy science fair. The next day I found myself in a car bouncing down a jungle road in the middle of nowhere. Soon the driver turned down an even smaller, dustier lane and then we parked in front of a small 3-room

adobe hut that was home to Jagath, his mother, and his brother. I had handed him a prize the day before, but didn't remember him from the sea of other faces.

But my host—himself a national treasure—had said we had to go see him, and soon I saw why. He had just finished 2nd in the national junior engineering competition. A third of the tiny house and an entire exterior wall were given over to his self-made laboratory/workroom and wildlife museum. Where I saw a stifling hot and humid room, Jagath saw a space where his mind could soar in a dozen directions. Where I saw a featureless jungle, he saw a biological wonderland. Where I saw road kill, he saw precious specimens. Where I saw an overgrown track and unclimbable rocks, he saw a pathway to his astronomical observatory. Where he saw the esteemed president of an international society, I saw a student who had much to learn from a young man who found inspiration everywhere he looked, and who, quite unawares, passed that inspiration to most people who met him, including his distinguished visitors.

In poverty, he found inspiration and abundance. In our richness—and we at this modest state university on the edge of the American heartland are incredibly rich—in our richness we must find our inspiration and our responsibility to use our dose of stardust beyond what we might think possible. If with all you have at your disposal, you can do as well as this modest young man in the jungle, you will have done very well indeed. You will have begun to fulfill the responsibility that you inherit today as a new member of Phi Beta Kappa, and you will have begun to fulfill the potential that lies within you as a liberal dose of stardust.