

The Revolution in Cosmology
A Mensa Colloquium at Albany, NY
—“Stimulation for the Uncommon Mind”

"There is nothing wrong with your television set. Do not attempt to adjust the picture. We are controlling transmission. If we wish to make it louder, we will bring up the volume. If we wish to make it softer, we will tune it to a whisper. We can reduce the focus to a soft blur, or sharpen it to crystal clarity. We will control the horizontal. We will control the vertical. For the next hour, sit quietly and we will control all that you see and hear. You are about to experience the awe and mystery which reaches from the inner mind to... The Outer Limits."
— Opening narration – The Control Voice – 1960s

In the beginning ...

I've been to many technical presentations and felt somewhat prepared for a "better-than-average" event, but beyond expectations what followed was priceless. There were 300 registered guests with more in a holding pattern ready to pounce on cancellations. I didn't expect so many foreign attendees but that testified to the appeal of the speakers. Beyond America they came from Canada, Spain, Poland, and as far as Australia to listen; some were sitting university theoretical physicists from those countries, and the ex-nationals were quite friendly and personable. Food & service were both very good and some fuzzy thought reminds me I had a nice room, but the company was far more distracting, the surroundings comfortable & refined, and a sense of restrained anticipation was evident everywhere. The Albany M-crew sponsored this event and promised a (forgive me this: just once ==>) stellar line-up and we were not disappointed.

As a 2 year warm-up to this event Doc Harry Ringermacher gave RG, AG, & WG seminars across America: Boston, Las Vegas, Chicago, New Jersey, New Orleans and more. I've heard several, each with different emphasis, but all focusing on Albert Einstein: his profound insights, papers, and speculations, all of which began in 1905. Einstein's projections so threatened established wisdom that they became the focus of the most unprecedented peer review for the past hundred years – and it still continues. Because of this transistors, lasers, microwave ovens, & cell phones are in common use today; our GPS works reliably because of known relativistic corrections; the subatomic world was exposed and nuclear power, particle physics, quantum energies are not only studied but exploited. The photoelectric effect is extensively used in all our orbiting satellites including the Hubble, Spitzer and COBE. All of this now warms to the colloquium topics and brings it full circle: you see when you look out far enough with sufficient clarity you're not only looking into distance but back into time as well ... and what a view!

Presenters & Topics

For brevity in-depth descriptions of colloquium topics are available online. Presentations were detuned for fledgelings but still powerful, fast paced, satisfying & saturating. Equations were at the associate level and numbered very few. Each speaker was restrained in only one way: "If a picture is worth a thousand words, then video graphics are worth a million"; and these folks did rise to that challenge. The graphics alone were excellent & the computer video simulations fully absorbing. It's remarkable that all of the presenters stayed compartmentalized: none stepped on others' toes, but periodically some added information to the prior speaker base; too smooth: it must've been choreographed.

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- George Musser, editor for Scientific American Magazine, gave an overview with emphasis on new precision in measurements of the cosmological expansion, cosmic microwave background radiation, and the concordance model that accounts for all current physical evidence to date. Also, the pursuit of the Holy Grail: a theory unifying relativity and quantum mechanics: what the theories were, their conflicts, & why it was important to resolve. Also the need to explain how order has emerged in the universe from the apparent randomness & chaos of the Big Bang. Copernicus would have been beside himself.
- Astrophysicist Francis Wilkin explained in laymen terms various methods of distance measurements and which ones are reliable. For instance visible triangulation and Cepheid variables take us to the center of our galaxy: ~25K light years beyond which spectral shifting, as calibrated by Type1A supernovae, is a must. For those of you who need to know, the universe is roughly 14 billion light years in radius; it is expanding (flat: $\Omega = 1$) and the rate of expansion is increasing; that one fact alone is dazzling. Matter began forming when the energy density decreased permitting a temperature drop to 10^{12} Kelvins: that's well into the hundred billion degrees range. Elements beyond boron all came from interstellar explosions, and therefore as a “carbon unit”, you are really a StarChild (but you suspected that already).
- Astronomer Vera Rubin's careful Doppler measurements on all parts of the Andromeda galaxy noted they didn't follow Newtonian laws of motion. This troublesome finding was later multiply validated. Inverse square laws for shell density decreases and shell volume increases apply even on the galactic level. Observations suggested the influence of a lot more matter than could be seen; like nine times more, and radially far, far out from the galactic edge. And so the body of evidence for Dark Matter (DM) in the universe, as inferred from its gravitational effect on normal (Baryonic) matter, began to build. The trouble is that all visible matter in the universe is now projected to be 10 percent of the total; the rest is DM. Ergo, we are not the principal players here.
- Princeton astrophysicist Jeremiah Ostriker also studies dark matter (DM) and dark energy (DE) effects. For instance, emergences of new galaxy formations in the Coma Cluster shouldn't happen because density of matter in the universe has declined to current levels; and yet they are appearing. DM & DE are the primary culprits in the universe expansion, and these combined with the bright stuff we can see finally drives the cosmological constant to unity (1.0). Apparently Einstein's self-castigating “blunder” wasn't such a mistake after all. Ostriker's latest model using the cosmic background variations and including dark matter produced a video slowly simulating the visible universe expanding from the Big Bang to today, predicting and plotting all known visible macrostructures - including our miniscule galaxy - and the well known

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6 billion light-year Great Wall. We watched this projection generated inside a pseudo cube 28 billion light years on each side.

- Theoretical physicist Lee Smolin has an academic pedigree as long as your arm. A purist at heart, he views the current cosmology revolution as incomplete until five unanswered problems are solved, among them: rectifying quantum mechanics & relativity, unifying different forces & particles, finding what determines the masses of particles. He is String Theory's vocal challenger. Relatedness of subject & observer reference frames is needful for proper theory unification and essential to the advancement of scientific understanding ... proof. Apparently, just to begin measurements confirming quantum effects at several magnitudes above the Planck Length a particle accelerator the size of our galaxy is needful; for confirmations at the Planck Length itself, however, a universe-sized accelerator is required - this could be daunting. More of his discussions are available in two books: “The Trouble With Physics”, and “Three Roads to Quantum Gravity”.
- Theoretical physicist Brian Greene was our keynote speaker and the enthusiastic progenitor of String Theory. A graphic sojourn took us through the world of atomic physics leading to subatomic composites like baryons, quarks, photons interactions with matter, and finally into string geometries, and the very structure of empty space. Imagine, if you will, an elevator that doesn't go down in the classical sense, but smoothly shrinks to 1/10 its former size in the first instant; then 1/10th its new former in the next instant, and then 1/10th again, and so on, until it is as small as current theories allow. Each reduction showed the scaled views as background to our diminishing elevator: fabrics, molecules, atoms, then subatomic particles, photons, and finally you're at the 32nd “floor” below the centimeter size where Planck length structures exist: and there is lots to see. Accordingly matter is not amalgams of point masses but interacting vibrations of associating string-loops on P-branes and M-branes. His theory is elegantly complex with seven more, necessary dimensions; adding the time dimension makes it eleven. In quantum mechanics dualities and probabilities are necessary and also present with strings. His book “The Elegant Universe” although detuned for the uninitiated is very detailed and written in a comfortable tone, but I think a single reading alone is hubris: especially at the end.
- NASA lent us their propulsion guru Marc Millis for the wrap-up session featuring Breakthrough Propulsion Physics. His work focuses not just on the physics but more importantly confronting paradigms that limit us to conventional methods & wisdom. Issues with chemical rocket propulsion are twofold: mass & time. Traveling to Andromeda (or was it Alpha Centauri?) in reasonable time will take a fuel mass the size of planetary Jupiter, and a similar quantity again to decelerate once you arrive. Earthbound vehicles also share this “sweaty palms quantity” issue; e.g.: liquid hydrogen in cars. However, Star Trek fans take heart; the feasibility of space drives, warp drives, and worm holes are now being seriously discussed in reputable journals, but we could still have a bit of a wait. Budding wisdom suggests it might be feasible

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to move “a chunk of space and all its contents” through far distant space-time, rather than just a single object. Stay tuned for more developments.

But there is some bad news: real estate values are going to fall. The dark matter of Rubin and Ostriker interacts with itself and has intertwined two neighboring galaxies: Andromeda and our Milky Way; apparently we have captured each other. All galaxies are speeding away from us: true, but refined measurements show that Andromeda is decelerating and the video modeling simulation illustrated just how the two will collide and blend about 6 billion years from now. So set your calendars; we already have front row seats for the most riveting galactic show in the local cluster! I can hardly wait.

Reflection

This was an event not to be missed: a captivating ride from the microscopic through the macroscopic into the galactic and onto the universal by enthusiastic speakers who’ve spent a lot of time in the crucible of peer review. The gleanings into their personalities and humor were an unexpected bonus, and being able to direct pointed questions to world class experts and receive focused, tailored and sometimes playful responses was fully enjoyable. Their insights are so clear they can reduce the profoundly complex to understandable parallels, humorous anecdotes, personal asides, and one leaves feeling as though the topics could be within reach of personal mastery. I was flattered.

Finally, when you do the math and account for cost of conference rooms, a buffet with carving tables, two seated dinners, beverages and such for 200+ people, it seems there wasn’t much left for the speakers. So, why did they come? Perhaps we should ask Doc Harry. Just look for a slender, white haired guy, with a mustache and twinkle in his eye that, remarkably, bears a mild resemblance to Einstein; or his wife & complement Judy Keating, President of MONNY, who inspired and labored equally: they know. It was a bargain at twice the price.

... and for a brief couple of days the world stopped turning, time stood still, and I was once again absorbed in wonder and “*the awe and mystery which reaches from the inner mind to... The Outer Limits.*”

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