Michael Siberry and Kate Forbes in 'Candida' at McCarter through April 11. Review, page 21.

Cash from E-Bay, page 4; Rebranding the Momo Brothers, 8; Harlem boys sing in Trenton, 42; Greg Olsen, astronaut, 54.

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THE UNIVERSE TO GO

Aram Friedman's portable planetarium brings astronomy to the classroom.

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Are the Stars Out Tonight? Digitally, Yes.

Remember Mars last summer burning a red hole in the fabric of the sky? For a week following August 27th, the War God's planet glowed like an pulsing ember as we watched from our backyards. Spirit and Opportunity, the latest Rovers for NASA's Mars Probe are now tantalizing us with images of eroded, dry stream beds. Where there was once water — Life? Of course we are driven to explore it. We must.

But unlike expeditions of old, this time, the thrill of Mars is not to be reserved for the explorers alone. Planetariums in our region have made comprehensible the divine artistry of the skies, without taking away any of their astronomical wonder. They offer to take us on a virtual journey to the red planet — showing how close he will come in the future and how his most intimate features appear in real time.

In New York, the Hayden Planetarium at the American Natural History Museum offers an eye-boggling view of Mars as the visitor flies through a virtual universe. In Philadelphia, the Fels Planetarium at the Franklin Institute programs a special visit to Mars. In Trenton, the state's largest planetarium, located at the New Jersey State Museum, features Mars in this month's sky shows, as does the small planetarium at Raritan Valley Community College.

And in Princeton, entrepreneur and engineer Aram Friedman dreams of using the latest digital technology to develop the next planetarium generation. Friedman led the team that rebuilt the Hayden Planetarium's presentation technology, and now he has opened a Nassau Street office for his new company, Ansible Technologies, to sell a $25,000 portable microdome. This 45-inch digital dome can be used in classrooms to teach everything from astronomy to history. Material comes downloaded directly from the International Space Station. Real time displays can be seen. Friedman envisions a day when, in addition to children being transported into the big city to see a planetarium, the planetarium can be brought to the classroom.

Sky Views: *Aram Friedman uses digital technology to create a portable planetarium with a view that he says compares favorably to that of the big planetariums.*

For now, Friedman is applying for loans and giving tours to schools. He is presenting a paper on the current state of technology for planetariums at a prestigious convention the week of April 15 at the University of Arizona. NASA officials are urging him to apply for a Small Business Innovation Research grant, among others. Even though Friedman admits he cannot predict a return with any degree of accuracy, investors are lining up.

Everything, including Friedman, is quickly packable and portable; ready to take off in a minute. In his small office, Friedman invites this reporter to witness a demonstration of what he names "The Portable Microdome." Deftly he rummages through huge crates and begins unsnarling the coils of wire that will soon immerse me in the universe. As he works, he asks my favorite constellation. I answer Orion and he responds, "All right, we'll go out that way.

Orion, that most commonly pointed out constellation, haunts the twilight of our low southern sky. He is most easily observed by the three-star belt cinching his manly figure. Renowned by the ancient Greeks as the greatest hunter, Orion nightly squares off against Taurus the bull who hides in his shoulder the much lusted-after Pleiades, those seven lovely sisters. At the tip of Orion's sword shines Sirius, the dog star whom Hercules dispatched with his famous club. From our back yards, we see these constellations just as the old planetarium would have shown them: flat and twinkling.

But now the digital kicks in. Projectors focused on the dome, joystick in hand, Friedman now guides my absorbing journey. We begin on the earth, today at Princeton. He flashes a red grid one light year wide across the screen and then a red dot on where the sun would lie. "We need guideposts as we move through space," he smiles. "After all, you always need to know how to get home."

With these albeit artificial reference points established, Orion in all his glory stands before me. He has not seemed so clear since I watched him atop Mount Kilimanjaro. Then we lift from earth, moving toward him. We pass through the Kuiper belt: a group of asteroids and cosmic dust bits just beyond Neptune's orbit. We zoom in for a look and I get my first experience of Friedman's promised "immersive environment."

As we head out toward Orion, Friedman sends out individual lines, like tracers from our vantage point to each of the constellation's stars. "We are no longer earthbound," he announces, "and what most people completely forget is that the sky is not flat. The stars in Orion are three-dimensionally placed throughout the universe. They have depth." Sure enough, as we change our perspective, rushing one, two, then ten light years from earth, the great Greek hunter's arms begin to distort.

With a flick of the button, Friedman puts Orion behind us and points us back earthward. He sets up a cube-shaped bound-

ary box in which we can focus on the Hades star cluster. I am boggled.

Friedman's office features a photo of the l934 New York skyline, where, bristling with scaffolding, the marvelous feat of the Hayden dome stands caught in mid construction. This photo, spanning the entire far wall, greets visitors and reminds its owner that technology moves ever forward. The setting seems somehow appropriate to the man who has grabbed the new technology and helped stargazers take that quantum leap from earthbound observations out to viewpoints among the stars themselves. Friedman is a man ardently committed to God's universe (or the skies) and to man's best ways of displaying it.

It was not always so. Friedman's sense of astronomical wonder remained dormant until l996. Growing up in Paramus, where his mother was a professional singer and his father a professional animator, Friedman spent more of his time focused on the workbench than the stars. As a youngster, he learned machining and welding at Hackensack's Manpower Training program. At 18 he entered the City College of New York intending to study liberal arts. But after two years, an up and coming electronic gadget caught his eye.

Computers held a galaxy of capabilities which Friedman jubilantly explored and enhanced. For the next decade, his nights were spent learning both hardware guts and software programming at the Metropolitan Technical Institute, New York Institute of Technology, and finally New York University. By day, he plied his evolving knowledge to the benefit of network television. Starting as a field engineer for CBS News and CBS Sports, he learned how to install remote data networks for everything from NFL playoffs to brushfires.

By the mid '90s, working for NBC and MTV, Friedman's animation and graphics expertise began to win him renown. As each of his latest 3D and real time graphics innovations hit the air, Friedman was inadvertently writing his resume on the tube.

Meanwhile, in l996 the American Natural History Museum had begun design on the mammoth Phineas and Sandra Priest Rose Center for Earth and Space, featuring a somehow marvelously upgraded Hayden planetarium.

The Hayden Planetarium dates from l934, when Charles Hayden, a Boston financier and philanthropist, stepped forward as the chief benefactor.

Friedman envisions a day when, in addition to children being bused to the big city planetarium, the planetarium can be brought to them.

Throughout his life, Charles Hayden had believed that everyone should gain "a more lively and sincere appreciation of the magnitude of the universe...and feel the immensity of the sky and one's own littleness."

Born to a prominent Boston family in 1870, Hayden tinkered his way through the Massachusetts Institute of Technology. Despite his formal lifestyle, exasperated family members claimed that he was never more at home than when fussing with some strange mechanical object in his rolled up shirtsleeves. Two years after graduation, Hayden took his engineering knowledge to market, founding the wildly successful Hayden, Stone & Company brokerage house. He began investing in copper stocks, diversified into a host of inventive companies during World War I and made himself a fortune. At the end of his life, in l937, this amazing financier and philanthropist had been elected to 58 boards of directors and had established the $50 million Hayden Foundation.

The Hayden Planetarium was an instant smash hit. Opening in l935, it drew record crowds to the Big Apple. Tourists happily trekked up from midtown shows to 79th Street and Central Park West to witness the heavens manipulated for their pleasure. The projections on the 75-foot dome rotated in all directions, displaying the solar system and the constellations from any point on earth at any given date in history. This planetarium highlighted the World's Fair in l939 and continued to amaze patrons for the next three decades.

By l997 the old Hayden was torn down and a new dome began to be constructed, yet no one really knew what would be inside. In 1998 six different video and digital design companies sent bids for the planetarium projection project, but no one at the Natural History Museum could read them. Their scientists were more at home with hieroglyphs than Fortran.

So Friedman, then an independent consultant, was invited in to review the bids and select the graphics installer for the new Hayden Planetarium. "I quickly saw that no one company had the stuff for the job," recalls Friedman. "There were a handful who could project video programs, showing a flat, linear movie."

"One other could play a computerized database in real time but it was only a series of dots and lines . . . like the very first computer games." Friedman decided that somewhere out there lay the next giant step in planetarium technology and the museum gave him the go-ahead to find it.

Thus early in l998, as director of engineering for the upcoming Hayden Digital Dome, Friedman gathered 15 subcontractors into an inventive team. The result was a breakthrough in both technology and experience. In the old planetarium, the viewer sat earthbound, able to see the virtual stars from any location, at any time on the globe. Now in the new Hayden, for the first time, the viewer can move limitlessly through a three-dimensional universe. He can study the moon while moving past it; observe the Big Dipper, then pull back from it to the edge of the galaxy. More than 118,000 stars are available to explore from any point in the universe, including a zoom-in close study or God's-eye view.

Such a quantum leap was scarcely achieved without a few stumbles. At the very outset of the project, a private donor had donated several million dollars for a specially made Zeiss Mark IX opto-mechanical star projector, to replace the dumbbell-shaped machine at the center of a traditional dome. "I had sought a totally digital scheme," says Friedman.

Additionally came the problem of the dome. It is one thing to cast an image on a flat screen, and pick a point to move through the images. But when casting an image on a sphere, your computer must distort every image to present a flow of sustained movement past a virtual center.

Eventually, using an Onyx II computer, the Zeiss, and seven CRT projectors (the world's largest costing $180,000 each,) the bugs were ironed out and the dome stood ready on schedule. The immersive experience of the universe awaited the public.

The Hayden was again a smash hit. Opening its doors on December 31, l999, at the cusp of the new millennium, crowds surged into Manhattan's latest marvel. The Museum showed continuous half hour shows 24/7 and still crowds lined the block. All those nervous investors who had blanched at the $17 million price tag and almost called off Friedman's project three times, now sat grinning smugly.

For Friedman the cyber engineer, it was the launch into a heavenly position. He and his staff of 16 like-minded engineers were hired to maintain and continually upgrade the Hayden digital dome. Theirs was a hive of innovation. New programs hit the screen: the Big Bang Theater, a trip through The Virtual Universe, and "Are We Alone?" a search for life that whisked viewers from earth's oceans to the moons of Jupiter. The crew endlessly tweaked the system and reveled in playing on the graphic image's cutting edge.

In 2001, Friedman realized that the "beast" — the $2 million Onyx main frame computer system that generated the digital movie, was unnecessary. As a replacement, he designed a digital disk recorder to take all the projection's data and play it back out, much like a VCR. Unfortunately, the massive amount of stuff to be stored frightened off all but one German firm that supplied the prototype gratis. Meanwhile, along with all his technical meanderings, Aram Friedman fell passionately in love with the stars. And their display became his crusade.

All good engineers, however, eventually build themselves out of a job. The American Museum of Natural History now had 4.5 million visitors annually thronging through its planetarium and other numerous halls. The Hayden was the world's best, board members kept saying. Do we really have to keep reinventing this successful product? Shortly after 9/11, 2002, they decided not. The tourism bubble had burst, belts needed tightening. With much gratitude and small severance, Friedman and his team were let go.

For 18 months he worked for Evans & Sutherland, a Salt Lake City-based leader in the visual imaging field that has just developed a new generation of celestial display (www.es.com).

Ironically, Friedman had rejected the E&S bid when it sought to install an early generation digital planetarium display system. (This early generation machine, Digistar 2, is currently in use at the Fels Planetarium.) E&S's Digistar 3 afforded that giant step in celestial viewing capability that previously had been available only to the Hayden Digital Dome. It was a savings in cost and complexity. Instead of being hardwired into a massively expensive mainframe computer, Digistar 3 runs off of PC clusters. This set the stars technically within reach of even a high school planetarium.

Astronomy is not new to high school curricula. Back in 1957 America fell under a terrorizing attack. The Soviets launched over our heads the first orbiting satellite in space. Though this vehicle remained innocuously high above our soil, its every beep cast our nation into a vast panic nonetheless. Why hadn't good old American technology done it first, everybody asked? What's the matter with our science and astronomical training? Defensively, the Eisenhower administration ordered 1,000 planetarium/observatories to be built at various high schools around the country from l958 through l960. Perhaps it worked: American pride was reestablished 12 years later when Yankee footsteps were the first on the moon.

Yet neither pride nor concrete lasts forever, and today those thousand planetariums are crumbling and woefully obsolete. To renovate an existing 1960s high school planetarium with traditional technology (opto-mechanical rather than digital) would cost the local school system at least $450,000. Ironically, to refurbish one with a digital installation, could cost $175,000. But few local school boards can pony up the necessary funds for any kind of planetarium repair.

Aram Friedman fell passionately in love with the stars. And their display became his crusade.

Friedman pushed for the company to develop a microdome that a small school could afford. "I repackaged the pieces that were there and developed the optical end of it," he says. The hemisphere screen is 48 inches in diameter, and the computers fit into a suitcase.

Somewhere between hurry and frenzy, Friedman moves constantly beneath seven overhead clocks ticking away the minutes at various global locales. His office is less company headquarters, and more of an engineer's hive. Throughout his cramped quarters, he shifts among cell phones, lap top, and the massive crates filled with cutting edge planetarium electronics.

Then, in the middle of this celestial show, my reverie is broken by the phone ringing. Friedman leaps up, and, dumping the joystick in my lap says "Here — go where you want." I would like to head for Alpha Centuri, but I drive like a teenager handed his first car keys. I move seldom where I aim. It takes practice, but nothing a high school science teacher couldn't quickly master.

My astronomical mentor gets off the phone and the bad news is official. Just several days before our meeting, Friedman had been told that the small dome would not be a profitable market for Evans & Sutherland.

You do not simply turn off Aram Friedman. At 47 he would like to spend more time with his wife Amy and their two girls, Raisha and Nova, at their Princeton Junction home. But, like Hayden, he believes that everyone should gain that sincere and lively appreciation of our universe. And he will not rest until they get the opportunity.

All day he remained on the phone with E & S executives, working out a new deal. "As a big public corporation, it was not prudent for E&S to be in this market," says Friedman, "but they agreed that I was in a better position to put together a private company that could afford to be in that market." His goal is to negotiate an Original Equipment Manufacturer (OEM) agreement, allowing him to repackage and market the portable microdome. Thus far, his former employer says that he can sell the dome and Digistar 3 technology to schools and institutions that do not already have planetariums.

Digital projectors, in contrast to the opto-mechanical systems, are not limited to earth bound observation. "We have in our grasp, with the digital systems, the ability to leave earth and view a universe that is as scientifically accurate as we know today," says Friedman. "We need to push ourselves and our viewers to higher expectations. And people are smart. If you show it to them, they will get it."

Friedman demonstrates that his digital product is far more than a stargazing dome. He slips in a new disc and we are transported to ancient Egypt in IMAX style. Slowly we enter the temple of Karnak as it was in the 15th dynasty and then the temple of Hathor. Suddenly the goddess ages, eroding to the structure I recall when I last visited. "We can travel not just through the universe and our seas," says Friedman, "but we can tour DNA molecules or the interior of a Neanderthal's brain. It is a limitless teaching tool."

Interestingly, this transition from planetarium to master teaching tool should satisfy both Friedman's educational obsession and his tinkering urges. Virtually all scientific graphic renderings internationally use a protocol called open graphics language (open GL.) For reasons of efficiency however, Digistar 3 employs Microsoft's Direct-X language. These liaison languages, which make hardware machines obedient to software commands, are standardized and typically exclusive.

Friedman's new problem is to help the Digistar 3 comprehend the open GL codes that currently, as he puts it, "have no guarantee of working on Digistar 3." He sees this as an easy fix.

"I play a role in the industry," says Friedman. "I am an advocate for scientifically accurate systems and I am trying to raise the expectations of the public. All the arguments against digital systems have pretty much been solved. Whether my competitors like it or not, I am here."

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