The Boy Who Played With Fusion

Taylor Wilson always dreamed of creating a star. Now he's become one

By Tom ClynesPosted (http://www.popsci.com/science/article/2012-02/boy-who-played-fusion?page=all)

(caption - **Standout** Taylor Wilson moved to suburban Reno with his parents, Kenneth and Tiffany, and his brother Joey to attend Davidson Academy, a school for gifted students. *Bryce Duffy)*

"Propulsion," the nine-year-old says as he leads his dad through the gates of the U.S. Space and Rocket Center in Huntsville, Alabama. "I just want to see the propulsion stuff."

A young woman guides their group toward a full-scale replica of the massive Saturn V rocket that brought America to the moon. As they duck under the exhaust nozzles, Kenneth Wilson glances at his awestruck boy and feels his burden beginning to lighten. For a few minutes, at least, someone else will feed his son's boundless appetite for knowledge.

Then Taylor raises his hand, not with a question but an answer. He knows what makes this thing, the biggest rocket ever launched, go up. And he wants—no, he obviously needs—to tell everyone about it, about how speed relates to exhaust velocity and dynamic mass, about payload ratios, about the pros and cons of liquid versus solid fuel. The tour guide takes a step back, yielding the floor to this slender kid with a deep-Arkansas drawl, pouring out a torrent of Ph.D.-level concepts as if there might not be enough seconds in the day to blurt it all out. The other adults take a step back too, perhaps jolted off balance by the incongruities of age and audacity, intelligence and exuberance.

As the guide runs off to fetch the center's director—You gotta see this kid!—Kenneth feels the weight coming down on him again. What he doesn't understand just yet is that he will come to look back on these days as the uncomplicated ones, when his scary-smart son was into simple things, like rocket science.

This is before Taylor would transform the family's garage into a mysterious, glow-in-the-dark cache of rocks and metals and liquids with unimaginable powers. Before he would conceive, in a series of unlikely epiphanies, new ways to use neutrons to confront some of the biggest challenges of our time: cancer and nuclear terrorism. Before he would build a reactor that could hurl atoms together in a 500-million-degree plasma core—becoming, at 14, the youngest individual on Earth to achieve nuclear fusion.

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When I meet Taylor Wilson, he is 16 and busy—far too busy, he says, to pursue a driver's license. And so he rides shotgun as his father zigzags the family's Land Rover up a steep trail in the Virginia Mountains north of Reno, Nevada, where they've come to prospect for uranium.

From the backseat, I can see Taylor's gull-like profile, his forehead plunging from under his sandy blond bangs and continuing, in an almost unwavering line, along his prominent nose. His thinness gives him a wraithlike appearance, but when he's lit up about something (as he is most waking moments), he does not seem frail. He has spent the past hour—the past few days, really—talking, analyzing, and breathlessly evangelizing about nuclear energy. We've gone back to the big bang and forward to mutually assured destruction and nuclear winter. In between are fission and fusion, Einstein and Oppenheimer, Chernobyl and Fukushima, matter and antimatter.

"Where does it come from?" Kenneth and his wife, Tiffany, have asked themselves many times. Kenneth is a Coca-Cola bottler, a skier, an ex-football player. Tiffany is a yoga instructor. "Neither of us knows a dang thing about science," Kenneth says.

Almost from the beginning, it was clear that the older of the Wilsons' two sons would be a difficult child to keep on the ground. It started with his first, and most pedestrian, interest: construction. As a toddler in Texarkana, the family's hometown, Taylor wanted nothing to do with toys. He played with real traffic cones, real barricades. At age four, he donned a fluorescent orange vest and hard hat and stood in front of the house, directing traffic. For his fifth birthday, he said, he wanted a crane. But when his parents brought him to a toy store, the boy saw it as an act of provocation. "No," he yelled, stomping his foot. "I want a real one."

This is about the time any other father might have put his own foot down. But Kenneth called a friend who owns a construction company, and on Taylor's birthday a six-ton crane pulled up to the party. The kids sat on the operator's lap and took turns at the controls, guiding the boom as it swung above the rooftops on Northern Hills Drive.

To the assembled parents, dressed in hard hats, the Wilsons' parenting style must have appeared curiously indulgent. In a few years, as Taylor began to get into some supremely dangerous stuff, it would seem perilously laissez-faire. But their approach to child rearing is, in fact, uncommonly intentional. "We want to help our children figure out who they are," Kenneth says, "and then do everything we can to help them nurture that."

At 10, Taylor hung a periodic table of the elements in his room. Within a week he memorized all the atomic numbers, masses and melting points. At the family's Thanksgiving gathering, the boy appeared wearing a monogrammed lab coat and armed with a handful of medical lancets. He announced that he'd be drawing blood from everyone, for "comparative genetic experiments" in the laboratory he had set up in his maternal grandmother's garage. Each member of the extended family duly offered a finger to be pricked.

The next summer, Taylor invited everyone out to the backyard, where he dramatically held up a pill bottle packed with a mixture of sugar and stump remover (potassium nitrate) that he'd discovered in the garage. He set the bottle down and, with a showman's flourish, ignited the fuse that poked out of the top. What happened next was not the firecracker's bang everyone expected, but a thunderous blast that brought panicked neighbors running from their houses. Looking up, they watched as a small mushroom cloud rose, unsettlingly, over the Wilsons' yard.

For his 11th birthday, Taylor's grandmother took him to Books-A-Million, where he picked out The Radioactive Boy Scout, by Ken Silverstein. The book told the disquieting tale of David Hahn, a Michigan teenager who, in the mid-1990s, attempted to build a breeder reactor in a backyard shed. Taylor was so excited by the book that he read much of it aloud: the boy raiding smoke detectors for radioactive americium . . . the cobbled-together reactor . . . the Superfund team in hazmat suits hauling away the family's contaminated belongings. Kenneth and Tiffany heard Hahn's story as a cautionary tale. But Taylor, who had recently taken a particular interest in the bottom two rows of the periodic table—the highly radioactive elements—read it as a challenge. "Know what?" he said. "The things that kid was trying to do, I'm pretty sure I can actually do them."

A rational society would know what to do with a kid like Taylor Wilson, especially now that America's technical leadership is slipping and scientific talent increasingly has to be imported. But by the time Taylor was 12, both he and his brother, Joey, who is three years younger and gifted in mathematics, had moved far beyond their school's (and parents') ability to meaningfully teach them. Both boys were spending most of their school days on autopilot, their minds wandering away from course work they'd long outgrown.

David Hahn had been bored too—and, like Taylor, smart enough to be dangerous. But here is where the two stories begin to diverge. When Hahn's parents forbade his atomic endeavors, the angry teenager pressed on in secret. But Kenneth and Tiffany resisted their impulse to steer Taylor toward more benign pursuits. That can't be easy when a child with a demonstrated talent and fondness for blowing things up proposes to dabble in nukes.

(caption - **Taylor Wilson:** *Bryce Duffy)*

Kenneth and Tiffany agreed to let Taylor assemble a "survey of everyday radioactive materials" for his school's science fair. Kenneth borrowed a Geiger counter from a friend at Texarkana's emergency-management agency. Over the next few weekends, he and Tiffany shuttled Taylor around to nearby antique stores, where he pointed the clicking detector at old radium-dial alarm clocks, thorium lantern mantles and uranium-glazed Fiesta plates. Taylor spent his allowance money on a radioactive dining set.

Drawn in by what he calls "the surprise properties" of radioactive materials, he wanted to know more. How can a speck of metal the size of a grain of salt put out such tremendous amounts of energy? Why do certain rocks expose film? Why does one isotope decay away in a millionth of a second while another has a half-life of two million years?

As Taylor began to wrap his head around the mind-blowing mysteries at the base of all matter, he could see that atoms, so small but potentially so powerful, offered a lifetime's worth of secrets to unlock. Whereas Hahn's resources had been limited, Taylor found that there was almost no end to the information he could find on the Internet, or to the oddities that he could purchase and store in the garage.

On top of tables crowded with chemicals and microscopes and germicidal black lights, an expanding array of nuclear fuel pellets, chunks of uranium and "pigs" (lead-lined containers) began to appear. When his parents pressed him about safety, Taylor responded in the convoluted jargon of inverse-square laws and distance intensities, time doses and roentgen submultiples. With his newfound command of these concepts, he assured them, he could master the furtive energy sneaking away from those rocks and metals and liquids—a strange and ever-multiplying cache that literally cast a glow into the corners of the garage.

Kenneth asked a nuclear-pharmacist friend to come over to check on Taylor's safety practices. As far as he could tell, the friend said, the boy was getting it right. But he warned that radiation works in quick and complex ways. By the time Taylor learned from a mistake, it might be too late.

Lead pigs and glazed plates were only the beginning. Soon Taylor was getting into more esoteric "naughties"—radium quack cures, depleted uranium, radio-luminescent materials—and collecting mysterious machines, such as the mass spectrometer given to him by a former astronaut in Houston. As visions of Chernobyl haunted his parents, Taylor tried to reassure them. “I’m the responsible radioactive boy scout,” he told them. “I know what I’m doing.”

One afternoon, Tiffany ducked her head out of the door to the garage and spotted Taylor, in his canary yellow nuclear-technician’s coveralls, watching a pool of liquid spreading across the concrete floor.
“Tay, it’s time for supper.”
“I think I’m going to have to clean this up first.”
“That’s not the stuff you said would kill us if it broke open, is it?”
“I don’t think so,” he said. “Not instantly.”

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That summer, Kenneth’s daughter from a previous marriage, Ashlee, then a college student, came to live with the Wilsons. “The explosions in the backyard were getting to be a bit much,” she told me, shortly before my own visit to the family’s home. “I could see everyone getting frustrated. They’d say something and Taylor would argue back, and his argument would be legitimate. He knows how to out-think you. I was saying, ‘You guys need to be parents. He’s ruling the roost.’ ”

“What she didn’t understand,” Kenneth says, “is that we didn’t have a choice. Taylor doesn’t understand the meaning of ‘can’t.’ ”

“And when he does,” Tiffany adds, “he doesn’t listen.”

“Looking back, I can see that,” Ashlee concedes. “I mean, you can tell Taylor that the world doesn’t revolve around him. But he doesn’t really get that. He’s not being selfish, it’s just that there’s so much going on in his head.”

Tiffany, for her part, could have done with less drama. She had just lost her sister, her only sibling. And her mother’s cancer had recently come out of remission. “Those were some tough times,” Taylor tells me one day, as he uses his mom’s gardening trowel to mix up a batch of yellowcake (the partially processed uranium that’s the stuff of WMD infamy) in a five-gallon bucket. “But as bad as it was with Grandma dying and all, that urine sure was something.”

Taylor looks sheepish. He knows this is weird. “After her PET scan she let me have a sample. It was so hot I had to keep it in a lead pig.

“The other thing is . . .” He pauses, unsure whether to continue but, being Taylor, unable to stop himself. “She had lung cancer, and she’d cough up little bits of tumor for me to dissect. Some people might think that’s gross, but I found it scientifically very interesting.”

What no one understood, at least not at first, was that as his grandmother was withering, Taylor was growing, moving beyond mere self-centeredness. The world that he saw revolving around him, the boy was coming to believe, was one that he could actually change.

The problem, as he saw it, is that isotopes for diagnosing and treating cancer are extremely short-lived. They need to be, so they can get in and kill the targeted tumors and then decay away quickly, sparing healthy cells. Delivering them safely and on time requires expensive handling—including, often, delivery by private jet. But what if there were a way to make those medical isotopes at or near the patients? How many more people could they reach, and how much earlier could they reach them? How many more people like his grandmother could be saved?

As Taylor stirred the toxic urine sample, holding the clicking Geiger counter over it, inspiration took hold. He peered into the swirling yellow center, and the answer shone up at him, bright as the sun. In fact, it was the sun—or, more precisely, nuclear fusion, the process (defined by Einstein as E=mc2) that powers the sun. By harnessing fusion—the moment when atomic nuclei collide and fuse together, releasing energy in the process—Taylor could produce the high-energy neutrons he would need to irradiate materials for medical isotopes. Instead of creating those isotopes in multimillion-dollar cyclotrons and then rushing them to patients, what if he could build a fusion reactor small enough, cheap enough and safe enough to produce isotopes as needed, in every hospital in the world?

At that point, only 10 individuals had managed to build working fusion reactors. Taylor contacted one of them, Carl Willis, then a 26-year-old Ph.D. candidate living in Albuquerque, and the two hit it off. But Willis, like the other successful fusioneers, had an advanced degree and access to a high-tech lab and precision equipment. How could a middle-school kid living on the Texas/Arkansas border ever hope to make his own star?

When Taylor was 13, just after his grandmother's doctor had given her a few weeks to live, Ashlee sent Tiffany and Kenneth an article about a new school in Reno. The Davidson Academy is a subsidized public school for the nation's smartest and most motivated students, those who score in the top 99.9th percentile on standardized tests. The school, which allows students to pursue advanced research at the adjacent University of Nevada–Reno, was founded in 2006 by software entrepreneurs Janice and Robert Davidson. Since then, the Davidsons have championed the idea that the most underserved students in the country are those at the top.

On the family's first trip to Reno, even before Taylor and Joey were accepted to the academy, Taylor made an appointment with Friedwardt Winterberg, a celebrated physicist at the University of Nevada who had studied under the Nobel Prize–winning quantum theorist Werner Heisenberg. When Taylor told Winterberg that he wanted to build a fusion reactor, also called a fusor, the notoriously cranky professor erupted: "You're 13 years old! And you want to play with tens of thousands of electron volts and deadly x-rays?" Such a project would be far too technically challenging and hazardous, Winterberg insisted, even for most doctoral candidates. "First you must master calculus, the language of science," he boomed. "After that," Tiffany said, "we didn't think it would go anywhere. Kenneth and I were a bit relieved."

(caption - **Hot House:** Taylor set up a nuclear laboratory in the family garage. Occasionally he uses it to process uranium ore into yellowcake. *Bryce Duffy)*

But Taylor still hadn't learned the word "can't." In the fall, when he began at Davidson, he found the two advocates he needed, one in the office right next door to Winterberg's. "He had a depth of understanding I'd never seen in someone that young," says atomic physicist Ronald Phaneuf. "But he was telling me he wanted to build the reactor in his garage, and I'm thinking, 'Oh my lord, we can't let him do that.' But maybe we can help him try to do it here."

Phaneuf invited Taylor to sit in on his upper-division nuclear physics class and introduced him to technician Bill Brinsmead. Brinsmead, a Burning Man devotee who often rides a wheeled replica of the Little Boy bomb through the desert, was at first reluctant to get involved in this 13-year-old's project. But as he and Phaneuf showed Taylor around the department's equipment room, Brinsmead recalled his own boyhood, when he was bored and unchallenged and aching to build something really cool and difficult (like a laser, which he eventually did build) but dissuaded by most of the adults who might have helped.

Rummaging through storerooms crowded with a geeky abundance of electron microscopes and instrumentation modules, they came across a high-vacuum chamber made of thick-walled stainless steel, capable of withstanding extreme heat and negative pressure. "Think I could use that for my fusor?" Taylor asked Brinsmead. "I can't think of a more worthy cause," Brinsmead said.

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Now it's Tiffany who drives, along a dirt road that wends across a vast, open mesa a few miles south of the runways shared by Albuquerque's airport and Kirkland Air Force Base. Taylor has convinced her to bring him to New Mexico to spend a week with Carl Willis, whom Taylor describes as "my best nuke friend." Cocking my ear toward the backseat, I catch snippets of Taylor and Willis's conversation.

(caption - **Nuke Hunter:** Taylor has one of the most extensive collections of radioactive material in the world, much of which he found himself. *Bryce Duffy)*

"The idea is to make a gamma-ray laser from stimulated decay of dipositronium."

"I'm thinking about building a portable, beam-on-target neutron source."

"Need some deuterated polyethylene?"

Willis is now 30; tall and thin and much quieter than Taylor. When he's interested in something, his face opens up with a blend of amusement and curiosity. When he's uninterested, he slips into the far-off distractedness that's common among the super-smart. Taylor and Willis like to get together a few times a year for what they call "nuclear tourism"—they visit research facilities, prospect for uranium, or run experiments.

Earlier in the week, we prospected for uranium in the desert and shopped for secondhand laboratory equipment in Los Alamos. The next day, we wandered through Bayo Canyon, where Manhattan Project engineers set off some of the largest dirty bombs in history in the course of perfecting Fat Man, which leveled Nagasaki.

Today we're searching for remnants of a "broken arrow," military lingo for a lost nuclear weapon. While researching declassified military reports, Taylor discovered that a Mark 17 "Peacemaker" hydrogen bomb, which was designed to be 700 times as powerful as the bomb detonated over Hiroshima, was accidentally dropped onto this mesa in May 1957. For the U.S. military, it was an embarrassingly Strangelovian episode; the airman in the bomb bay narrowly avoided his own Slim Pickens moment when the bomb dropped from its gantry and smashed the B-36's doors open. Although its plutonium core hadn't been inserted, the bomb's "spark plug" of conventional explosives and radioactive material detonated on impact, creating a fireball and a massive crater. A grazing steer was the only reported casualty.

Tiffany parks the rented SUV among the mesquite, and we unload metal detectors and Geiger counters and fan out across the field. "This," says Tiffany, smiling as she follows her son across the scrubland, "is how we spend our vacations."

Willis says that when Taylor first contacted him, he was struck by the 12-year-old's focus and forwardness—and by the fact that he couldn't plumb the depth of Taylor's knowledge with a few difficult technical questions. After checking with Kenneth, Willis sent Taylor some papers on fusion reactors. Then Taylor began acquiring pieces for his new machine.

Through his first year at Davidson, Taylor spent his afternoons in a corner of Phaneuf's lab that the professor had cleared out for him, designing the reactor, overcoming tricky technical issues, tracking down critical parts. Phaneuf helped him find a surplus high-voltage insulator at Lawrence Berkeley National Laboratory. Willis, then working at a company that builds particle accelerators, talked his boss into parting with an extremely expensive high-voltage power supply.

With Brinsmead and Phaneuf's help, Taylor stretched himself, applying knowledge from more than 20 technical fields, including nuclear and plasma physics, chemistry, radiation metrology and electrical engineering. Slowly he began to test-assemble the reactor, troubleshooting pesky vacuum leaks, electrical problems and an intermittent plasma field.

Shortly after his 14th birthday, Taylor and Brinsmead loaded deuterium fuel into the machine, brought up the power, and confirmed the presence of neutrons. With that, Taylor became the 32nd individual on the planet to achieve a nuclear-fusion reaction. Yet what would set Taylor apart from the others was not the machine itself but what he decided to do with it.

While still developing his medical isotope application, Taylor came across a report about how the thousands of shipping containers entering the country daily had become the nation's most vulnerable "soft belly," the easiest entry point for weapons of mass destruction. Lying in bed one night, he hit on an idea: Why not use a fusion reactor to produce weapons-sniffing neutrons that could scan the contents of containers as they passed through ports? Over the next few weeks, he devised a concept for a drive-through device that would use a small reactor to bombard passing containers with neutrons. If weapons were inside, the neutrons would force the atoms into fission, emitting gamma radiation (in the case of nuclear material) or nitrogen (in the case of conventional explosives). A detector, mounted opposite, would pick up the signature and alert the operator.

He entered the reactor, and the design for his bomb-sniffing application, into the Intel International Science and Engineering Fair. The Super Bowl of pre-college science events, the fair attracts 1,500 of the world's most switched-on kids from some 50 countries. When Intel CEO Paul Otellini heard the buzz that a 14-year-old had built a working nuclear-fusion reactor, he went straight for Taylor's exhibit. After a 20-minute conversation, Otellini was seen walking away, smiling and shaking his head in what looked like disbelief. Later, I would ask him what he was thinking. "All I could think was, 'I am so glad that kid is on our side.' "

For the past three years, Taylor has dominated the international science fair, walking away with nine awards (including first place overall), overseas trips and more than $100,000 in prizes. After the Department of Homeland Security learned of Taylor's design, he traveled to Washington for a meeting with the DHS's Domestic Nuclear Detection Office, which invited Taylor to submit a grant proposal to develop the detector. Taylor also met with then–Under Secretary of Energy Kristina Johnson, who says the encounter left her "stunned."

"I would say someone like him comes along maybe once in a generation," Johnson says. "He's not just smart; he's cool and articulate. I think he may be the most amazing kid I've ever met."

And yet Taylor's story began much like David Hahn's, with a brilliant, high-flying child hatching a crazy plan to build a nuclear reactor. Why did one journey end with hazmat teams and an eventual arrest, while the other continues to produce an array of prizes, patents, television appearances, and offers from college recruiters?

The answer is, mostly, support. Hahn, determined to achieve something extraordinary but discouraged by the adults in his life, pressed on without guidance or oversight—and with nearly catastrophic results. Taylor, just as determined but socially gifted, managed to gather into his orbit people who could help him achieve his dreams: the physics professor; the older nuclear prodigy; the eccentric technician; the entrepreneur couple who, instead of retiring, founded a school to nurture genius kids. There were several more, but none so significant as Tiffany and Kenneth, the parents who overcame their reflexive—and undeniably sensible—inclinations to keep their Icarus-like son on the ground. Instead they gave him the wings he sought and encouraged him to fly up to the sun and beyond, high enough to capture a star of his own.

After about an hour of searching across the mesa, our detectors begin to beep. We find bits of charred white plastic and chunks of aluminum—one of which is slightly radioactive. They are remnants of the lost hydrogen bomb. I uncover a broken flange with screws still attached, and Taylor digs up a hunk of lead. “Got a nice shard here,” Taylor yells, finding a gnarled piece of metal. He scans it with his detector. “Unfortunately, it’s not radioactive.”

“That’s the kind I like,” Tiffany says.

Willis picks up a large chunk of the bomb’s outer casing, still painted dull green, and calls Taylor over. “Wow, look at that warp profile!” Taylor says, easing his scintillation detector up to it. The instrument roars its approval. Willis, seeing Taylor ogling the treasure, presents it to him. Taylor is ecstatic. “It’s a field of dreams!” he yells. “This place is loaded!”

Suddenly we’re finding radioactive debris under the surface every five or six feet—even though the military claimed that the site was completely cleaned up. Taylor gets down on his hands and knees, digging, laughing, calling out his discoveries. Tiffany checks her watch. “Tay, we really gotta go or we’ll miss our flight.”

“I’m not even close to being done!” he says, still digging. “This is the best day of my life!” By the time we manage to get Taylor into the car, we’re running seriously late. “Tay,” Tiffany says, “what are we going to do with all this stuff?”

“For $50, you can check it on as excess baggage,” Willis says. “You don’t label it, nobody knows what it is, and it won’t hurt anybody.” A few minutes later, we’re taping an all-too-flimsy box shut and loading it into the trunk. “Let’s see, we’ve got about 60 pounds of uranium, bomb fragments and radioactive shards,” Taylor says. “This thing would make a real good dirty bomb.”

In truth, the radiation levels are low enough that, without prolonged close-range exposure, the cargo poses little danger. Still, we stifle the jokes as we pull up to curbside check-in. “Think it will get through security?” Tiffany asks Taylor.

“There are no radiation detectors in airports,” Taylor says. “Except for one pilot project, and I can’t tell you which airport that’s at.”

As the skycap weighs the box, I scan the “prohibited items” sign. You can’t take paints, flammable materials or water on a commercial airplane. But sure enough, radioactive materials are not listed.

We land in Reno and make our way toward the baggage claim. “I hope that box held up,” Taylor says, as we approach the carousel. “And if it didn’t, I hope they give us back the radioactive goodies scattered all over the airplane.” Soon the box appears, adorned with a bright strip of tape and a note inside explaining that the package has been opened and inspected by the TSA. “They had no idea,” Taylor says, smiling, “what they were looking at.”

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Apart from the fingerprint scanners at the door, Davidson Academy looks a lot like a typical high school. It’s only when the students open their mouths that you realize that this is an exceptional place, a sort of Hogwarts for brainiacs. As these math whizzes, musical prodigies and chess masters pass in the hallway, the banter flies in witty bursts. Inside humanities classes, discussions spin into intellectual duels.

Although everyone has some kind of advanced obsession, there’s no question that Taylor is a celebrity at the school, where the lobby walls are hung with framed newspaper clippings of his accomplishments. Taylor and I visit with the principal, the school's founders and a few of Taylor's friends. Then, after his calculus class, we head over to the university's physics department, where we meet Phaneuf and Brinsmead.

Taylor's reactor, adorned with yellow radiation-warning signs, dominates the far corner of Phaneuf's lab. It looks elegant—a gleaming stainless-steel and glass chamber on top of a cylindrical trunk, connected to an array of sensors and feeder tubes. Peering through the small window into the reaction chamber, I can see the golf-ball-size grid of tungsten fingers that will cradle the plasma, the state of matter in which unbound electrons, ions and photons mix freely with atoms and molecules.

"OK, y'all stand back," Taylor says. We retreat behind a wall of leaden blocks as he shakes the hair out of his eyes and flips a switch. He turns a knob to bring the voltage up and adds in some gas. "This is exactly how me and Bill did it the first time," he says. "But now we've got it running even better."

Through a video monitor, I watch the tungsten wires beginning to glow, then brightening to a vivid orange. A blue cloud of plasma appears, rising and hovering, ghostlike, in the center of the reaction chamber. "When the wires disappear," Phaneuf says, "that's when you know you have a lethal radiation field."

I watch the monitor while Taylor concentrates on the controls and gauges, especially the neutron detector they've dubbed Snoopy. "I've got it up to 25,000 volts now," Taylor says. "I'm going to out-gas it a little and push it up."

Willis's power supply crackles. The reactor is entering "star mode." Rays of plasma dart between gaps in the now-invisible grid as deuterium atoms, accelerated by the tremendous voltages, begin to collide. Brinsmead keeps his eyes glued to the neutron detector. "We're getting neutrons," he shouts. "It's really jamming!"

Taylor cranks it up to 40,000 volts. "Whoa, look at Snoopy now!" Phaneuf says, grinning. Taylor nudges the power up to 50,000 volts, bringing the temperature of the plasma inside the core to an incomprehensible 580 million degrees—some 40 times as hot as the core of the sun. Brinsmead lets out a whoop as the neutron gauge tops out.

"Snoopy's pegged!" he yells, doing a little dance. On the video screen, purple sparks fly away from the plasma cloud, illuminating the wonder in the faces of Phaneuf and Brinsmead, who stand in a half-orbit around Taylor. In the glow of the boy's creation, the men suddenly look years younger.

Taylor keeps his thin fingers on the dial as the atoms collide and fuse and throw off their energy, and the men take a step back, shaking their heads and wearing ear-to-ear grins.

"There it is," Taylor says, his eyes locked on the machine. "The birth of a star."

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