

The Eventful Career of Dr. Kevin Pearson, Astronomer

Edward A. Laag,*

**Department of Earth Science, University of California Riverside*

1. The Curious Spectrum

Kevin Pearson walked across an unkept lawn. The grass was moist with dew. He paused to take in the scene around him. The stars weren't twinkling. It was a clear night with no hint of the trade winds. The seeing was excellent. Kevin looked up at the mountain and saw the twin white domes of the Keck telescopes 12,000 feet above him. He thought about the thin bundle of wires connecting him and those domes. Gone were the days when an astronomer sat at the top of a 50-foot tall moving telescope, in the prime focus cage, with his heavy photographic plates. At prime focus you were literally swimming in a sea of stars. Occasionally, those days seemed romantic for an astronomy graduate student. But Kevin appreciated the modern conveniences. He could be in the heated observing room at Keck Headquarters, sipping an energy drink, while his predecessors would have been wearing two parkas, and drinking boiling hot coffee to stay awake.

Kevin reached the door to the main building that housed the telescope observing rooms. He punched in the four digit key code to open the door. "5-0-0-7, so easy to remember" he thought to himself. It was an emission line of the oxygen atom. Any grad student who had had a class in spectroscopy would know that number well. With the door to the hallway open, Kevin could now hear people laughing in the observing room. He recognized the voices of two other grad students – a fellow third year named Larry Andrews, and Collette Edwards, a first year. This was her first Keck observing run. She was giggling at everything Larry said, and her high-pitched tone made her sound like she'd never been happier. Kevin remembered that feeling. He had felt that way before he was put through the stress of the qualifying exams, the fierce competition for telescope time, the grant deadlines, and the peer review process. Those experiences had taken a lot of the spirit out of him. The one voice he didn't hear was his advisor's, Gerard Kloose.

Kevin sauntered into the room, which was dimly lit by the glow of 12 flat screen computer monitors. Larry was juggling pens. Collette was staring at images of stars on a computer screen. “Where’s Gerard this time?” asked Kevin.

“Dunno,” said Larry dropping one of his pens. “He said he was hungry and left.”

“Where are we time-wise?” asked Kevin. It was a question he was about to answer himself by looking at the control panels. He just wanted to chastise Larry for being distracted. “Five minutes left,” said Kevin answering his own question. “Have you been keeping up with the logs?”

“Yeah, I’ve got it covered.”

Kevin knew never to rely on Larry’s chicken scratch log charts. That’s why he always kept his own. “What are you doing, Collette?”

“I’m helping Larry by making finder charts,” said Collette. She didn’t look up from the screen and began to type more vigorously.

Kevin opened his lab notebook and stared at his target list. The target list was a neatly laid out table of stars with their coordinates, in right ascension (RA) and declination (DEC), in one column, and their transit (directly overhead) times in another. H264B2B would be transiting soon. So would GLEIS349. H264B2B was a G-type star in the constellation Perseus, but it was 13th magnitude, so it was too faint to be visible to the naked eye. Every time he looked at a star name Kevin couldn’t help but chuckle. People pay good money to put their name in something called the “International Star Registry”. That sounds official but it’s not. Never in his life had Kevin heard an astronomer refer to a star by a name like “Robert Allen Smith.” Sometimes Kevin wished he had thought of selling off the stars before that other guy.

Suddenly, there was a loud series of beeps from one of the computers. It was a warning that in two minutes the shutter on the new high contrast spectrograph would close. It meant the telescope would soon be free to re-position, so they could move on to their next star. Kevin picked up his pen and wrote down the exact time the previous exposure would stop on the log chart. “Okay, Lare,” said Kevin, “where’s the finder?”

Larry looked at Collette. Collette handed Larry a big stack of finder charts and he started shuffling through them. If you gave the computer a set of coordinates in RA and DEC on the sky, it could move to that general patch of sky. For the big telescope to really lock on a star though, you still had to refine the pointing. That involved recognizing the field of stars

you were looking at, and picking out your specific target based on comparison to a finder chart. Some of the old school astronomers could do this in 20 seconds. Gerard was among the best. He could usually pick out any star in 10 seconds. It always took Kevin and Larry a few minutes of debate to really decide they knew what it was they were looking at. In the meantime precious starlight was landing on the mirror, reflecting into the high contrast spectrograph instrument, and landing on a black shutter, not the detector camera.

The computer beeped again. The shutter was now closed and the telescope was ready to move. It was time to pick a star. Kevin sighed. "Where is Gerard?" he thought. "Probably out eating pizza and drinking a beer." Gerard was always gone when it came time to make a critical decision. Kevin looked over at a video monitor. There was a man in an Eskimo parka sitting in a small booth. His name was Dave, and he was the telescope operator. It was his job to be in the booth on the 13,000 foot mountaintop doing the actual telescope mechanical control.

Kevin pressed a button to talk to Dave. "Hey Dave, we're ready to move now. RA 3 hours 8 minutes 15 seconds, DEC 40 degrees 57 arc-minutes." Dave nodded and began typing something on the computer. Kevin carefully wrote down the star's name and location, in RA and DEC, on his own log chart, as he had repeated them to Dave. He also recorded the exposure time, 20 minutes, and the approximate time it would begin.

The twin Keck 10 meter diameter telescopes were so large they could not be mounted on a fork mount like an amateur telescope. They had to sit on the ground like two enormous cannons pointed up, pivoting about one axis. In order to track a star, the computer had to perform a complicated set of calculations that translated RA and DEC coordinates into electronic commands for the motors. Kevin knew right at this moment twenty tons of glass and steel were gliding along a track. On one screen the stars were whizzing by so fast they looked like streaks. Eventually the sky stopped spinning. Kevin and Larry now had to translate the obscure pattern of dots on the screen into a recognizable location on the sky.

"Here's the chart," said Larry. Kevin held up the computer print out. It didn't really look like the pattern on the screen. Then again, it only had three good stars on it. The trouble with stars was that over time, they sometimes moved with respect to one another. He flipped the chart right and left. Larry watched over his shoulder.

"There," said Larry pointing to a star. Kevin cautiously nodded his head. They clicked on the target to tell the computer which star. Kevin slumped down in his chair and closed his

eyes. They were collecting light again. He took another sip of his energy drink and savored the sugary taste. Then he picked up a Spiderman comic book he had been reading.

“My name is Gerard Kloose, and I have a difficult task ahead of me,” began Gerard in his thick German accent. He was giving a lecture to 250 students and faculty, as part of a special series on groundbreaking new instrumentation work being done at the university. Even though it was an important speech, Gerard was as calm as if he were having a conversation with close friends over dinner. He had given the same lecture a hundred times to various would-be benefactors. “In the midst of this climate of Mars obsession, I have to convince you all of the worthiness of studying planets located outside our solar system. Why have we invested billions of dollars in this ultimate Mars mission? Is it the possibility that life once existed, or still exists somewhere on Mars – and we want human beings, not robots, to prove it?”

“Let me tell you a bit about how astronomers are approaching the problem. There are currently about 300 known planets orbiting stars other than our sun; and if we look at those on a plot,” Gerard clicked to the next slide. “...showing mass and temperature, nearly all of these planets are extremely massive and hot. Their size is comparable to our Jupiter. Most of them have been found orbiting very near their parent star. What we have now is a bunch of hot Jupiters. So far, no Earth-sized planet has been found in the habitable zone. Nothing at all Earth or Mars-like.” Gerard paused for effect. He wanted people to ruminate on that fact.

“But are we to believe planet Earth is unique? That there are no Earth-like planets out there in this enormous universe?” Gerard took a drink of water. He looked up into the audience he held on the edge of their seats. He was pleased to see his three grad students were there, sitting in the second row. “Well, there’s a good explanation for why we haven’t found any. It’s what we call in science a selection effect. You see, the problem has been the way we go about looking for them. Stars are so bright, compared to their planets, that they simply drown them out with light. Imagine I had one of those searchlights up here – the kind they shine from helicopters at night looking for criminals.” Gerard had a helicopter graphic for this that he loved to show. “As I’m shining this light in your face, I happen to take out a lighter.” Gerard took out a lighter. He clicked it to show the flame. “And I flick on this lighter right next to that searchlight.”

“This should give you an idea of what we are dealing with. This lighter is like the light from Earth that we’re trying to separate from the star. So how do we grab the light from the lighter and throw away only the light from the star?”

“That’s where HIPPOS comes in.” Gerard displayed a cute picture of a group of hippos wallowing in a muddy pond that he had gotten off the Internet somewhere. He always showed that silly hippo slide. “HIPPOS is our cute name for the High Intensity Proto-Planetary Object Spectrograph. We call it high intensity, for the high dynamic range we must achieve to get to the needed level of contrast between the star and the planet. It’s a spectrograph, which means we don’t get a picture in the normal sense. Instead, we get a plot, like this. It’s a graph of intensity versus wavelength, and it tells us a whole lot more than we would know from a simple picture. Basically, it can tell us what that planet is made of, and hopefully what kind of atmosphere it has. Now it’s proto-planetary, because we think that we still can’t quite get down to the contrast level of an Earth. The Earth is simply too dim in its evolved state, compared to the sun, to have any hope of seeing it with current technology. It will be a job for the next generation of astronomers. However, if we could turn back the clock, to when Earth was still hot right after the solar system formed, we might have a chance of capturing it with HIPPOS.”

“That’s how we find these systems. We look for hot dusty debris disks around stars, where solar systems are in the beginning stages of forming. Even if we did have the technology to see an Earth, we wouldn’t even know where to start looking. They’re simply invisible. We’d have to go around blindly looking at stars just in the hopes that one of them had an Earth. As you well know, there are a lot of stars out there. HIPPOS isn’t the whole story. We hope to take what we learn from this instrument, and apply it to the next one. That is, if this new ultimate Mars mission doesn’t take all the money first.” There were a few chuckles from the audience.

Gerard put up a picture of a tiny blue dot surrounded by darkness. “So what can astronomy teach us about the universe? Probably that we are not unique. The Earth is not an island in a lifeless universe. I do think one day we will see an Earth. It’s just a matter of when.”

“This concludes my lecture. Thank you all,” said Gerard. There was a roar of applause from the audience.

Kevin's cramped office was on the fourth floor of the physics building. He shared the office with Larry. It was a highly sought after office by grad students, because it was among the few with a window. Kevin was still working on reducing the data from the Keck HIPPOS observing run.

Kevin turned his monitor around so it faced Larry. It displayed a one dimensional spectrum plot Kevin had been working with for the last hour. "Hey, what does that look like to you?"

Larry frowned at the computer screen. "Noise," said Larry. He looked away.

"You barely looked," said Kevin.

"I dunno, did you subtract off a G-type star yet?"

"Yes, I already did."

"Well, I've never seen anything like it," said Larry. Kevin brought up another less noisy spectrum.

"Does it look like this?" asked Kevin. Larry looked at both of them.

"Well, very vaguely, I guess you might say it bares a family resemblance," said Larry. "What is that one you're comparing it to?"

"Earth," said Kevin.

Larry's jaw dropped. "Where did you get a spectrum of the Earth? How did you get a spectrum of the Earth?"

"The moon," said Kevin. "It was a new moon. They took a spectrum, and it's all Earth's light reflected off the surface of the moon."

Larry squinted at the screen. "I dunno, it's so noisy, it could resemble anything. I've seen dozens of weird spectra. Every time the explanation was some simple reduction error. Somewhere in your data reduction pipeline, there's a stupid mistake. Sooner or later, you're going to find it." Kevin didn't say anything. He just looked out the window. "You can show it to Gerard, but if I can give you one piece of advice, don't publish this. We'll look like idiots if we have to retract this!" Larry made sure to emphasize the word "idiots" as he said it. "Imagine how our careers will be ruined if we were the fools that thought they found the first extra-solar Earth."

Gerard was just as skeptical as Larry had been. He didn't have a perfect explanation. It puzzled him too in a way, but he knew it must have been some kind of fluke.

“Did you check the logs?”

“About 12 times,” said Kevin. “My paper logs are meticulous. You know that. I even compared it to Larry’s logs and the ones from the telescope operator. That has to be what we observed.”

The only answer Gerard could give Kevin was that they observe it again during the next HIPPOS run. He assured Kevin that there was no possibility they were seeing an Earth-like planet. HIPPOS hadn’t been designed for that level of contrast.

The days turned into weeks. They lost a few nights to bad weather. Finally the night that Kevin had been waiting for came – their second observing run with HIPPOS. He felt like he was going to be ill as he locked the guider onto H264B2B. The twenty minutes it took to observe the target seemed like an hour. There was silence in the observing room when the computer began beeping. By now, everyone knew what this observation meant to Kevin. Secretly, Gerard just wanted to get it over with. He knew Kevin had somehow made a mistake, and he hoped this observation would put an end to the obsession.

Usually, Kevin put off reducing the data until he got home from the observing run. This time he couldn’t wait to get his hands on it. He quickly did the preparatory steps on his laptop. He rushed through complicated measurements like wavelength calibration and sky line subtraction. Before he was even halfway through with the data reduction, he couldn’t take it anymore. He plotted the spectrum anyway. It was clear from the moment he brought it up though, that there was no need to continue the reduction. It was a normal stellar spectrum. There was no trace of the Earth-like atmosphere he had seen before.

There was still a lot of noise, but it didn’t resemble anything in particular. Kevin checked the instrument control panel for HIPPOS. They were pointed at the same star as the finder chart. They were at the same RA and DEC in the sky. This had to be H264B2B, but it wasn’t the same spectrum. Kevin’s heart sank. He must have made a mistake.

Gerard had an “I told you so” look on his face. Kevin checked the logs again. They matched the target list exactly. He even tried taking the spectra of the other two stars on the chart. He still got nothing but stellar spectra.

2. Ultimate Mars Express

It was quiet inside the Mars Express shuttle. Kevin glanced up from his notebook computer. Life on board the shuttle had become monotonous. Kevin had had so much time to reflect on his life since this mission began he almost couldn't bear to think anymore.

There were multiple menial tasks mission control had them perform daily. Check this experiment, test that mechanism. Then there were the mealtimes and the times for exercise. Kevin began to relish these tasks. In his spare time Kevin was working on a review paper, but he was easily distracted from it and hadn't gotten past the introduction. Another scientist was working on his autobiography, something Kevin disapproved of on principle.

When it had been announced that six of the top young scientists in the world would be selected to go on the Mars expedition, Kevin had eagerly applied, although he knew the odds were against him. The mission would take 10 months to complete, not including a year of part-time training. Despite this, Kevin barely had a second thought about it. He had no family ties holding him back.

The truth was, Kevin had been depressed ever since grad school. He had identified hundreds of proto-planets during his short career. He had gotten 2 papers published in top journals, both on exciting new planetary systems he had identified. With Gerard's help, he was also developing the successor instrument to HIPPOS. Officially it was called the Next Generation High Contrast Imager, and it would have a million times more sensitivity than HIPPOS. It was unofficially nicknamed "HIPPOS 2." After all this, Kevin still felt like an incomplete person. It had surprised him when he received the letter informing him he was accepted into the training program. He didn't think that his interview had gone well.

Kevin remembered how he felt the first day he saw that curious spectrum. It was like the weight of the value of astronomy to the world was placed on his shoulders. He had let everyone down. The Universe had opened up a window to him, the possibility of another place in the galaxy like Earth, and he had lost it through some unknown mistake. Compared to the epic nature of discovering a planet that was like Earth, everything else he had accomplished in life amounted to nothing. Sometimes, before he went to sleep, Kevin wondered if the spectrum had been real. Maybe it had been an elaborate hoax by some enemy of his. Perhaps it had never happened at all. Maybe he had unconsciously put those details into the spectrum himself, just because he wanted it to be real so much.

For months, everyone on board had been looking forward to the day of their arrival, scheduled for August 15, when their boredom would be relieved. On that day, the orbital vehicle, which was the larger part of the Mars Express shuttle, would separate from the Mars lander. They would all squeeze into the tiny lander's cockpit and strap themselves into four-point harnesses. The lander was then to begin an autopilot controlled descent through the Martian atmosphere to their destination, near the south pole. Meanwhile the shuttle would continue to orbit the surface awaiting their return.

When the day came, in addition to excitement, Kevin felt a sense of impending doom. His first thought was that the lander seemed smaller and more fragile than he remembered from their simulated mission. He reminded himself it had to be kept lightweight and small so there was enough fuel to propel them off the surface and back to the main orbiter.

The landing area was an isolated crater near the ice cap. In the lander's six seats, buckling their harnesses, were Sergey, the pilot, David Johnson, co-pilot, Dr. Mary Strauss, a biologist, Dr. Hiram Jones, an earth scientist, Dr. Gaither, an M.D., and Kevin - the *persona non-grata* astronomer.

Outside the window Kevin could see the red surface. There was a disturbing metallic clang as the lander broke free and began its descent. Soon they were falling rapidly.

"What the...," said the pilot Sergey. There was clearly discomfort in the Russian's voice. Kevin had the feeling they might be falling too fast.

"What is it Sergey?" said David, the American. Just then a computer started sounding an alarm.

"We're descending at twice what we should be," said Sergey.

In a few seconds everyone had the uncomfortable feeling of roller coaster-like negative G's. Sergey began to struggle to maintain control. They had done many simulations of all different types of crises. Nothing prepared them for this reality. Dr. Mary Strauss started to scream. She was seated directly in front of Kevin. It was an ear-piercing cry as if she were being murdered, and she wouldn't stop.

"Shut-up, Mary," said David. It was no use - she wouldn't listen.

"Somebody get her to shut-up," said Sergey, who was frantically trying to regain control of the lander. Mary continued to scream so loudly everyone with free hands was covering their ears. Combined with the incessant alarm of the descent monitor, and the uncomfortable feeling that they were nearly in free fall, it was almost unbearable in the little cabin.

The geologist, Hiram, began praying loudly in Arabic. Kevin couldn't stand the helpless feeling. He looked over at the ship's doctor, Dr. Gaither, seated to his left. She was clutching a bag on her lap and staring straight ahead.

"Give her a sedative," said Kevin. Dr. Gaither ignored him.

"We have to shut her up, give her something dammit."

"What's taking so long?" someone else asked Sergey.

"I have to do five things at once to duplicate the auto-pilot code, just shut her up," said Sergey.

"Dr. Gaither, give her the sedative," said Kevin. He was by now getting very angry.

"No," she said clutching her bag tighter. Kevin grabbed the bag as firmly as he could.

"What are you doing? You can't do that," she said, but it was hard to hear anything over the noise. Mary's screaming had devolved into uncontrolled moans and whimpers. Kevin unzipped the bag and began rummaging in it. He soon found a number of syringes. He found one labeled "Propofol sedative" and ripped open the plastic package.

"You could kill her," said Dr. Gaither, who began fighting with Kevin for the bag. It was too late. Kevin jammed the syringe into Mary's neck and she quickly passed out. Seconds later it was eerily quiet. The beeping from the descent monitor finally stopped. All that could be heard was everyone's heavy breathing. It was dark outside.

"Uh, I'm not sure this is where we're supposed to be," said Sergey.

Mary was fast asleep in her seat. Dr. Gaither looked at Kevin. She took the packaging from the syringe and checked the label. Dr. Gaither sighed. "If you had given her the wrong dose, you could have killed her. You've probably ruined the mission for her as it is."

"Well I guess Mary won't be sending me a Christmas card," said Kevin loudly and looking right at Dr. Gaither. He didn't really care what these people thought of him anymore. It wasn't like they could vote him out of the mission now.

"Let's not start blaming each other," said David Johnson. "We need to keep our composure." Kevin could hear the pilot moving the manual stick. The lander hit the ground with an abrupt thud. Nobody spoke. Because of the enormous light travel distance, mission control wouldn't even know about their rapid descent for several minutes.

Another beep startled them. Everyone was still full of adrenaline. "What's happened now!" shouted Dr. Gaither.

"It's just the computer," said Sergey, holding back a laugh. "It says Windows has en-

countered a problem and needs to shut down.” Everyone breathed a sigh of relief.

In the days to come they would be canvassing the area. Kevin spent most of his time mending the damaged lander. The lander contained their only equipment, water, food, and shelter. A portion of it would remain behind on the surface, awaiting the next mission that may or may not come.

After a short two weeks on Mars it was time to return to the orbiter. Luckily, their return trip went much smoother than their arrival. They easily docked with the orbiter and began the long trip home.

There came a day when Dr Strauss gave a shout of excitement. She had found something that looked alive in one of her soil samples. She interrupted everyone’s schedule to call a crew meeting. They needed to decide whether to announce her finding immediately to mission control. There was some trepidation among the crew as to the wisdom of a formal announcement. If they were premature, they could not take it back. In the end, they decided to announce it to mission control with everyone present.

Mary spoke first. “We’ve gathered you all together today because we have found something exciting. For the past few days I’ve been working on a sample of crusty soil collected from the bottom of a small crater. It initially appeared to me to be some form of biological crust, sometimes called a cryptobiotic crust on Earth. I’ve been studying this sample under a microscope, and I’m ready to announce our preliminary findings. I think, ... I mean, we think, we have found some form of cyanobacteria very similar to a prehistoric species found on Earth. Basically, it’s like a very small plant. I can’t say just yet whether it really is a new species, or possibly one already known to science but extinct.”

Nobody expected what happened next. “Well, not so fast,” said Kevin moving into view of the camera. Everyone had had their back turned to him. The astronomer wasn’t even supposed to speak. While out of view, Kevin had put on latex gloves. In his right hand, Kevin was holding a cotton swab. In his left hand he was holding a tarnished gold ring.

Dr. Strauss breathed in heavily. Everyone else on board looked confused. “You bastard, what were you doing in my sleeping quarters?” Mary asked angrily.

“What is the point of this?” asked Dr. Gaither.

“Everyone just hear me out,” said Kevin. “I admit, I did enter your sleeping area, but only because I was looking for something important. In my left hand, I am holding what

appears to be a small gold ring probably intended to be worn on the little toe.” Kevin held the ring up to the camera. “I found this with Mary Strauss’s things. What’s unusual about this item is that when I went back into the list of each person’s approved personal items, it’s not on Mary’s list, or anyone else’s for that matter.”

“My daughter gave me that ring as a farewell present. I sterilized it with alcohol personally,” said Dr. Strauss.

“Still, it wasn’t on the list,” said Kevin. “Now, in my right hand, I have a cotton swab. How much will anyone bet me that if I swab this ring and put it on a slide, I’m going to find cyanobacteria on it?”

Dr. Strauss sighed. “Well of course you’re going to find it on there. I wear that ring at night, and because I’ve been working with that bacteria for the last 4 days, it wouldn’t surprise me if a few cells got on there.” There was an awkward silence. “It’s not like I brought those bacteria from Earth on that ring. That’s just ludicrous.” The NASA director had his head down. The delay time was obviously up.

“This is very disappointing Mary,” said Dr. Jones, the geologist. Everyone in the shuttle was scowling at Mary.

“Oh come on. It’s not like I sabotaged this mission or something.” It was too late to defend her actions, the damage was already done. Dr. Strauss’s reputation had been sullied, and so had the entire mission’s.

3. Lonely Planet

“New Year’s Eve, and here you are sulking in your house like always,” said Larry shaking his head and walking toward the door. “I’m headed to the party. You know that Collette is in town don’t you?” Kevin said nothing in response. Larry sighed. He pulled on his jacket and shut the door behind him.

Kevin stared out the window. The sun was setting in a blaze of red. It was another good South American sunset. The red sun reminded him of something. For a moment he thought back to the Mars mission. Billions of dollars, dozens of redundant safety checks, and some incompetent engineer puts in the drag coefficient for Earth’s atmosphere instead of the one for Mars!

If it hadn’t been for that Russian pilot and his calm attitude in the face of extreme stress, they would have been killed. It would have looked even worse than just a 100 billion dollar mission with no science result. One short line of code, just a two digit number really, had almost cost them everything.

Kevin pulled up the old spectrum of H264B2B on his computer. It seemed so painfully quaint now. The quality was terrible. Detectors had come a long way. His digital camera had better signal to noise. He couldn’t imagine doing science with something like this. He might just as well drive around a Model T or cook on a wooden stove.

Then Kevin had an unpleasant thought. Gradually a realization was developing. His head felt hot, like it had before his brutal qualifying exam.

Kevin opened the H264B2B spectrum as a text file on his computer. His screen filled with numbers. At the top of the text file, before the code making up the image, there was a long table called the image header. It contained mostly useless information, meant to be read by computers, about the state the instrument was in when it took the exposure. Of course, he had looked at these things before. But this time he was looking for something he had never considered might be there. In some data files there was an 8-digit number, just a single line, which recorded the commands sent to the Keck telescope motors. Kevin had never used them before, but he recognized the possible keywords when he saw them. About halfway down the page, they were there, labeled as *motor 1* and *motor 2*. “Why had Gerard not mentioned these? Always holding me back,” grumbled Kevin.

Kevin had his work cut out for him. He had to convert the raw machine numbers into RA

and DEC, and then precess those numbers back to the year 2008. Kevin typed commands on the computer. If there was one thing he was fast at, it was processing numbers. As he typed commands his mind raced. When it came to that first night with HIPPOS, Kevin assumed there may have been some kind of human error. The RA and DEC he had dictated to the telescope operator in the booth could have been entered incorrectly without anyone noticing. Perhaps they had actually moved to a completely different part of the sky than they thought they had. Kevin shuddered as he recalled the details of that night. Gerard was gone. Larry was goofing off. Collette had never been on an observing run. The stupid finder chart Collette had made only had 3 stars on it, hardly a unique pattern in nature. He hadn't even looked at the instrument control panel after they began exposing. The pattern of stars had looked roughly like the orientation in the finder, but then again, it could have resembled millions of groupings of stars on the sky. He had chalked the mis-match up to a star with a high proper motion. But what Kevin hadn't considered until now, was that there might be some way to recover the lost position on the sky.

"Son of a bitch," mouthed Kevin as he stared at the results of his calculations on the screen. "Bastard telescope operator." The RA and DEC weren't even in Perseus. Ironically, he would have known that had he been in the prime focus cage. He felt a wave of anger hit him; all the missed chances at greatness and fame – the wasted money – the wasted career.

Kevin stood up. He grabbed his keys and his coat. He had to know. He had to be sure. Kevin left the house without locking the front door. He knew he had a long drive. It was at least 3 hours to the high plateau in the Andes where the 30-meter telescope had been built. The 30-meter was so far from anything that no astronomer ever went there. Everything was done remotely. At most there would be 2 maintenance workers on staff. Robots did everything else. It was an autonomous observatory. Computers planned and executed all the observations. When they were completed, they processed them and delivered them to the scientists. "So much better," thought Kevin. "At least computers never make mistakes or enter the wrong coordinates." Kevin stepped on the gas. Driving at 300 kilometers per hour on a lonely stretch of Chilean highway, his car still felt sluggish.

When he reached the telescope, Kevin turned off the engine and paused to collect his thoughts. He remembered it was New Year's Eve. He hadn't gotten anyone's permission to be here. He hadn't asked anyone to give up their observing time for the night. With any luck no one would be paying attention.

Kevin had to try about six emission lines before the front door would open. Some things never change. There was one guy half asleep in the booth.

“Dr. Pearson?” asked the confused workman. Well, at least he recognized him.

“I’m sorry about this,” said Kevin. Kevin tightened his fist and punched the man. The workman slumped over and fell onto the concrete floor.

Kevin sat down in the seat. He took control of the telescope. He felt happy. This would be the greatest observing night of his life. The seeing was excellent. The high contrast imager was up and running. Kevin moved the telescope. He heard the dome grumble to life and his heart pounded. A 30-meter diameter mirror was turning.

Then he clicked the expose button and waited. He wished he had brought a cigar or a bottle of tequila. The wait was agonizing.

“Bleep.” In front of him appeared a snapshot image. A smile crossed Kevin’s face. In the middle of the blackness was a little four pixel blue dot. To the right of the snapshot was the spectrum. All he had to do was click on it to see it in detail. But he didn’t have to click on it. He knew what it was going to be. He had already seen it.