

SCHWARZSCHILD RADIUS

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"When a star collapses, it sort of falls in on itself." Travers curved his hand into a semicircle and then brought the fingers in. "And sometimes it reaches a kind of point of no return where the gravity pulling in on it is stronger than the nuclear and electric forces, and when it reaches that point, nothing can stop it from collapsing and it becomes a black hole." He closed his hand into a fist. "And that critical diameter, that point where there's no turning back, is called the Schwarzschild radius." Travers paused, waiting for me to say something.

He had come to see me every day for a week, sitting stiffly on one of my chairs in an unaccustomed shirt and tie, and talked to me about black holes and relativity, even though I taught biology at the university before my retirement, not physics. Someone had told him I knew Schwarzschild, of course.

"The Schwarzschild radius?" I said in my quavery, old man's voice, as if I could not remember ever hearing the phrase before, and Travers looked disgusted. He wanted me to say, "The Schwarzschild radius! Ah, yes, I served with Karl Schwarzschild on the Russian front in World War I!" and tell him all about how he had formulated his theory of black "holes while serving with the artillery, but I had not decided yet what to tell him. "The event horizon," I said.

"Yeah. It was named after Schwarzschild because he was the one who worked out the theory," Travers said. He reminded me of Muller with his talk of theories. He was the same age as Muller, with the same shock of stiff yellow hair and the same insatiable curiosity, and perhaps that was why I let him come every day to talk to me, though it was dangerous to let him get so close.

"I have drawn up a theory of the stars," Muller says while we warm our hands over the Primus stove so that they will get enough feeling in them to be able to hold the liquid barretter without dropping it. "They are not balls of fire, as the scientists say. They are frozen."

"How can we see them if they are frozen?" I say. Muller is insulted if I do not argue with him. The arguing is part of the theory.

"Look at the wireless!" he says, pointing to it sitting disemboweled on the table. We have the back off the wireless again, and in the barretter's glass tube is a red reflection of the stove's flame. "The light is a reflection off the ice of the star."

"A reflection of what?"

"Of the shells, of course."

I do not say that there were stars before there was this war, because Muller will not have an answer to this, and I have no desire to destroy his theory, and besides, I do not really believe there was a time when this war did not exist. The star shells have always exploded over the snow-covered craters of No Man's Land, shattering in a spray of white and red, and perhaps Muller's theory is true.

"At that point," Travers said, "at the event horizon, no more information can be transmitted out of the black hole because gravity has become so strong, and so the collapse appears frozen at the Schwarzschild radius."

"Frozen," I said, thinking of Mullen

"Yeah. As a matter of fact, the Russians call black holes 'frozen stars.' You were at the Russian front, weren't you?"

"What?"

"In World War I."

"But the star doesn't really freeze," I said. "It goes on collapsing."

"Yeah, sure," Travers said. "It keeps collapsing in on itself until even the atoms are stripped of their electrons and there's nothing left except what they call a naked singularity, but we can't see past the Schwarzschild radius, and nobody inside a black hole can tell us what it's like in there because they can't get messages out, so nobody can ever know what it's like inside a black hole."

"I know," I said, but he didn't hear me.

He leaned forward. "What was it like at the front?"

It is so cold we can only work on the wireless a few minutes at a time before our hands stiffen and grow clumsy, and we are afraid of dropping the liquid barretter. Muller holds his gloves over the Primus stove and then puts them on. I jam my hands into my ice-stiff pockets.

We are fixing the wireless set. Eisner, who had been delivering messages between the sectors, got sent up to the front when he could not fix his motorcycle. If we cannot fix the wireless, we will cease to be telegraphists and become soldiers, and we will be sent to the front lines.

We are already nearly there. If it were not snowing, we could see the barbed wire and pitted snow of No Man's Land, and the big Russian coal boxes sometimes land in the communication trenches. A shell hit our wireless hut two weeks ago. We are ahead of our own artillery lines, and some of the shells from our guns fall on us, too, because the muzzles are worn out. But it is not the front, and we guard the liquid barretter with our lives.

"Eisner's unit was sent up on wiring fatigue last night," Muller says, "and they have not come back. I have a theory about what happened to them."

"Has the mail come?" I say, rubbing my sore eyes and then putting my cold hands immediately back in my pockets. I must get some new gloves, but the quartermaster has none to issue. I have written my mother three times to knit me a pair, but she has not sent them yet.

"I have a theory about Eisner's unit," he says doggedly. "The Russians have a magnet that has pulled them into the front."

"Magnets pull iron, not people," I say.

I have a theory about Muller's theories. Littering the communications trenches are things that the soldiers going up to the front have discarded: water bottles and haversacks and bayonets. Hans and I sometimes tried to puzzle out why they would discard such important things.

"Perhaps they were too heavy," I would say, though that did not explain the bayonets or the boots.

"Perhaps they know they are going to die," Hans would say, picking up a helmet.

I would try to cheer him up. "My gloves fell out of my pocket yesterday when I went to the quartermaster's. I never found them. They are in this trench somewhere."

"Yes," he would say, turning the helmet round and round in his hands, "perhaps as they near the front, these things simply drop away from them."

My theory is that what happens to the water bottles and helmets and bayonets is what has happened to Muller. He was a student in university before the war, but his knowledge of science and his intelligence have fallen away from him, and now we are so close to the front, all he has left are his theories. And his curiosity, which is a dangerous thing to have kept.

"Exactly. Magnets pull iron, and *they* were carrying barbed wire!" he says triumphantly. "And so they were pulled in to the magnet."

I put my hands practically into the Primus flame and rub them together, trying to get rid of the numbness. "We had better get the barretter in the wireless again or this magnet of yours will suck it to the front, too."

I go back to the wireless. Muller stays by the stove, thinking about his magnet. The door bangs open. It is not a real door, only an iron humpie tied to the beam that reinforces the dugout and held with a wedge, and when someone pushes against it, it flies inward, bringing the snow with it.

Snow swirls in, and light, and the sound from the front, a low rumble like a dog growling. I clutch the liquid barretter to my chest, and Muller flings himself over the wireless as if it were a wounded comrade. Someone bundled in a wool coat and mittens, with a wool cap pulled over his ears, stands silhouetted against the reddish light in the doorway, blinking at us.

"Is Private Rottschieben here? I have come to see him about his eyes," he says, and I see it is Dr. Funkenheld.

"Come in and shut the door," I say, still carefully protecting the liquid barretter, but Muller has already jammed the metal back against the beam.

"Do you have news?" Muller says to the doctor, eager for new facts to spin his theories from. "Has the wiring fatigue come back? Is there going to be a bombardment tonight?"

Dr. Funkenheld takes off his mittens. "I have come to examine your eyes," he says to me. His voice frightens me. All through the war he has kept his quiet bedside voice, speaking to the wounded in the dressing station and at the stretcher bearer's posts as if they were in his surgery in Stuttgart, but now he sounds agitated, and I am afraid it means a bombardment is coming and he will need me at the front.

When I went to the dressing station for medicine for my eyes, I foolishly told him I had studied medicine with Dr. Zuschauer in Jena. Now I am afraid he will ask me to assist him, which will mean going up to the front. "Do your eyes still hurt?" he says.

I hand the barretter to Muller and go over to stand by the lantern that hangs from a nail in the beam.

"I think he should be invalided home, Herr Doktor," Muller says. He knows it is impossible, of course. He was at the wireless the day the message came through that no one was to be invalided out for frostbite or "other non-contagious diseases."

"Can you find me a better light?" the doctor says to him.

Muller's curiosity is so strong that he cannot bear to leave any place where something interesting is happening. If he went up to the front, I do not think he would be able to pull himself away, and now I expect him to make some excuse to stay, but I have forgotten that he is even more curious about the wiring fatigue. "I will go see what has happened to Eisner's unit," he says, and opens the door. Snow flies in, as if it had been beating against the door to get in, and the doctor and I have to push against the door to get it shut again.

"My eyes have been hurting," I say, while we are still pushing the metal into place, so that he cannot ask me to assist him. "They feel like sand has gotten into them."

"I have a patient with a disease I do not recognize," he says. I am relieved, though disease can kill us as easily as a trench mortar. Soldiers die of pneumonia and dysentery and blood poisoning every day in the dressing station, but we do not fear it the way we fear the front.

"The patient has fever, excoriated lesions, and suppurating bullae," Dr. Funkenheld says.

"Could it be boils?" I say, though of course he would recognize something so simple as boils, but he is not listening to me, and I realize that it is not a diagnosis from me that he has come for.

"The man is a scientist, a Jew named Schwarzschild, attached to the artillery," he says, and because the artillery are even farther back from the front lines than we are, I volunteer to go and look at the patient, but he does not want that either.

"I must talk to the medical headquarters in Bialy-stok," he says.

"Our wireless is broken," I say, because I do not want to have to tell him why it is impossible for me to send a message for him. We are allowed to send only military messages, and they must be sent in code, tapped out on the telegraph key. It would take hours to send his message, even if it were possible. I hold up the dangling wire. "At any rate, you must clear it with the commandant," but he is already writing out the name and address on a piece of paper, as if this were a telegraph office.

"You can send the message when you get the wireless fixed. I have written out the symptoms."

I put the back on the wireless. Muller comes in, kicking the door open, and snow flies everywhere, picking up Dr. Funkenheld's message and sending it circling around the dugout. I catch it before it spirals into the flame of the Primus stove.

"The wiring fatigue was pinned down all night," Muller says, setting down a hand lamp. He must have gotten it from the dressing station. "Five of them froze to death, the other eight have frostbite. The commandant thinks there may be a bombardment tonight." He does not mention Eisner, and he does not say what has happened to the rest of the thirty men in Eisner's unit, though I know. The front has gotten them. I wait, holding the message in my stiff fingers, hoping Dr. Funkenheld will say, "I must go attend to their frostbite."

"Let me examine your eyes," the doctor says, and shows Muller how to hold the hand lamp. Both of them peer into my eyes. "I have an ointment for you to use twice daily," he says, getting a flat jar out of his bag. "It will burn a little."

"I will rub it on my hands then. It will warm them," I say, thinking of Eisner frozen at the front, still holding the roll of barbed wire, perhaps.

He pulls my bottom eyelid down and rubs the ointment on with his little finger. It does not sting, but when

I have blinked it into my eye, everything has a reddish tinge. "Will you have the wireless fixed by tomorrow?" he says.

"I don't know. Perhaps."

Muller has not put down the hand lamp. I can see by its light that he has forgotten all about the wiring fatigue and the Russian magnet and is wondering what the doctor wants with the wireless.

The doctor puts on his mittens and picks up his bag. I realize too late I should have told him I would send the message in exchange for them. "I will come check your eyes tomorrow," he says, and opens the door to the snow. The sound of the front is very close.

As soon as he is gone, I tell Muller about Schwarzschild and the message the doctor wants to send. He will not let me rest until I have told him, and we do not have time for his curiosity. We must fix the wireless.

"If you were on the wireless, you must have sent messages for Schwarzschild," Travers said eagerly. "Did you ever send a message to Einstein? They've got the letter Einstein sent to him after he wrote him his theory, but if Schwarzschild sent him some kind of message, too, that would be great. It would make my paper."

"You said that no message can escape a black hole?" I said. "But they could escape a collapsing star. Is that not so?"

"Okay," Travers said impatiently, and made his fingers into a semicircle again. "Suppose you have a fixed observer over here." He pulled his curved hand back and held the forefinger of his other hand up to represent the fixed observer. "And you have somebody in the star. Say when the star starts to collapse, the person in it shines a light at the fixed observer. If the star hasn't reached the Schwarzschild radius, the fixed observer will be able to see the light, but it will take longer to reach him because the gravity of the black hole is pulling on the light, so it will seem as if time on the star has slowed down, and the wavelengths will have been lengthened, so the light will be redder. Of course that's just a thought problem. There couldn't really be anybody in a collapsing star to send the messages."

"We sent messages," I said. "I wrote my mother asking her to knit me a pair of gloves."

There is still something wrong with the wireless. We have received only one message in two weeks. It said, "Russian opposition collapsing," and there was so much static we could not make out the rest of it. We have taken the wireless apart twice. The first time we found a loose wire, but the second time we could not find anything. If Hans were here, he would be able to find the trouble immediately.

"I have a theory about the wireless," Muller says. He has had ten theories in as many days: The magnet of the Russians is pulling our signals in to it; the northern lights, which have been shifting uneasily on the horizon, make a curtain the wireless signals cannot get through; the Russian opposition is not collapsing at all. They are drawing us deeper and deeper into a trap.

I say, "I am going to try again. Perhaps the trouble has cleared up," and put the headphones on so I do not have to listen to his new theory. I can hear nothing but a rumbling roar that sounds like the front.

I take out the folded piece of paper Dr. Funkenheld gave me and lay it on the wireless. He comes nearly every night to see if I have gotten an answer to his message, and I take off the headphones and let him listen to the static. I tell him that we cannot get through, but even though that is true, it is not the real reason I have not sent the message. I am afraid of the commandant finding out. I am afraid of being sent to the front.

I have compromised by writing a letter to the professor that I studied medicine with in Jena, but I have not gotten an answer from him yet, and so I must go on pretending to the doctor.

"You don't have to do that," Muller says. He sits on the wireless, swinging his leg. He picks up the paper with the symptoms on it and holds it to the flame of the Primus stove. I grab for it, but it is already burning redly. "I have sent the message for you."

"I don't believe you. Nothing has been getting out."

"Didn't you notice the northern lights did not appear last night?"

I have not noticed. The ointment the doctor gave to me makes everything look red at night, and I do not believe in Muller's theories. "Nothing is getting out now," I say, and hold the headphones out to him so he can hear the static. He listens, still swinging his leg. "You will get us both in trouble. Why did you do it?"

"I was curious about it." If we are sent up to the front, his curiosity will kill us. He will take apart a land mine to see how it works. "We cannot get in trouble for sending military messages. I said the commandant was afraid it was a poisonous gas the Russians were using." He swings his leg and grins because now I am the curious one.

"Well, did you get an answer?"

"Yes," he says maddeningly, and puts the headphones on. "It is not a poisonous gas."

I shrug as if I do not care whether I get an answer or not. I put on my cap and the muffler my mother knitted for me and open the door. "I am going out to see if the mail has come. Perhaps there will be a letter there from my professor."

"Nature of disease unknown," Muller shouts against the sudden force of the snow. "Possibly impetigo or glandular disorder."

I grin back at him and say, "If there is a package from my mother, I will give you half of what is in it."

"Even if it is your gloves?"

"No, not if it is my gloves," I say, and go to find the doctor.

At the dressing station they tell me he has gone to see Schwarzschild and give me directions to the artillery staff's headquarters. It is not very far, but it is snowing and my hands are already cold. I go to the quartermaster's and ask him if the mail has come in.

There is a new recruit there, trying to fix Eisner's motorcycle. He has parts spread out on the ground all around him in a circle. He points to a burlap sack and says, "That is all the mail there is. Look through it yourself."

Snow has gotten into the sack and melted. The ink on the envelopes has run, and I squint at them, trying to make out the names. My eyes begin to hurt. There is not a package from my mother or a letter from my professor, but there is a letter for Lieutenant Schwarzschild. The return address says "Doctor." Perhaps he has written to a doctor himself.

"I am delivering a message to the artillery headquarter," I say, showing the letter to the recruit. "I will take this up too." The recruit nods and goes on working.

It has gotten dark while I was inside, and it is snowing harder. I jam my hands in the ice-stiff pockets of

my coat and start to the artillery headquarters in the rear. It is pitch-dark in the communication trenches, and the wind twists the snow and funnels it howling along them. I take off my muffler and wrap it around my hands like a girl's muff.

A band of red shifts uneasily all along the horizon, but I do not know if it is the front or Muller's northern lights, and there is no shelling to guide me. We are running out of shells, so we do not usually begin shelling until nine o'clock. The Russians start even later. Sometimes I hear machine-gun fire, but it is distorted by the wind and the snow, and I cannot tell what direction it is coming from.

The communication trench seems narrower and deeper than I remember it from when Hans and I first brought the wireless up. It takes me longer than I think it should to get to the branching that will lead north to the headquarters. The front has been contracting, the ammunition dumps and officer's billets and clearing stations moving up closer and closer behind us. The artillery headquarters has been moved up from the village to a dugout near the artillery line, not half a mile behind us. The nightly firing is starting. I hear a low rumble, like thunder.

The roar seems to be ahead of me, and I stop and look around, wondering if I can have gotten somehow turned around, though I have not left the trenches. I start again, and almost immediately I see the branching and the headquarters.

It has no door, only a blanket across the opening, and I pull my hands free of the muffler and duck through it into a tiny space like a rabbit hole, the timber balks of the earthen ceiling so low I have to stoop. Now that I am out of the roar of the snow, the sound of the front separates itself into the individual crack of a four-pounder, the whine of a star shell, and under it the almost continuous rattle of machine guns. The trenches must not be as deep here. Muller and I can hardly hear the front at all in our wireless hut.

A man is sitting at an uneven table spread with papers and books. There is a candle on the table with a red glass chimney, or perhaps it only looks that way to me. Everything in the dugout, even the man, looks faintly red.

He is wearing a uniform but no coat, and gloves with the finger ends cut off, even though there is no stove here. My hands are already cold.

A trench mortar roars, and clods of frozen dirt clatter from the roof onto the table. The man brushes the dirt from the papers and looks up.

"I am looking for Dr. Funkenheld," I say.

"He is not here." He stands up and comes around the table, moving stiffly, like an old man, though he does not look older than forty. He has a mustache, and his face looks dirty in the red light.

"I have a message for him."

An eight-pounder roars, and more dirt falls on us. The man raises his arm to brush the dirt off his shoulder. The sleeve of his uniform has been slit into ribbons. All along the back of his raised hand and the side of his arm are red sores running with pus. I look back at his face. The sores in his mustache and around his nose and mouth have dried and are covered with a crust. Excoriated lesions. Suppurating bullae. The gun roars again, and dirt rains down on his raw hands.

"I have a message for him," I say, backing away from him. I reach in the pocket of my coat to show him the message, but I pull out the letter instead. "There was a letter for you, Lieutenant Schwarzschild." I hold it out to him by one corner so he will not touch me when he takes it.

He comes toward me to take the letter, the muscles in his jaw tightening, and I think in horror that the sores must be on his legs as well. "Who is it from?" he says. "Ah, Herr Professor Einstein. Good," and turns it over. He puts his fingers on the flap to open the letter and cries out in pain. He drops the letter.

"Would you read it to me?" he says, and sinks down into the chair, cradling his hand against his chest. I can see there are sores in his fingernails.

I do not have any feeling in my hands. I pick the envelope up by its corners and turn it over. The skin of his finger is still on the flap. I back away from the table. "I must find the doctor. It is an emergency."

"You would not be able to find him," he says. Blood oozes out of the tip of his finger and down over the blister in his fingernail. "He has gone up to the front."

"What?" I say, backing and backing until I run into the blanket. "I cannot understand you."

"He has gone up to the front," he says, more slowly, and this time I can puzzle out the words, but they make no sense. How can the doctor be at the front? This is the front.

He pushes the candle toward me. "I order you to read me the letter."

I do not have any feeling in my fingers. I open it from the top, tearing the letter almost in two. It is a long letter, full of equations and numbers, but the words are warped and blurred. "My Esteemed Colleague! I have read your paper with the greatest interest. I had not expected that one could formulate the exact solution of the problem so simply. The analytical treatment of the problem appears to me splendid. Next Thursday I will present the work with several explanatory words, to the Academy!"

"Formulated so simply," Schwarzschild says, as if he is in pain. "That is enough. Put the letter down. I will read the rest of it."

I lay the letter on the table in front of him, and then I am running down the trench in the dark with the sound of the front all around me, roaring and shaking the ground. At the first turning, Muller grabs my arm and stops me. "What are you doing here?" I shout. "Go back! Go back!"

"Go back?" he says. "The front's that way." He points in the direction he came from. But the front is not that way. It is behind me, in the artillery headquarters. "I told you there would be a bombardment tonight. Did you see the doctor? Did you give him the message? What did he say?"

"So you actually held the letter from Einstein?" Travers said. "How exciting that must have been! Only two months after Einstein had published his theory of general relativity. And years before they realized black holes really existed. When was this exactly?" He took out a notebook and began to scribble notes. "My esteemed colleague..." he muttered to himself. "Formulated so simply. This is great stuff. I mean, I've been trying to find out stuff on Schwarzschild for my paper for months, but there's hardly any information on him. I guess because of the war."

"No information can get out of a black hole once the Schwarzschild radius has been passed," I said.

"Hey, that's great!" he said, scribbling. "Can I use that in my paper?"

Now I am the one who sits endlessly in front of the wireless sending out messages to the Red Cross, to my professor in Jena, to Dr. Einstein. I have frostbitten the forefinger and thumb of my right hand and have to tap out the letters with my left. But nothing is getting out, and I must get a message out. I must find someone to tell me the name of Schwarzschild's disease.

"I have a theory," Muller says. "The Jews have seized power and have signed a treaty with the Russians."

We are completely cut off."

"I am going to see if the mail has come," I say, so that I do not have to listen to any more of his theories, but the doctor stops me on my way out of the hut.

I tell him what the message said. "Impetigo!" the doctor shouts. "You saw him! Did that look like impetigo to you?"

I shake my head, unable to tell him what I think it looks like.

"What are his symptoms?" Muller asks, burning with curiosity. I have not told him about Schwarzschild. I am afraid that if I tell him, he will only become more curious and will insist on going up to the front to see Schwarzschild himself.

"Let me see your eyes," the doctor says in his beautiful calm voice. I wish he would ask Muller to go for a hand lamp again so that I could ask him how Schwarzschild is, but he has brought a candle with him. He holds it so close to my face that I cannot see anything but the red flame.

"Is Lieutenant Schwarzschild worse? What are his symptoms?" Muller says, leaning forward.

His symptoms are craters and shell holes, I think. I am sorry I have not told Muller, for it has only made him more curious. Until now I have told him everything, even how Hans died when the wireless hut was hit, how he laid the liquid barretter carefully down on top of the wireless before he tried to cough up what was left of his chest and catch it in his hands. But I cannot tell him this.

"What symptoms does he have?" Muller says again, his nose almost in the candle's flame, but the doctor turns from him as if he cannot hear him and blows the candle out. The doctor unwraps the dressing and looks at my fingers. They are swollen and red. Muller leans over the doctor's shoulder. "I have a theory about Lieutenant Schwarzschild's disease," he says.

"Shut up," I say. "I don't want to hear any more of your stupid theories," and do not even care about the wounded look on Muller's face or the way he goes and sits by the wireless. For now I have a theory, and it is more horrible than anything Muller could have dreamed of.

We are all of us—Muller, and the recruit who is trying to put together Eisner's motorcycle, and perhaps even the doctor with his steady bedside voice—afraid of the front. But our fear is not complete, because unspoken in it is our belief that the front is something separate from us, something we can keep away from by keeping the wireless or the motorcycle fixed, something we can survive by flattening our faces into the frozen earth, something we can escape altogether by being invalided out.

But the front is not separate. It is inside Schwarzschild, and the symptoms I have been sending out, suppurative bullae and excoriated lesions, are not what is wrong with him at all. The lesions on his skin are only the barbed wire and shell holes and connecting trenches of a front that is somewhere farther in.

The doctor puts a new dressing of crepe paper on my hand. "I have tried to invalid Schwarzschild out," the doctor says, and Muller looks at him, astounded. "The supply lines are blocked with snow."

"Schwarzschild cannot be invalided out," I say. "The front is inside him."

The doctor puts the roll of crepe paper back in his kit and closes it. "When the roads open again, I will invalid you out for frostbite. And Muller, too."

Muller is so surprised, he blurts, "I do not have frostbite."

But the doctor is no longer listening. "You must both escape," he says—and I am not sure he is even listening to himself—"while you can."

"I have a theory about why you have not told me what is wrong with Schwarzschild," Muller says as soon as the doctor is gone.

"I am going for the mail."

"There will not be any mail," Muller shouts after me. "The supply lines are blocked." But the mail is there, scattered among the motorcycle parts. There are only a few parts left. As soon as the roads are cleared, the recruit will be able to climb on the motorcycle and ride away.

I gather up the letters and take them over to the lantern to try to read them, but my eyes are so bad, I cannot see anything but a red blur. "I am taking them back to the wireless hut," I say, and the recruit nods without looking up.

It is starting to snow. Muller meets me at the door, but I brush past him and turn the flame of the Primus stove up as high as it will go and hold the letters up behind it.

"I will read them for you," Muller says eagerly, looking through the envelopes I have discarded. "Look, here is a letter from your mother. Perhaps she has sent your gloves."

I squint at the letters one by one while he tears open my mother's letter to me. Even though I hold them so close to the flame that the paper scorches, I cannot make out the names.

" 'Dear son,' " Muller reads, " 'I have not heard from you in three months. Are you hurt? Are you ill? Do you need anything?' "

The last letter is from Professor Zuschauer in Jena. I can see his name quite clearly in the corner of the envelope, though mine is blurred beyond recognition. I tear it open. There is nothing written on the red paper.

I thrust it at Muller. "Read this," I say.

"I have not finished with your mother's letter yet," Muller says, but he takes the letter and reads: " 'Dear Herr Rottschieben, I received your letter yesterday. I could hardly decipher your writing. Do you not have decent pens at the front? The disease you describe is called Neumann's disease or pemphigus—' "

I snatch the letter out of Muller's hands and run out the door. "Let me come with you!" Muller shouts.

"You must stay and watch the wireless!" I say joyously, running along the communication trench. Schwarzschild does not have the front inside him. He has pemphigus, he has Neumann's disease, and now he can be invalided home to hospital.

I go down and think I have tripped over a discarded helmet or a tin of beef, but there is a crash, and dirt and revetting fall all around me. I hear the low buzz of a daisy cutter and flatten myself into the trench, but the buzz does not become a whine. It stops, and there is another crash and the trench caves in.

I scramble out of the trench before it can suffocate me and crawl along the edge toward Schwarzschild's dugout, but the trench has caved in all along its length, and when I crawl up and over the loose dirt, I lose it in the swirling snow.

I cannot tell which way the front lies, but I know it is very close. The sound comes at me from all directions, a deafening roar in which no individual sounds can be distinguished. The snow is so thick, I

cannot see the burst of flame from the muzzles as the guns fire, and no part of the horizon looks redder than any other. It is all red, even the snow.

I crawl in what I think is the direction of the trench, but as soon as I do, I am in barbed wire. I stop, breathing hard, my face and hands pressed into the snow. I have come the wrong way. I am at the front. I hear a sound out of the barrage of sound, the sound of tires on the snow, and I think it is a tank and cannot breathe at all. The sound comes closer, and in spite of myself I look up and it is the recruit who was at the quartermaster's.

He is a long way away, behind a coiled line of barbed wire, but I can see him quite clearly in spite of the snow. He has the motorcycle fixed, and as I watch, he flings his leg over it and presses his foot down. "Go!" I shout. "Get out!" The motorcycle jumps forward. "Go!"

The motorcycle comes toward me, picking up speed. It rears up, and I think it is going to jump the barbed wire, but it falls instead, the motorcycle first and then the recruit, spiraling slowly down into the iron spikes. The ground heaves, and I fall, too.

I have fallen into Schwarzschild's dugout. Half of it has caved in, the timber balks sticking out at angles from the heap of dirt and snow, but the blanket is still over the door, and Schwarzschild is propped in a chair. The doctor is bending over him. Schwarzschild has his shirt off. His chest looks like Hans's did.

The front roars and more of the roof crumbles. "It's all right! It's a disease!" I shout over it. "I have brought you a letter to prove it," and hand him the letter which I have been clutching in my unfeeling hand.

The doctor grabs the letter from me. Snow whirls down through the ruined roof, but Schwarzschild does not put on his shirt. He watches uninterestedly as the doctor reads the letter.

"The symptoms you describe are almost certainly those of Neumann's disease, or pemphigus vulgaris. I have treated two patients with the disease, both Jews. It is a disease of the mucous membranes and is not contagious. Its cause is unknown. It always ends in death." Dr. Funkenheld crumples up the paper.

"You came all this way in the middle of a bombardment to tell me there is no hope?" he shouts in a voice I do not even recognize, it is so unlike his steady doctor's voice. "You should have tried to get away. You should have—" and then he is gone under a crashing of dirt and splintered timbers.

I struggle toward Schwarzschild through the maelstrom of red dust and snow. "Put your shirt on!" I shout at him. "We must get out of here!" I crawl to the door to see if we can get out through the communication trench.

Muller bursts through the blanket. He is carrying, impossibly, the wireless. The headphones trail behind him in the snow. "I came to see what had happened to you. I thought you were dead. The communication trenches are shot to pieces."

It is as I had feared. His curiosity has got the best of him, and now he is trapped, too, though he seems not to know it. He hoists the wireless onto the table without looking at it. His eyes are on Schwarzschild, who leans against the remaining wall of the dugout, his shirt in his hands.

"Your shirt!" I shout, and come around to help Schwarzschild put it on over the craters and shell holes of his blasted skin. The air screams and the mouth of the dugout blows in. I grab at Schwarzschild's arm, and the skin of it comes off in my hands. He falls against the table, and the wireless goes over. I can hear the splintering tinkle of the liquid barretter breaking, and then the whole dugout is caving in and we are under the table. I cannot see anything.

"Muller!" I shout. "Where are you?"

"I'm hit," he says.

I try to find him in the darkness, but I am crushed against Schwarzschild. I cannot move. "Where are you hit?"

"In the arm," he says, and I hear him try to move it. The movement dislodges more dirt, and it falls around us, shutting out all sound of the front. I can hear the creak of wood as the table legs give way.

"Schwarzschild?" I say. He doesn't answer, but I know he is not dead. His body is as hot as the Primus stove flame. My hand is underneath his body, and I try to shift it, but I cannot. The dirt falls like snow, piling up around us. The darkness is red for a while, and then I cannot see even that.

"I have a theory," Muller says in a voice so close and so devoid of curiosity it might be mine. "It is the end of the world."

"Was that when Schwarzschild was sent home on sick leave?" Travers said. "Or validated, or whatever you Germans call it? Well, yeah, it had to be, because he died in March. What happened to Muller?"

I had hoped he would go away as soon as I had told him what had happened to Schwarzschild, but he made no move to get up. "Muller was invalidated out with a broken arm. He became a scientist."

"The way you did." He opened his notebook again. "Did you see Schwarzschild after that?"

The question makes no sense.

"After you got out? Before he died?"

It seems to take a long time for his words to get to me. The message bends and curves, shifting into the red, and I can hardly make it out. "No," I say, though that is a lie.

Travers scribbles. "I really do appreciate this, Dr. Rottschieben. I've always been curious about Schwarzschild, and now that you've told me all this stuff, I'm even more interested," Travers says, or seems to say. Messages coming in are warped by the gravitational blizzard into something that no longer resembles speech. "If you'd be willing to help me, I'd like to write my thesis on him."

Go. Get out. "It was a lie," I say. "I never knew Schwarzschild. I saw him once, from a distance—your fixed observer."

Travers looks up expectantly from his notes as if he is still waiting for me to answer him.

"Schwarzschild was never even in Russia," I lie. "He spent the whole winter in hospital in Gottingen. I lied to you. It was nothing but a thought problem."

He waits, pencil ready.

"You can't stay here!" I shout. "You have to get away. There is no safe distance from which a fixed observer can watch without being drawn in, and once you are inside the Schwarzschild radius, you can't get out. Don't you understand? We are still there!"

We are still there, trapped in the trenches of the Russian front, while the dying star burns itself out, spiraling down into that center where time ceases to exist, where everything ceases to exist except the naked singularity that is somehow Schwarzschild.

Muller tries to dig the wireless out with his crushed arm so he can send a message that nobody can hear—

"Help us! Help us!"—and I struggle to free the hands that in spite of Schwarzschild's warmth are now so cold I cannot feel them, and in the very center Schwarzschild burns himself out, the black hole at his center imploding him cell by cell, carrying him down into darkness, and us with him.

"It is a trap!" I shout at Travers from the center, and the message struggles to escape and then falls back.

"I wonder how he figured it out," Travers says, and now I can hear him clearly. "I mean, can you imagine trying to figure out something like the theory of black holes in the middle of a war and while you were suffering from a fatal disease? And just think, when he came up with the theory, he didn't have any idea that black holes even existed."