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**Lost in the Great Galactic Drift, Their
Only Chance Was to Follow the Stars!
Supernal Forces Catapult Two Lone Space
Voyagers into an Uncharted, Timeless Void**

**A Complete
Novelette
of
Space-Time**

A MONTH A MINUTE

By RALPH MILNE FARLEY

Author of "Liquid Life,"
"The Radio Planet," etc.

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CHAPTER I

61 Cygni

Young Benson Crocker shifted his well-built body in the easy chair and addressed the elderly scientist before him.

"I can understand why, Professor, if you give the space ship a sudden impulse, like that given to a bullet by a gun, it would instantly smash the man in the ship to pulp; but, if the acceleration were built up gradually—"

"Bah!" spat Professor Porter, his high-domed forehead contorting into a frown. His lame leg, resting stiffly on the stool in front of his chair, seemed to stiffen even more. "What you're thinking of is *velocity*. If you had given serious attention to your mathematical physics, instead of being satisfied with the lowest grade which would still permit you to play football, you would realize that force always equals mass times acceleration, regardless how slowly the acceleration is built up. An acceleration of one mile per second squared would cause a one-hundred-and-eighty-pound young man such as yourself to weigh almost exactly fifteen tons—quite an unbearable weight."

"But there must be *some* way in which to build up sufficient velocity for interstellar travel," Crocker persisted.

"There is!" The old professor paused dramatically. "I have discovered a new scientific principle. Not only that, but I have built a space ship to utilize my new principle. You are to be the first person in all the world to whom I shall disclose it. That's why I invited you over here this evening."

"Me! Why me?"

"Because, Crocker, I like you. Strange, is it not, that I, a physicist, should like you, a mere football player, who nearly flunked one of my courses!"

Benson Crocker grimaced.

"What stumps me, sir, is the theoretical part of the subject. I do all right in the practical applications, don't I?"

"Yes, Ben, you do. And perhaps that's why I like you. At any rate, let's say that that's why I chose you as the first person with whom to discuss my new theory. I want to subject it to the scrutiny of a practical mind; for my space ship will have to be practical if it is to succeed."

"All right, sir."

The professor's pale blue eyes glowed in deadly earnest.

"Do you recall enough of your freshman course in analytic geometry to remember what a 'minimal line' is?"

But Crocker was not listening, for just at that moment his keen grey eyes, roaming the room, had fallen upon the tinted photograph of a golden-haired blue-eyed girl of about his own age. And so, as he studied the picture, the dissertation of the old professor rumbled into the background of Crocker's thoughts.

The girl *was* beautiful! Probably the credit was all due to photographic retouching, for the face of the girl in the picture was an unusually attractive one. Crocker studied each contour and lineament with appraising incredulity.

Who was this sweet wistful vision of loveliness, he wondered. Not Porter's daughter, certainly, for the codger was too old to have a daughter as young as she. His granddaughter? Or perhaps his grandniece?

Crocker's conjecture as to the relationship of this girl to his host caused his attention to flash back to the old professor, just in time to hear the latter say:—"And so we don't have to decide whether light is a pulse or a wave, inasmuch as the two are the same on a line which is perpendicular to itself at every point along its entire length. That's my own addition to Eddington's theory!"

"Wonderful, sir!" Crocker exclaimed, with a forced pretense at intense interest.

Beaming with gratification, Professor Porter continued.

"As you know, velocity equals distance divided by time. If some method could be invented to interchange distance and time, the ratio would be inverted, and any object which was traveling slowly would suddenly find itself traveling at a phenomenal rate—and without having undergone any damaging acceleration. This method I have devised and used as the principle of my new space ship. To effect this change, all that is necessary is to make a 90° shift of the coordinated axis of space and time."

"But doesn't that take tremendous force?"

"Not at all! Inasmuch as the line of travel of any object through space-time is a minimal line, and as a minimal line is at right angles to itself, the shift requires no force at all!"

Just then the door of the study opened, and in walked the girl of the picture. Crocker stood up unsteadily. The picture had not been a retoucher's masterpiece after all. He stared rudely at the girl; she flushed with embarrassment, then glanced inquiringly at the professor.

"Oh—ah—my dear," he said, "this is one of my students, Mr. Benson Crocker. Crocker, this is my granddaughter Iralene, just back from school in the East."

Crocker murmured something incoherent. The girl smiled impishly.

They sat down. To cover his embarrassment, Crocker turned to his host and asked the first question which popped into his head.

"What would life be like," he asked, "with space and time interchanged?"

This turned out to be just the right sort of question to start the old man off on an enthusiastic lecture. Iralene leaned forward and listened intently. Crocker studied her with equal intentness.

"Of course, you realize," the professor explained, "that it is only *one* of the three space dimensions that gets interchanged with time, namely the one along which the object is moving. Velocity remains velocity, but with a greatly altered speed. Acceleration in the line of travel becomes seconds per foot squared. Specific gravity becomes the ratio between two sectional densities. Angular velocity becomes any one of three different things, depending on ___"

But Crocker had ceased to listen. He was more interested in Iralene Porter than in mathematical physics. When Professor Porter's declamatory voice next obtruded itself upon Crocker's consciousness, the old man was concluding with, "Shape, weight, smell, heat, electricity—everything—will be converted into something new. The human mind cannot conceive what it would be like to experience these new dimensional combinations. I wish that some day I might experience them."

"But won't you know," Crocker pointed out, "when you take the trip in your space ship?"

A queer light came into Porter's pale eyes.

"Yes and no," he replied. "Within the space ship all will seem unchanged, for the senses will have undergone the same transformation as the things observed. The ship will be traveling too fast for the outside world to observe changes in it. And, looking out through the fused-quartz windows of my ship, all that one will be able to see would be the stars—and I have not yet figured out what changes pinpoints of light will undergo under my transformation."

"Where do you intend to go?" Crocker asked.

"For the present, merely upstairs," Porter replied cryptically. "Come on. I'll show you my apparatus."

He grasped the knee of his stiff leg with both hands, lifted it off the stool, and planted his foot on the floor. Then, picking up the cane which leaned against his chair, he arose, and led the way to his attic laboratory. Thence up a ladder—one rung at a time, drawing his stiff leg after him—and through a trapdoor onto the star-lit flat roof.

The professor threw a wall switch, flooding the place with light. On a pedestal a small model of what looked like a submarine, surrounded by a mesh of fine insulated wire, came into view.

"See that little space ship?" he announced, with a wave of his hand. "Those wires, when energized, interchange space and time within their field. Observe!"

He pushed a button on the side of the pedestal. The tiny space ship vanished. The maze of wires hung torn and disrupted.

"Where has it gone?" Crocker exclaimed.

"Hurling off into space, with unbelievable velocity. And now observe this one." The professor removed the cover from an apparently identical enmeshed model on an identical pedestal. He pushed a button. Nothing happened.

"What's the matter?" Crocker asked.

Professor Porter grinned.

"Everything's okay," he replied. "This little ship has apparatus within it to set up a neutralizing field. I turned on both fields simultaneously, and so of course nothing happened."

"Say, here's an idea, sir," Crocker suggested, with one eye on the girl, to note her reaction. "Why don't you turn on the neutralizing field a thousandth of a second after you turn on the first field? By measuring just how far and in what direction your model traveled in that brief interval, you would have a complete check on your theory."

"My theory needs no check!" the professor asserted, drawing himself erect. Then softening, "Yet it *would* be interesting to try. I have a successive-contact button on the desk here. It will take only a minute to hitch it up. Of course it will not enable us to measure the time interval, but at least it will give us a qualitative test."

The scientist deftly made the substitution. Then he pressed the newly installed button.

But nothing happened. He frowned.

"Perhaps," Crocker suggested, "you pushed so quickly that the first field got neutralized before it put in its effect."

"Perhaps," the professor agreed. "All right. I will try again more slowly."

He pushed the button more gingerly. The three persons gasped.

The little ship was gone, its wire cage wrecked, and the conduit which supplied current to its insides, snapped off.

Professor Porter stared for a moment, then glanced hurriedly at his wrist-watch.

"Come," he said. "I will show you my full-sized ship."

He removed a canvas covering from a bulky object, disclosing a spindle-shaped form of glistening chromium-plate about ten feet high and thirty feet in length, within a network of wires. Then he removed the covering from a small object, disclosing a bank of switches and clockwork.

"I have computed, to a millionth of a second," he explained, "the exact instant at which the combined effect of the rotation of the earth, the motion of the earth in its orbit about the sun, the rotation of the galaxy of which the Solar System forms a part, the drift of the entire galaxy through space, and whatever independent motion the sun may have within the galaxy will be carrying this laboratory toward 61 Cygni, one of the nearest stars, about ten light-years away, at the comparatively slow speed of 244,000 miles per hour. At exactly that instant, provided that my master switch has first been closed, my time-clock will energize this field, and my ship will shoot off at a speed faster than light, almost directly toward that distant star."

"May I ask," the athlete interrupted, "why you didn't pick out some nearer star? Aren't there some—"

"Only one is appreciably nearer, namely Alpha Centauri, four light years away; but no point on the surface of the earth ever moves even approximately toward Alpha Centauri."

"That's almost incredible!" Crocker exclaimed. "I should think—"

"You would think that there would be some time of the day or year at which some spot on the earth would be moving toward almost any given point in the sky. But you forget the galactic drift, so stupendous as to render almost insignificant the minor motions of the earth. And so I say that no spot on the earth moves except toward one very small portion of the sky. It is indeed fortunate that a star even as near as 61 Cygni lies within this small portion. Furthermore, my ship will be traveling at about 2750 times the speed of light, and so will traverse the ten light-years in just a bit less than a day.

"My ship contains the means for stopping, for changing the direction of its travel, and for landing gently on any planet which 61 Cygni may possess. Now, would you both like to step inside?"

CHAPTER II

The Fallacy

There was a small gap in the surrounding mesh of wires, beyond which was an opened door in the side of the spindle-shaped ship.

Crocker motioned Iralene Porter to precede him, and the two crawled through the wires and entered the ship.

Within, it truly resembled a ship. There was a berth along each side; a hanging folding table in the middle; bookcases and cupboards on the walls; circular portholes.

Suddenly the door slammed behind them. Impelled by some instinctive fear, Crocker wheeled and seized the handle. It turned easily—too easily. But the door would not open.

Peering frantically through the circular window in the door, he saw Professor Porter, smiling reassuringly, waving to him. Then the professor glanced at his wrist-watch, and limped over to the control table, where he closed a switch.

Holding his wrist-watch up before his eyes, he raised his right hand as though for a signal; then stared expectantly at the space ship.

Horrified, Crocker stared back. He felt Iralene behind him, clutching his arm. Then, suddenly, before their retinas registered it, they realized that the rooftop on which the ship had stood was gone. They were out in space.

"Well, I'll be damned!" Crocker exclaimed, drawing back from the port-hole. For a full minute he stood stunned; then turned, and faced the girl.

Iralene shrugged her pretty shoulders.

"Well, Mr. Crocker," she said airily, "here we are, hurtling through space, toward the Swan."

"Toward the what?"

"Toward Cygnus—the constellation of the Swan."

Crocker swore softly.

"So we're to take a swan-dive, are we? Just because that old fool of a scientific maniac—"

"He was foolish enough to let you pass his course!"

"Now look here!" Crocker said sharply. "We're in a jam. If that old idiot's theories are correct, we are due to arrive at 61 something-or-other in about twenty-three hours; and so, if we don't hurry up and figure out what to do when he get there, this swan-dive of ours is likely to prove a swan-song. In other words, my pet, we have less than a day in which to figure out how to stop this perambulator or else we'll keep on cruising through space forever."

"Forever?" The girl's voice broke with horror.

Crocker raised his eyebrows.

"Well, not exactly forever," he said coolly. "Merely until our food and our air-supply give out. Or perhaps our heat."

"Oh!" she cried, dawning terror in her eyes.

Crocker drew her toward him and held her close.

"Now, if I had listened to your grandfather's two orations this evening," he said, grinning, "instead of studying your photograph during the first one, and watching you during the second, I might have some faint idea what this trip is all about."

Iralene smiled up at him through a single tear.

"You really—" she began.

"Yes," he said quietly. Their eyes met, then locked. Gently he released her. "Well, now it's up to me to try and get us out of this mess."

The two of them stared around the little cabin of the space ship.

"Here's a note for us," the girl announced, picking up a sheaf of neatly typewritten pages from the hanging central table.

Side by side, they sat down on one of the berths and studied the note. It read:

My dear Iralene and Ben Crocker:

I am sending the two of you out into space, in order that science may be advanced. There is no risk, or I would not send a person whom I love as much as I do Iralene. I would go myself, were it not that my leg might hamper me, and anyone who accompanied me, on a strange planet. Your speed will be so many times that of light that you will span a distance of ten light-years in about twenty-three hours.

Those twenty-three hours will give you scant time in which to master the controls of your ship. But do not fear. Everything is provided for. Food, water, heat, light and power. Full directions for steering the ship, if you should happen to get slightly off your course. Means for landing gently. Means for your return to the earth.

The first matter to consider is charting your course through the skies. I am convinced that, in spite of your changed state of existence, light will look like light. Even so, inasmuch as you will be traveling many times the speed of light, you will be able to see only those stars almost directly ahead. Look through the forward porthole, and pick out 61 Cygni from the accompanying chart—

"Come on," Crocker interrupted. "Let's star-gaze."

They got up from where they were seated on the bunk. But, as they started for the bow, Iralene looked through a porthole on the left side of the ship. A little cry escaped her. "A planet!" she exclaimed, "a planet, to the left and a little below us!"

"Impossible!" Crocker replied. "The old fool—I mean, your grandfather said we would be traveling at nearly three thousand times the speed of light. At that rate, we ought to be well outside the Solar System by now. It should be invisible because we are outdistancing its rays."

Iralene shrugged. "And yet there it is," she retorted.

Crocker peered out of the bow port-hole. There, a bit below, hung a dimly illumined half-disc. Its curved edge, lying to the left and slightly downward, was a sharply defined arc, from which several bright splotches extended inward. Its straight edge was dim and indistinct.

"It must be the earth," he asserted, thinking aloud. "Those bright splotches could be Australia, and the edge of Asia and Alaska, I'd judge."

Iralene joined him, and with heads close together at the porthole they watched the earth gradually shrink and recede, shift downward and to the left.

Finally Crocker ran a hand through his sandy hair.

"I don't quite get it," he asserted. "This space ship was headed east, and yet here we are, way to the west of America. We must be traveling backward."

Iralene laughed.

"It doesn't take all your complicated reasoning to figure that out," she said. "The earth is ahead of us, and rapidly receding; therefore it's obvious we're going backward."

"And not so very fast at that," Crocker added. He took out a pencil, and held it at arm's length, like an artist measuring a landscape; then glanced at the watch on his left wrist.

"What on earth are you doing?" the girl asked.

"Trying to figure out how fast we are going," he replied. "If you want to help, get out a ruler or something and measure the distance from the tip of this pencil to my thumbnail, and the distance from the pencil to my eye," She found a tape-measure, and did so. "Now see if the library, which your grandfather so kindly provided for us, includes an atlas and trig-book."

About ten minutes later, he commented, "Half size now." Returning to the table, he took a pad of paper, and sat down on the right hand bunk. Iralene seated herself on the left hand bunk, across the table from him, and watched him, chin on palms and elbows on table, as he busied himself with mathematical calculations.

A half hour later Crocker announced that they were speeding away from earth at the rate of five hundred thousand miles per hour!

"So what?" asked Iralene.

"So this! That old id—I mean, your grandfather told me that the spot on the earth where his laboratory is located was moving through space at about 244,000 miles per hour. We are moving backward away from the earth at about twice that speed, which means that for some reason we are just about doubling the effect of being left behind!"

"I don't believe it! I can't believe it! Grandfather can't be wrong in his calculations."

"He can't, eh?" Crocker snapped, and shrugged his broad shoulders. "You remind me of the lawyer, who told his client over the telephone, 'They can't put you in jail for that.' You remember the client's reply? 'I'm phoning from the jail.'"

"Then why are we sitting here arguing—wasting time?" the girl asked nervously. "We have less than twenty-three hours in which to find out what to do when we reach our destination. Why don't you do something?"

A tolerant smile spread over Crocker's face. It maddened the girl.

"At only five hundred thousand miles an hour, we won't get anywhere very fast," he pointed out. "So let's calm down and take our time. Suppose you check up on our domestic arrangements, while I read the rest of his letter and try and figure out where he made his mistake, and where we are really headed."

"I don't believe he made any mistake!" she protested. "Grandfather couldn't—"

Crocker gripped her by the arm until his knuckles went white.

"Now look here," he interrupted. "We may be cooped up together in this one little spindle-shaped room for months—perhaps for life—and not such a long life at that. I'm going to do my damndest to try and figure how to run this craft. Or, if you know more math than I do, I'll do the housework, and let you handle the books. But, in the meantime, let's both try to be friends. I'll do my part by trying not to tell you too often what I think of the old fool who got us into this fix."

Iralene's blue eyes flashed again at this last remark; then she heaved a deep sigh, her shoulders slumped, and all the fire went out of her.

"All right, Einstein, you win," she sighed. "I'll play house."

Crocker laughed.

"I'm not so hot, myself," he confessed. "Not much opportunity to heave a forward pass out here in space." He paused. "Well, it's late at night and we've had a nerve-wracking experience. We ought to get some sleep in on our borrowed time."

"But what about the twenty-three hours?"

"That's out! We're not headed for 61 Cygni. We're not traveling faster than light. And we are still within the Solar System. It's now almost morning, Earth-time. A good sleep will clear our heads. Six or eight hours from now we may have traveled far enough so that we can figure out just where we're headed."

Iralene began rummaging in the various cupboards. Crocker, still-seated, ran his fingers through his tousled sandy hair, and resumed the reading of the letter from the professor. Once Iralene made him move to sit on the opposite bunk, but he scarcely noticed, so engrossed was he in the message. Finally he reached the end of the letter. He looked up.

"Well?" asked the girl, smiling down at him.

"It's all here," he replied. "Full directions how to regulate the heat, how to reoxidize our air, how to redistill our waste water, and even how to steer this old tub. There is water, food and fuel enough for nearly a year. Your grandfather certainly didn't overlook anything!"

"I rather thought you'd eventually come to appreciate him. I knew he wouldn't have sent us off into space unless he had made every necessary provision for our safety. Well, our bunks are ready. Good night, and happy landings."

She sat down on the bunk across from Crocker, swung her trim legs up onto the mattress and drew the curtains closed.

Crocker did the same in his. He stared out for a moment at the sun, still hanging low to one side. Then he drew a shutter across the porthole, undressed, and crawled between the sheets. He was still pondering the contents of the professor's letter as he dozed off to sleep.

CHAPTER III

Lost

Crocker awoke with a start. For a few moments he couldn't quite recollect where he was. Then, as his

predicament dawned upon him, his heart began to race. Taking a firm grip on himself, he slid open the shutter of his porthole, and peered out.

His eyes met jet black darkness, peppered with stars. No sun. Hurriedly he pulled on his clothes, and swung out of the bunk. Iralene's curtains were still drawn.

He now noticed that the sun was streaming in through the overhead portholes, at quite a slant from the right. He glanced at his wrist-watch: twelve o'clock noon. Then he hurried to the bow porthole, and peered out—but no sign of the earth. It had disappeared completely.

"After we had been out about twenty minutes," he mused aloud, "the earth seemed about one and three-quarters inches high at arm's length. If it halved its size each time the time doubled—" He glanced at his wristwatch again. —"We've been traveling for twelve hours. The earth should be now a little less than one thirty-second its size—about a twentieth of an inch. It still ought to be visible."

Some instinct caused him to pace to the rear of the space ship and peer out. There, in the black sky, hung a tiny half disc. It was too small for him to distinguish any of its continents; yet it must be the earth, for it was too large to be any star or planet. At one side of the earth, an inch and a half away, was a bright dot; it must be the moon.

Suddenly Crocker gave a glad shout. Iralene poked her head out from between the curtains of her bunk.

"Why the glee?" she asked sleepily.

"We're headed back! We must be!" Crocker exclaimed. "We started out backward, with the receding earth seen through our front porthole. Now the earth is behind us. If we are still backing, we must be returning toward it."

Iralene withdrew her head, dressed hurriedly, and joined him. Hand in hand, and with new hope in their hearts, they stared out across space at the distant planet, from which they had departed twelve hours ago.

Finally Iralene disengaged her fingers from his.

"I'll tell you what we can do to celebrate," she announced. "Let's have some breakfast."

The girl busied herself at the electric stove and soon they sat down to a steaming meal of scrambled eggs and coffee. Little was said during the meal, but Crocker eyed the girl with unconcealed approval.

After they had washed and put away the dishes, they again stared out through the stern porthole at the distant earth.

"The earth has moved!" Crocker exclaimed. "Or, rather, we're no longer headed exactly toward it. It is higher and further to the left than it was before breakfast. Come on! We've got to steer the ship!"

"How?"

"Your grandfather's letter tells how." He fished it out of his pocket, turned the leaves, and then read:

Inasmuch as one of your space-dimensions has been interchanged with time, a lateral distortion of your ship in any direction will result in accelerating the ship in that direction, thereby changing its course. The steering-wheels in the bow accomplish this distortion. Use them as though they were ordinary steering-wheels.

"Come on," said Iralene. "There's no time to waste!"

The steering-wheels were clearly marked: one "Up" and "Down"; the other "Right" and "Left." Together they swung the two wheels to the right and down. A series of clicks, then the purr of motors. The framework of the space ship creaked and strained.

Further and further they turned the wheels, until both wheels reached a notch marked "Danger." The distant speck of light which was the earth, in the black void of space, continued to mount higher and to the left.

"Further! Further!" cried the girl in panic. She tried to wrench the wheels past the stops.

But Crocker ripped her hands away. The two wheels spun back to neutral.

"Do you want to wreck us?" he cried harshly.

With a gasp, she flung herself upon him—tried to reach the wheels—beat upon him with her fists. But flinging his strong arms around her, he held her tightly until she went limp in his arms.

"There, there, dear," he soothed, as he led her to one of the bunks, and forced her to sit down. "Getting panicky won't help any. And we ought to know better than to try to steer this boat. Something fundamental went haywire with your grandfather's calculations. Space and time have not been interchanged—we ought to know that, from the fact that we are not hurtling toward 61 Cygni as planned—and so everything else that depends on the swapping of space and time is all wrong too."

He seated himself beside her, and placed one arm across her shoulders.

"But Grandfather couldn't—" Iralene began.

"Skip it!" he snapped.

She stiffened momentarily, then relaxed, and leaned against him. Looking up into his face, she murmured hopefully, "You called me 'dear' a moment ago, Ben."

He clasped her to him, and kissed her firmly on the lips.

When he finally released her, she drew away, a frown on her face.

"Well, that's that. What are we going to do about it?" she asked.

"About the steering? We can't—" he evaded deliberately.

"No, silly. About us."

"Nothing," he said. "Until I get out of this mess, I've no right—Iralene, sweet, we've a long life ahead of us, *if* we can get back to the earth. Let's hope for that."

He leaned over, and kissed her gently on the cheek. Then he spread the professor's letter out on the table, and fell to studying it. The girl watched him for a few moments, then got up quietly, and busied herself about the stove. From time to time, Crocker would arise and stare out of the various portholes at the star-dotted blackness which surrounded them.

"I think that I have it, Iralene," he said finally. "Our ship is still moving way from the earth, and is tumbling over and over in space, in a sort of screw motion. Decidedly screwy, in fact." He grinned wryly. "I've figured out roughly that our ship is revolving around an axis, running through the upper left side and lower right side of the ship. When we were on your grandfather's roof, such an axis would have been parallel to the polar axis of the earth. But now we are rotating just the wrong way around. Something has sent us spinning backward through space, with the same speed as the earth's, but with exactly the reverse motion. I intend to find out what."

Benson Crocker continued his calculations and his star-observations. Iralene put the ship on a regular domestic schedule, and attended to the housework. In addition she regulated the heating and lighting, redistilled the wastes. And gradually she learned to help her companion with his astronomical observations, and with the simpler of his calculations.

By the end of a week he had definitely confirmed the fact that, like a little planet, their ship was rotating about a fixed axis, one revolution every twenty-four hours. The distant earth gradually shrank, until it became merely one more star in the black void. But still Crocker could think of no explanation for these phenomena.

It was Iralene who finally suggested that the solution must lie in the "minimal lines" about which her grandfather has discoursed so learnedly on the evening of their departure into space.

They delved through all of the books in the ship's library, and marked and read every reference to the subject—especially pamphlet copies of papers by Eddington and Birkhoff on relativity, and Professor Porter's own monograph in which he had elaborated on Eddington's theory.

They learned that a minimal line is an imaginary conception of pure mathematicians—a line of a sort which could never exist in real space, in other words an equation of analytic geometry ($y=ix$, in which i is the square root of minus one), having supposedly no meaning in actual reality.

But Eddington had shown that this was the true equation of a ray of light in four-dimensional space-time: $s=it$, in which s is the distance in light-years, measured along the ray, and t is the time in years.

A minimal line has zero length; therefore Eddington had shown that the source of a ray of light, and the eye which perceives it, touch each other; and hence no ether or other medium is needed for its transmission. A minimal line is at right angles to itself at every point on it; therefore Porter had shown that the pulse theory of light and the wave theory of light were identical.

And Porter had proved one more point, which his granddaughter and Ben Crocker vaguely remembered having heard him mention, namely that, by proper choice of one's units of space and time, the path not only of a ray of light, but of *every* object through space-time, is a minimal line.

"So what?" asked Iralene. And there the matter rested.

But one day, as Crocker was aimlessly toying with the fascinating little equation, $s=it$, it suddenly occurred to him to interchange space and time in that equation. The result was $t=is$. Multiplied through by i , the answer was $it=s$. That was the original equation back again with space negative! It meant going backward along one's world line in space-time!

"Iralene," he shouted. "I've got it!"

She came running, and he showed her the simple transformation which he had worked out.

"We are merely back-tracking over the earth's orbit, following the path through space formerly traced by New York. It is now June 22—"

"June 22!" she exclaimed. "Your Class Day. Oh, what a pity. Were you taking a girl?"

He shook his head, and grinned.

"No."

"I'm glad. But it's too bad you can't be there. You were to have been one of the Class Marshals, weren't you?"

He nodded.

"The football captain usually is," he explained. "But it really doesn't matter. I'd much rather be here with you. That is to say, I'd rather be with you. I'll take you to next Class Day, to make up for it. I guess they'll have to mail

me my diploma."

"But will there be any next Class Day? I mean—"

"Yes," he asserted happily. "For, as I was about to announce when we got off on this tangent about my missing my graduation, all we've got to do is wait for December, and then meet up with the earth on the other side of its orbit. Kiss me, dear. I may become a mathematical physicist some day, after all."

"That's a fine reason for kissing a girl," she retorted, holding up her lips dutifully.

CHAPTER IV

The Galactic Drift

The next few days were a joyous relief to the young couple marooned in space. Their hours of feverish study and computation were over. They had figured out that they were safe. All that remained for them now was to wait for a little more than five months, and then effect a gentle landing on the earth. All seemed well.

But two people, no matter how congenial, cooped up together in one small room, must eventually get on each other's nerves. Crocker began to worry about the supply of food, heat and water. According to calculations which he made, the supply might not last until December. When Crocker announced a schedule of rationing, Iralene cried that she was hungry, and cold, and thirsty. On the question of thirst, Crocker suggested that she be more careful with the redistillation. They quarreled, and she refused to speak to him for the rest of the day.

The next morning both of them apologized, and for a day or two they were even closer to each other. But the hurt rankled just below the surface, threatening to break out again at the slightest provocation. So passed a series of days of alternate idyllic bliss and petty quarrels.

Finally, about a month after they had been launched into space from the roof of Professor Porter's laboratory, Crocker was moodily staring out of a porthole during one of their spats, when he suddenly noticed that not only the earth, but also the sun, seemed to be falling behind!

This was not readily evident, and was due to the fact that at midnight the front of the ship was pointed toward the receding earth, with the sun slightly below abreast of the left side of the ship; whereas at noon the rear of the ship was pointed toward the earth, with the sun almost overhead.

Crocker worried a good deal about this new discovery of his. Each noon and midnight he made a pencil mark on the table, to indicate where the shadow of the edge of a porthole fell, and noted that the noon mark moved steadily forward, whereas the midnight mark moved steadily aft.

His worried condition kept him from quarreling. Iralene noticed his preoccupation, and worried about his health. So things went quite peacefully aboard the ship for several days. Then one day the girl caught him making one of his periodic marks on the center tableland demanded an explanation.

"I'm not such a good physicist after all," he groaned. "Here we've been living in a fool's paradise for days! We aren't ever going to see the earth again!"

"Why not?" she asked tremulously.

Crocker laughed grimly.

"As your grandfather said to me once before, 'But you forget the galactic drift, Ben!' Well, that's just what I've done. We are retracing the path of New York through space, all right; but, by the time that we reach December,

1936, and the earth reaches December, 1937, the whole Solar System will have drifted. Let's see." Crocker did some rapid figuring on a piece of paper; then looked up at the girl, face white. "It's even worse than I thought," he said dismally. "We are going to miss the earth by almost exactly fifteen billion miles."

For one horror-stricken moment the girl stared down at him. Then, as though in a trance, she moved toward the panel of control-switches. Sensing disaster, Crocker sprang to his feet and thrust himself between the girl and the controls.

"What's the big idea?" he demanded.

"I can't stand it!" she cried. "Going on, day after day, with our supplies gradually petering out, knowing that death is just ahead. I can't face it."

"What do you intend to do?"

"Throw the neutralizing switch. Make space-time normal again." Then, as he started to protest, "Oh, I know that Grandfather's theories are all cockeyed. You've demonstrated it, again and again; but what good have you done with all your proofs? You haven't got us out of here."

"Wait a minute, dear. Let's stop and figure out what will be the effect of putting things back to normal. We may get ourselves into a worse fix."

"We can't be worse off than we now are. Anything for a change!"

She lunged forward, tried to crowd past him, to reach the switchboard. He seized her roughly.

"I hate you!" she screamed.

Then suddenly, with a superhuman burst of strength, she threw him off his balance. Before he could recover, she was at the switches. The ship gave a sickening lurch. Iralene flung her arms around his neck.

"Oh, Ben," she cried, "I love you. Forgive me. I don't want to die."

He held her close, stroked her shoulder. They peered out through a nearby porthole.

"Look, Iralene, look!" he cried.

The space ship was resting on its pedestal on the rooftop of Professor Porter's house, just as it had been on that well-remembered night a month ago. Now, as then, it was night. Now, as then, Professor Porter was standing by his bank of switches staring at them out of pale eyes beneath a domed forehead.

"Of course!" Crocker exclaimed. "The neutralizing field has completely neutralized the effect of the other field. We are back to normal. Come on, dear."

Turning the door-knob he opened the door and led the girl out through the maze of wires to where her grandfather stood.

The old man's face fell as they approached him.

"It failed! My great invention failed!" he cried.

"What do you mean?" Crocker asked.

"I closed the switch, and nothing happened. And then out you step. Did you throw the neutralizing switch?"

"I'm just beginning to get it," said Crocker levelly. "Professor Porter, your granddaughter and I have been

traveling through space for a month. Then she threw the neutralizing switch, and here we are back to normal—normal *time* as well as normal *space*: the same instant, as well as the same place, from which we started a month ago.

"We really ought to have expected it from the behavior of that second little model which you showed us—if you can remember back that far, sir."

"Back that far? Oh, yes, I understand. It was a month ago for you, although only a minute for me. Well, we have a lot of figuring to do; but that can wait. Tell me about yourselves. Are you both well?"

"Well—and happy," Crocker replied, putting his hand in Iralene's. "And I guess I'm the fastest worker on record. I proposed to Iralene less than a minute after I met her!"

"Your math's still wrong," commented Professor Porter dryly. "43,200 minutes!"

[End of *A Month a Minute*, by Ralph Milne Farley]