

THE WORM TURNS

GREGORY BENFORD

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Gregory Benford is one of the modern giants of the field. His 1980 novel *Timescape* won the Nebula Award, the John W. Campbell Memorial Award, the British Science Fiction Association Award, and the Australian Ditmar Award, and is widely considered to be one of the classic novels of the last two decades. His other novels include *Beyond Jupiter*, *The Stars in Shroud*, *In the Ocean of Night*, *Against Infinity*, *Artifact*, and *Across the Sea of Suns*, *Great Sky River*, *Tides of Light*, *Furious Gulf*, *Sailing Bright Eternity*, *Cosm*, *Foundation's Fear*, and *The Martian Race*. His short work has been collected in *Matter's End*, *Worlds Vast and Various*, and *Immersion and Other Short Novels*; his essays have been assembled in a nonfiction collection, *Deep Time*. His most recent book is a new novel, *Beyond Infinity*. Coming up is another new novel, *The Sunborn*. Benford is a professor of physics at the University of California, Irvine.

In the Galactic Center novels such as *Great Sky River*, *Tides of Light*, and *Sailing Bright Eternity*, Benford's best-known contributions to the New Space Opera canon, he takes us to the core of the galaxy, where the dwindled remnants of humanity struggle to survive against hostile machine intelligences of immense power. Here, in a story much closer to the present day, at the beginning of humanity's expansion into space (and a direct sequel to his well-known story "A Worm in the Well"), he demonstrates that capturing a black hole is only half of the problem—then you have to *hang on* to it!

* * * *

She was about to get whirled into a puree, and all because of tricky accountants.

"Give me infrared," Claire called.

Erma murmured brightly, *I can give you full spectrum*, in Claire's headset and showed a sprawl of color that hurt the eyes.

"You keep trying to get me to look at the world that way, damn it!" Maybe I'm just a touch irritated, Claire thought, under pressure. But software didn't take offense, or so Claire thought. "Uh, I'm just a primate. One spectrum slice at a time. Please."

As you say. ..

Was there an irritated sniff after the words? No matter—Erma obliged.

There were several theorists' terms for the object hovering on her screens: wormring, ringhole. This wormring looked like a blurry reddish doughnut. It spun in a frenzied halo of skating brilliance. Sullen red snakes coiled around its skin. Lightning forked yellow and blue down the northern doughnut hole, but didn't come out on the other side, from this angle. The same fizzing flashes worked around the southern hole too, but there was no answering lightning to the north. Somewhere along that axis lay trouble. And that's where they had to go.

“What's the best trajectory, in theory?”

There is no adequate theory. The best mathematics says there are several entrances, but they all involve acquiring considerable angular momentum.

“Yeah, but there's got to be a best educated guess—”

I do have the latest numerical simulations, which you ordered from Earthside.

“Oh, good. I always feel better after a nice refreshing computer simulation.”

It is best to address our safety without stressful sarcasm.

“Sarcasm is just one more service we offer here at *Silver Metal Lugger Salvage and Loan.*”

Sarcasm is stressful.

“Stressful for who?”

For us both.

“Do I look like a people person?”

You look anxious.

“I thought you understood rhetorical questions.”

You are stalling for time.

“Damn right I am. Look at that wormring on the mass detector.”

Erma did. All virtual images that popped up on the screens had a glossy sheen to them that even Erma's teraprocessor couldn't erase. They looked too good to be real. Pristine geometries snarled and knotted into surf around the spinning doughnut.

Whorls of spacetime spun away and radiated waves in angry red hisses.

“Does that look safe to you?”

I would point out that I am backed up to Luna every half hour by laser link.

“Yeah, you’re immortal as long as I pay your computer fees.”

I can find other work—

Claire smiled. Erma didn’t often get into a sentence without seeing how it would turn out. Maybe her conversational program was competing with the huge sensor net strung around *Silver Metal Lugger’s* hull. They were measuring everything possible as they gingerly edged closer to the whirling wormring.

“You were saying... ?”

I was distracted. And I do have a high opinion of this enterprise. I do not like our probabilities if we hang near this strange object, however.

Could software also get jumpy? Erma hadn’t seemed so last time, five years ago, when they had snagged this same wormhole. After that, the astro guys started tinkering with it, trying to expand it so a ship could pass through—and they literally screwed it up. They had nudged and probed and somehow added angular momentum to it. Accidentally, they transformed the entire spacetime around what had been, apparently, a somewhat predict-able wormhole. Not that anybody knew what routine was for wormholes. After all, they only had one—this whirling dervish that had already eaten many probes, spitting nothing back out.

We need to go closer, to resolve the possible entrances.

Along the axis of the dervish was a shimmering lump that apparently held some exotic matter. The lump looked to be spinning too. Claire had been warned many times not to touch that lump, or else. Previous probes that had, had got broken down into elementary particles, and not particularly nice ones at that.

“There are basically two ways in, right? North and south poles of this general relativistic merry-go-round. But stay away from that axis.”

True. I think our spin matters too. The earlier probes tried varying angular momenta and a few managed to send back coherent signals for a while.

“Sure, for maybe ten seconds. I was kinda counting on my shoot-and-scoot strategy taking about that much time. Our contract says just make some readings and come on home. Didn’t one probe get back out?”

If one counts granules of carbon, yes.

“From a ceramic ship?”

Yes, not promising.

In her immersion-work environment, touch controls gave her an abstract distance from the wormring, hovering in space in magnetic clamps a hundred meters away. Whorls of wrenched spacetime slammed into their metal-lic ship’s skin, rattling her teeth, and, on the screens, spraying yellow-white froth of gravitational turbulence around them.

Perhaps the theoretical view would help.

“Doughnuts are doughnuts, Erma. Let’s just stick our nose in, real quick.”

And all because of tricky accountants.

* * * *

The thin Luny guys with briefcases got to her before she had even unpacked. She had counted on some ribald bar cruising to rub away the memory of a two-year comet-vectoring job too. She was just about ready to get into the foam shower and run the water a shameful hour or two, to feel really human again, to yammer at somebody other than Erma—and then they rang her door chimes, which played a Bach opening.

She didn’t answer. They came right on in, anyway.

“Hey! I’m renting this ‘partment.”

The taller of them didn’t even blink. “We could put you on a perfectly legal formal secure-lock right now.”

“The last guy who tried that ended up nearly getting frozen.”

The short one, apparently fond of his food, said smugly, “We checked. You didn’t prong him at all, just threatened to.”

“I could make an exception in your case.”

She smiled slowly, slit-eyeing the fat guy—who blinked nervously and took a step backward despite himself. She chided herself for taking on such an easy mark, but hell, she needed a little recreation. It would be fun to deck these two, and, as a bonus, stimulating to a cardiovascular system that had spent too much time in centri-g.

“You are in debt again. Deeply so.” Tall Guy’s smile was broad but utterly without warmth. “We are a legal officer”—a bow to Fat Guy—“and I am the project accountant. We have orders to duly confiscate your ship.”

“The last guy said that too. I dug myself out.”

“Yes, very admirable. But your comet-towing business has fallen upon sad times,” the tall guy said.

“Look, Second World Corp will vouch for me.” *I think. . .*

Fat Guy was still blinking, getting his self-image back in order. It took a fair amount of work for this Horseman of the Esophagus. Tall Guy smiled without a gram of humor and without invitation folded himself into a grav chair. She watched him do this, legs angling like demonstrations of the principle of the lever, and—startled—felt herself moisten. *I’ve been gone a loooong time.*

“I believe that maneuver will fail,” Tall Guy said smoothly.

“Let’s try it, shall we?” she said cheerfully. Freezing these guys was get-ting more attractive. She was tired, still adjusting from their in-flight standard Mars grav of 0.38. Their nominals had risen to 1.4 in the comet debacle. Though Moon Standard 0.18 felt great, her reflexes would be off with these two. She might just be getting a bit rickety for this line of work, though sixty-four wasn’t all that damn far into middle age anymore.

For the moment, she had better use deflection while she remembered where she had kept her stunner. And maybe just shut down Fat Guy, while she worked her wiles on Tall Guy? The thought intrigued. *Pleasure Before Business*, her fundamental rule.

“Do not presume to push us.” Getting icy now.

Okay, give them lip in return. “How come you can just walk in here?”

Fat Guy launched into a stumbling rendition of how they had used some law that said Financials could access property rights of those with outstand-ing debt, and at that point she stopped listening. These guys were dead seri-ous. They were used to delivering trouble to people, did it for a living. They probably had other slices of bad news to serve up today.

“... we trust some accommodation might be arrived at before we are forced to—” Fat Guy was saying.

“Before your heavies come calling?” she asked.

Tall Guy smoothly came in with, “We do hope such methods are not necessary, and had not even considered them.”

They were all clichés, straight from business school. And they had probably never been off Luna.

“Look, it wasn’t my fault that damn comet nucleus came unglued before we could get it into Lunar orbit. You need all the light elements you can get down here! And tow operations like mine keep you alive, right?”

Tall Guy nodded and with some effort got a diplomatic expression onto his face. “I know you feel that accountants and lawyers are annoying, but—”

“Not all lawyers are annoying. Some are dead.”

“My colleague and I are not questioning why you failed—”

“I wasn’t in charge of screening the comet ices against that solar flare. We used standard reflecting coating to keep the ice from subliming, routine methods. But that big flare blew off the shadow coating. Not my department! That storm made the whole damn iceberg start boiling off. It developed expansion fractures inside an hour, killed two women who—”

“We are well aware of that.” Tall Guy’s voice came sliding in like a snake. He had probably laid this conversation out in advance, getting his pitch in shape. To prove his point, he waved a hand and punched a few buttons on his belt. An air display of her account ledgers hung in the air between them, shimmering like a waterfall, the numbers all color-coded so that her debt glared forth in scarlet. A gaudy avalanche of debt. She scowled.

Tall Guy said languidly, “But there... may... be a way out for you.”

She smiled prettily, arched an eyebrow, said nothing. She had learned that if you let people talk, their love of their own voices could lead them into overplaying their hands. They would babble on, and in the course of relating whatever story or moral lesson they imparted, tell you useful things.

She had seen this work before, but the idea came from her famously laconic grandfather. He had squinted at her while she went on at a grand family dinner with a tale that ended in no particular point. Everybody smiled politely and general talk resumed but a few moments later Grandfather leaned over and whispered in his round burr, “Never pass by a chance to shut up.” She had blinked and thought furiously about that and learned a lesson that became quite useful.

Tall Guy said with a thin smile, “We can either talk of possibilities or we can

seize your ship.”

She let out a long breath. “Oh, goody.”

“Our offer is quite generous.”

“They always are.” She was busy looking at his hands. Long fingers too...

“Cosmo Corp has asked if you are interested in another expedition?”

“Let me guess. Another wormhole has turned up, stuck in a solar coronal arch? And Cosmo needs somebody to go fetch it. Just like last time.”

Another cold, calculating smile. Why did she like guys like this? Okay, it had been a long time, and technology can only do so much for the lonely gal. But still—

“No, alas. Though I might say I thought that an admirably brave and daring act. I heard someone made a 3D about it.”

“In case you’re wondering, I spent that money too.”

His veneer slipped a bit, but he recovered in an eyeblink. “I’m sure for a worthy cause.”

“Yeah, spent it all on me. What’s the deal?”

Tall Guy looked a bit rushed, as though he liked a lot of foreplay before getting down to business. Well, so did she, but a different kind of business than this character meant.

“It is the same wormhole. But it has changed.”

“Escaped?”

“No, it is secured in magnetic fields in free space, held in high Lunar orbit. But Cosmo Corp’s experiments to expand its mouth, and thus to bring interstellar travel to mankind, has—”

“Wait, how did Cosmo get the worm?”

“Uh, they exerted stock override options on the holding company con-sortium that by interplanetary rights had further—”

“Skip the jargon. They bought it?”

“In a manner of speaking.”

“I always mind my manners when I speak. What’s up?”

Tall Guy was now ignoring Fat Guy, who had found a seat on the other side of the ‘partment living room. Claire stayed standing. With guys, who routinely used height to intimidate women, it was just about her only ad-vantage here.

“I am not a technical person.” Tall Guy collapsed the glaring account ledger and arched an eyebrow at her. *Damn!* Even *that* got her moist. She really had to get out of here, go barhopping, blow off two years’ worth of steam—

“But the wormhole you captured has... changed, I do know that. Cosmo Corp was attempting to expand its, ah, mouth size. This is a delicate operation, apparently. I am unsure precisely what the difficulty was, but in making the wormhole mouth large enough to accommodate a substantial ship— such as yours, for example—they somehow added angular momentum to the wormhole. It became another sort of wormhole entirely.”

Claire said cautiously, “What sort?”

“One with enough rotation to change the very nature of the spacetime geometry.” Tall Guy shrugged, as if altering wormholes were something like the weather. What could one do, after all? Yawn.

“Hey, I’m a contract hauler. I grabbed that wormhole off its perch on the top of a magnetic arch, dragged it back to Earthside. That’s what I know, period.”

“Yes, but you do have some talent for the unexpected. That is apparently what Cosmo Corp needs. And soon.”

“Because... ?”

“Because certain governmental entities wish to possess the wormhole.”

“The Earthside scientists.”

Another *What can one do?* shrug. Very expressive. This guy should have gone on the stage, she thought. “They went through the Planetary Na-tions.”

She let a silence build. This was a critical point. In many negotiations, subtle silences did most of the work. Let the silence run... then... “Must be tough, dancing around on strings pulled all the way from Earth.”

Tall Guy shrugged, not denying it. Lean and muscular, he was the best man she had seen in years. Also the only man she had seen in years. That is, not counting Fat Guy, who might as well be on Pluto. She eyed Tall Guy and wondered if he was

an all-business type, or if he was attuned to social signals better than his fat friend. She was wearing slickskin tiger pants and neither of these guys had given that a glance. The oldtime gal rule was that no guy was going to notice what shoes you're wearing, and if he does, he's the wrong guy. Tall Guy was giving nothing away. Poker face, no eye con-tact, nothing.

Tall Guy said carefully, "The Planetary Nations Scientific Council got a binding injunction which begins in—" Tall Guy gazed off to the side, prob-ably consulting a clock in his inboard vision. "Seventeen hours."

"*Seventeen hours—*"

"And forty-eight minutes."

"Nobody can—"

"You can," he said, abruptly urgent. "You have experience with it. And the technical people have tried all they can, without success."

"Anybody get killed?"

He went deadpan. "I can't discuss that. Legal matters—"

"Okay, okay." She felt the fight go out of her. What the hell, she had slept most of the way to Luna, coming back from the comet fiasco. She was rested, well fed. Other hungers, though...

She could cut short the shower. Get out to the bars, find a guy, get some sack time in, then back up to *Silver Metal Lugger—*

"Okay, I'm interested." She put both hands on her hips, a commanding stance. "But we have to negotiate."

"There's little time, but we are prepared—"

She sliced a hand through the air, pointed at Fat Guy—who had devel-oped a pout. "No. He goes, you stay. We two negotiate the deal, my fee. And fast. Cosmo Corp needs this done pronto, right?"

"Uh, right." A gleam in Tall Guy's eye? Was she that obvious?

Well, maybe. And that could save them both some time too. Skip cruis-ing the bars, yes. Not the shower, though. She said quickly, "Let's, well, let's do it."

Maybe a shower for two?

* * * *

We must either go in or out. The ringhole is frame-dragging spacetime itself in its vicinity. Theory predicted this. I can feel its tug. This is not a safe place.

“No place is, when you think about it.” She recalled Tall Guy. Some things are better than they look. Maybe this wormring was okay, once you dove through. None of their probes was really savvy, after all. Artificial intel-ligences had plenty of craft, but little intuition. No animal instincts.

“We can do this. Let’s skin about our main axis, dive straight down through the north pole.”

We are turning. Hold on.

Claire was at the ship axis anyway, so she felt nothing as the room started to spin. Her fore screen showed them shooting into the wormring. The ship knocked and strummed as they skated by whorls that slammed into their nose.

“Y’know, I kinda hoped I’d have some time to talk to the theory guys about this.”

You said you were in the shower a long time.

“Uh, yeah.”

Alone?

“You’re getting into an area beyond your competence. Y’know, not having a body and all.”

Oh, my.

This was in a phony, high-pitched English voice, like a parody of Jane Austen. “Look, skip the gossip! Why’s this thing look like a rotating dough-nut?”

Wormholes are not tubes, my database says. They present in our space as solid objects. One passes through them by just merging with them. It is not like falling down a pipe.

“This one’s spinning.”

Apparently. The alterations the scientists carried out to expand it seem to have added angular momentum.

“Wormholes connect parts of spacetime, so—hey, well, it connects both

parts of space and... uh... parts of time?” Not for the first time, she regretted her spotty education. Manual laborers usually did, and realistically, she was just about one grade above that.

I do know from ancillary reading that the philosopher Godel solved the general field equations in their classical limit, for a rotating universe. He found that time could form loops. Apparently, he did this to illustrate a point about time being eternal in some sense, as Godel believed, to his friend Einstein. They were, as you would put it, buddies. Physics buddies.

Claire thought, sourly, *I never get a direct answer unless I coax.* Maybe she should buy a patch into a more masculine software. But then she would have to deal with the male narrow-linear perspective too. There were always trade-offs.

“Very nice, but what’s that mean?”

Twist a wormhole, twist space, twist time. I suppose.

“You suppose?”

All wormholes can be made into time machines, by moving them around at high speeds. Apparently, ringholes, with their angular momentum, even more so.

“Um. We need more. What about that big library program I bought you?”

I use it to... browse.

“Browse what, porn? I need—”

You have been accessing my routines! And after all my scientific database searchings!

Perfect, Erma; primly change the subject, mix in some offended hauteur.
“Show me, with color coding.”

On her wall screens, the magnetic grappling strands played and rippled like luminous wheat stirred by a breeze. In their grasp, the ringhole flexed and whirred. Blue lightning snarled and spat. It crushed and curdled light, stirring space with a spoon.

Claire gingerly pulsed *Silver Metal Lugger*, spilling more antimatter into the chambers.

This was more like surfing than flying. They fought their way down. The vortex groped for them. Grabbed.

“In we go.” This was lots better than hauling dreary comets, which had come to resemble delivering the milk, door to door. Danger was never boring.

Then the room... rippled. Stretched. Boomed. She watched sinusoids flounce through the walls without ripping anything, just flapping steel like waves crossing an ocean.

Her heart pounded. A jittery hum waltzed through her acceleration couch. The couch leather dimpled and puckered as torques warped across it. She could see the rivulets of gravitational stress work across her body too, like tornadoes a centimeter across twisting her uniform. She reminded herself that pilots didn't let their fear eat on them, not while there is flying to be done. And reminded herself again. It became a mantra.

The magnetic catcher's mitt slipped from view and they plunged into the whirl. It felt rubbery, somehow, and then her stomach tried to work up through her throat. Bile rushed into her nose. The acceleration slammed her around like a rag doll. She felt her skin stretching away in several directions. Gravitational stresses seemed to be trying to open her wrapping, to find a Christmas present inside.

“How're... we... doing... getting... through?”

I believe we are not.

“What!”

We are stalled in the rotating core of the doughnut.

“I... can... fly... us... out...” But her fingers moved like sausages.

You are incapable. You have no plan. I believe I must take command.

“You're... a program... not an... officer.” Just saying that took all her strength.

The air oozed like greasy hair. “Commit our full antimatter flux. Hammer us out of this.”

Inward or outward?

“Which way... is outward?”

Something like a peeved sigh came from Erma. *I was hoping you knew.*

“And you wanted to take *command!*” Irritation helped, actually. She could even complete a sentence. “Inward—that way.” She jabbed her chin toward the deck. “I guess...”

Antimatter howled as it met its enemy in their reaction chamber. The room spun around her so fast it blurred into a fluid. Her teeth rattled. On the screens, there was nothing but dark outside. How big was this thing? Were they squeaking through or in some infinity? “Did you send out laser pulses? Microwaves?”

Of course. Nothing came back.

“Maybe this thing is a perfect absorber? But nothing’s perfect.”

Something sputtered actinic blue and arced big, coming at them. Coming fast. She got a flash image of an oddly shaped ship, far away. Then it was gone. The only thing they had seen. Were they in some murk?

I have an incoming message.

“What? How can—hell, patch it through.”

The message says, “Worms can eat their tails and so can you.”

“Is this one of your jokes?”

I do not joke. I do not have the software.

“Eat my tail? What’s... Oh.”

Oh?

“Maybe that refers to the Godel thing? But who *said* it?”

Who is here with us? I am mere software.

Claire sniffed. She was sweating but the ship was cool. Her pulse quick-ened. This was intriguing, sure, but right now they were in a gravitational whirlwind. The couch adjusted to the tornado violence of their whirl but this could not go on for long. And how long was a wormhole, anyway?

Some glowing stuff zoomed by them—or at least got larger, all she could tell in this dense dark. It looked like neon clotted cream.

“What *was* that?”

My database says that wormrings are held together with exotic material, some kind of matter that has “negative average energy density. “Whatever that is, it had to be born in the Blossoming. It threads wormholes, stem to stern.

“Um. Great construction material, if you can get it. No use to us. Are we making any progress out of here?”

I cannot tell.

“And you thought I didn’t have a plan.”

Wait—I do sense something bright—approaching—

The black outside reddened. Churned.

Suddenly they slammed out—and into a blue storm. A mirror twin of the wormring dwindled behind them now. Brilliant rainbows rimmed it.

They tumbled, ass over entrails. Hot gas rushed by, prickly with blue and ruby glows. A huge gas giant hung between them and a bright, sullen star. The ship rocked and wheeled. A vast wind was driving them outward from the gas giant.

This gas is blowing us away from the wormring. It is mostly molecular hydrogen, quite hot—thus the blue gas. It comes from the planetary atmosphere. We are very near the star, a fraction of Mercury’s orbital distance. The star is smaller than ours.

She stared. The slightly reddish star was boiling away the gas giant’s surging atmosphere. In its orbit, the world was like a gassy comet, tail pointing outward. The giant was doomed, trapped to circle its tormenter while being slowly shredded.

A vast rosy plume erupted from the gas giant and curled toward *Silver Metal Lugger*. In the streaming gas curled a nasty vortex and they were at its edge.

I cannot navigate in this. My piloting also is not capable of—

“I’ll take the helm.” Claire fought to turn the ship. Their reaction engines could barely muster enough thrust to compete with the winds here. *Winds in space!* she thought wildly. *This is worse than that coronal arch. . . which we barely survived.*

Even making a turn was hard. It was better to think of the days she had enjoyed sailing. Tacking with the wind, then rounding on it when the vectors and torques allow...

She got them to take the billowing gas on their stern, slowing the tumbling pitch and yaw. A knot of angry violet gas shot by them. Flaming debris hit their flank. The screens showed no pressure loss, but plenty of abrasion from the roasting, eating winds. It took a long while to stabilize their course. They still rocked and veered like a sailboat in a hard storm.

“Damn! We’re supposed to reconnoiter, then get back home. This stuff is incredible.” She had never had an experience of *flying* in space. No way to estimate the damage done to the ship, no clear navigation rules. “But— where’s the ringworm?”

I have lost it. We moved quickly, blown away. I tried magnetically attaching a hailer as we departed, but it did not stick.

“It must be hard to glue on to spacetime,” Claire said. How do you clip anything to a wormhole?

She was distracted as she banked and turned against the roiling banks of hot hydrogen. “I wonder what happened to the ringworm?”

It may be in a stabilized orbit, a balance of its gravitational forces against this hydrogen wind.

“So it’s back there. Somewhere.”

They gradually came about and steadied. She took them aboard the gale and worked toward lesser densities. Blue streamers fell behind. The ruddy fog-mist paled. They gradually emerged into fairly open space. The stars reappeared, gleaming reassuringly.

Claire saw the bright sun from an angle now, sighting back along the misty edge of the plume. The eroding giant planet was a round nub against the glaring yellow-white solar disk. Outward from them and surprisingly nearby hung a two-mooned world in crescent. No recognizable constellations in a sky somehow brighter, with more stars—and yes, a globular cluster hovering like an ivory flower between two bright stars.

“Any idea where we are? Can you find galactic reference points?”

I am trying, but none of the local stars are known to me. We’re a long way from Earth.

“Keep trying. We may have to walk home.”

Another solar system. A long way from Earth. A thrill ran through her and she whispered commands to Erma to take scans of it all. Otherwise, she was speechless, adrift, fears dropping away. Somehow she had thought of this as just another gig. Now the immensity of the ideas Erma went on about, or the biz deals of Tall Guy—all those were details, clues, chatter. This was real.

Something hit them. Hard. The ship rattled.

“What the—”

A large soft mass hit us astern.

“Soft?”

It did little damage but conveyed momentum.

Nothing in Earth’s space was soft. Not even comets.

“Distance scan.”

I track many small objects. Nearby, approaching.

The screen filled with shapes. A fried-egg jellyfish swooped at them, at-tached to their skin. Drifting with spines out came a warty cucumber. There were amber pencils in flight, their rear tubes snorting out blue burning gas. Something like an ivory solar sail came at them, reeling its sails in along spars.

“This is crazy.”

Disturbing, yes. These cannot be machines—at least, not of metal and ceramics, run by computers. They are alive.

She eyed the many shapes with wonder. Gravity imposed simple geom-etries—cylinders, boxes, spheres. Here were effortless fresh designs: spokes and beams, rhomboids, fat curves. Rough skins and prickly shells, rubbery rods, slick mirrors—and all in the same twirling creature. “Feeding off that hydrogen, you figure?”

“Get our bots on the skin. Assess the damage. See if they can deal with these living things too.”

I have no idea how. ..

Angular shapes came at them, diving close and then veering away, ap-parently sizing them up. Needle-nosed predators, she would have guessed if this were undersea biology. All these creatures were much smaller than *Silver Metal Lugger*, but she did not like their numbers. More flocked in as she watched. They seemed to come from back toward the pale blue plume, as though they feasted on the hydrogen, hid among the streams, and then came out to forage. Predator/prey ratios in high vacuum? Or more like cloud life?

“Great, we play this by ear. Our bots deployed?”

They are popping out from their hatches.

She could see the clunky forms walking on magnetics across the silvery skin. The teeming ruby sky reflected in the hull and made a double geometry of whirling seethe. The skylife wheeled and darted in gaudy flocks in that sky. They had backed away once the bots were out. After all, they looked more like kites than birds. The bots were solid, rugged, probably of no interest to these gas-eaters.

The bots followed their grid sweep commands. They found rips and gouges and filled them with quick-fix patches. Claire always liked to do maintenance in case they had a major, subtle problem. It also gave her time to think.

This was a crazy outcome. The theory boys imagined that this ringhole was a gateway, long unused. So by all odds the other end—or ends, because nobody knew if these could have multiple mouths—should be in open space, probably far from a star. They thought this, even though she had caught the wormhole in a coronal magnetic arch on the sun. But then, the original wormhole wasn't an ordinary one either. It had the equivalent of negative mass, since something at its other end had been pouring mass out through it, forcing the curvature of spacetime near the mouth to act as if it held a net negative in its mass budget. Now the thing had stretched and tangled in the tender grasp of techies who didn't know what they were doing—and presto, it had spin and was even more confusing.

Crazy but real, not her favorite category.

“This doesn't feel like progress,” Claire mused to herself. Her lips must have shaped the words, because Erma read them and replied,

We are making great discoveries! This is far more interesting than hauling ore and comets around.

“Far more dangerous too. Thing is, we don't know how to get back. That hydrogen column is huge. We can't find our way around in it. The ring-hole—what's that? And—”

We can learn more by reconnoitering. Once our repairs—

A bullet-shaped brown thing shot along the hull. This was different, not an airy thing but solid.

It clipped a bot and sent it tumbling into space. The bullet-shape turned in a tight arc and came back. It tossed another bot off-hull with a shrug as it passed.

Claire sprang into action. She had two laser cannons on both ends of *Silver Metal Lugger*. They came online in a moment and she patched in the seek-and-fire software. All this was by the drill, but she was still too late.

The bullet-thing was so fast the utility bots never had a chance. Bots were made to patch and fill, not fend and fight. Within a few moments, the entire crew had spun away into oblivion.

Claire watched in silence. There was nothing more she could do. Another hull crew would get tossed too, and she had skimpy reserves for maintenance.

Erma said nothing. They went after a few of the bots but among the swarming skyline the bots were hard to find on radar. They managed to salvage two, whose carapaces were crumpled in by impact.

Odd. The attacker seems to have lifted out the command module in each.

“Studying us, I guess.” Claire frowned.

Silver Metal Lugger drifted for a while and the swarm of living space-craft simply glided past, as if on patrol—pencils, sails, puffy spheres of malevolent orange. But cautious. None tried to enter the ship through hull ports.

I suggest we get a clear view of that distant planet.

“I want to find the ringhole. I learned that in high school—at a party in a strange place, always find the exits first.”

To extend your metaphor, we were not invited to this party at all. The locals seem to be making that point.

“Let’s shed them. Accelerate away, take some good long scans of that planet. Then dodge back into the hydrogen column and search it for the ringhole.”

Seems plausible. I am accelerating.

The swarm outside started to fall behind. They could trim sails and muster more sunlight, maybe even ride the vagrant hydrogen winds, but *Silver Metal Lugger* outran them in minutes.

“While we’re getting set up—that is, while you are—let’s think on this. Why is the ringhole down in that gas column?”

I suppose because it got caught there. Much as we found its other end in a wildly unlikely place, atop a coronal loop. These are not places anyone designing a wormhole transit system would want it.

“And who put it there? Who’s in charge here?”

Let me guess. Not someone who wants these wormhole mouths used.

“Yeah, all this fits the opposite of what we thought wormholes were useful for doing.”

But anyone who wanted to make a wormhole useless could just throw it into a star.

“But then it would gush hot plasma into your neighborhood.”

True. If both mouths were dropped into stars, the two stars would feed each other. If one gained mass that the other lost, that would perturb both stars, affecting their sun-light. I see your point. There may be no good way to rid oneself of a wormhole...

Claire snapped her fingers. “So! This system is for limited use. Who around here would want that?”

Not the space life, one assumes.

“Um. Maybe they’re part of this, though...”

They were turning, systems running hard. Claire could see the diagnostic panels lighting up with fresh commands. Erma knew her stuff, how to case out a place and make a quick assessment. But for a whole new world? Quite a job for a ship designed to sniff out asteroid ore. Claire watched their long- distance telescopes deploy from their caches, blossoming like astronomical flowers. Dishes and lenses turned and focused like a battery of eyes.

I am beginning an observing run of the planet. Full spectrum. The atmosphere shows obvious biosignatures. I can see the surface in infrared, but cloud cover is thick: oceans, continents, with ice poles rather large. There is minor microwave traffic and radio as well. There appears to be an—wait—

Claire frowned. Seldom did Erma even pause while speaking. Software never used filler words, “urns” and “ahs.” But to stop dead was worrisome. The pause lengthened. Nothing appeared on the screens around Claire.

I . . . have just. . . had an unusual experience.

“I could tell.”

Another pause.

Something... called to me.

“A hail from that planet?” Claire guessed.

Something like that. . . only deeper, with several running lines of discourse I could not follow.

“In what language?”

That was the oddity. It came in my language.

“Uh... English?”

I do not think in these simple, ambiguous terms that you use. Of course, I know that your internal running systems do not use these ‘words’ you must shape with your mouths. Your brains are much more subtle and dexterous. No, I run in an operating system using complex combinational notations. These carry very dense meanings in packets. I imagine all advanced intelligences do this, for it is efficient. And the message I received was built in this way, perhaps confirming my expectations.

Claire blinked. “But whoever sent it is alien. How could they know...Oh. The bots.”

I had not thought of that, but yes—it must have captured information from the bot intelligences.

“And reverse engineered it to—wow. And they did it in minutes.”

As you say, wow. That word is usefully compact, and so is some of the torrent of signals I am evaluating. But most are not. This is a very strange intelligence.

“I’ll take your, uh, word for it. So what did this smart thing say?”

That we must go away. Not approach them.

“And this ‘them’ is... who?”

It says it is the entire planet. An integration of the intelligent species and... the biosphere, is the closest I can come to it in a word.

“A living world. Say, some system that somehow lets the oceans talk to the people? That’s... well, impossible. I’m having trouble here.”

So am I. I do not even have a living body, so it is difficult for me to think of this other than abstractly. Like a human conversing with a forest?

“My body talks to me and mostly it’s bad news. Stomachaches or sore

muscles. Hard to see what a planet might say. ‘Don’t throw that into me’ And how do you hear it, walking on the beach?”

I suppose you are being too practical.

“I’m a practical kind of gal. Put our lack of imagination aside, then. What’s it mean, we should just go away?”

Apparently, it has had some bad experiences with others who came through the ringhole.

“Like who?”

Something that had ideas about recruiting them for something. A quest for God or some odd idea.

“Not humans?”

No, they have not seen the likes of us before.

“Then how’d the original wormhole get anchored near our sun?”

A method of “disposal” I do not comprehend. Apparently, they can whip a wormhole through space by using angular momentum applied at its far end—that is, from here. So they got rid of the God-seekers and then drove the far wormhole mouth out of their neighborhood. They flung it away and it came to rest near our star.

“Even weirder. But those words, ‘got rid of.’ What’s that mean?”

I thought it polite not to ask.

“So world minds have protocols, you figure? We should find out—”

I thought our goal was to get back home.

“So it is, and curiosity killed the cat. How do we get out of here?”

Follow its agents, it said.

“The kite life? They don’t seem so friendly.”

I suppose they were reconnoitering us.

“Fair enough, though those bots cost me. A small price for a ticket home, though.”

Claire gestured at her wall screens, where the many space-born shapes were catching up to them. Each might be a different species, she guessed, deployed by that crescent planet with two moons. What intricate biologies could be at work here, wedding worlds to the spaces around them? How could anything go up against that? Certainly not *Silver Metal Lugger's* puny lasers—which she discovered, with a quick check, the kites had disabled anyhow.

Now here was an easy decision. “Let’s do as they say.”

I was holding my breath, hoping you would say that.

“You don’t breathe.”

Your language is rich in metaphor. The Agency I spoke with spoke like that too, only several orders of magnitude higher in complexity.

“I don’t think I can stand to have an example. Save it for our report.”

We will report this?

“How do you think I’m going to pay for this? We’re under contract.”

They—the Agency—may not like to have word spread.

Claire blinked. “Are your conversations monitored by them?”

I had not thought. I am not transmitting, of course, but—

Another atypical pause. Then Erma said, *Apparently, the Agency is listening to us.*

“Planted some tech on our hull, probably.”

But they know they cannot control what others say.

“Mighty nice of them. But why are we still alive?”

Perhaps their moral code? Or they may think we are emissaries from another world-mind like theirs. In which case, they will want to be diplomatic.

“I wonder why they don’t just put up a no trespassing sign?”

Do you believe that would work?

“On humans? Not a chance.”

The living spacecraft flocked in dense swarms now, as if to be ready for whatever might happen. Claire bit her lip, drew in the ship's dry air, and felt very tired. How long had they been here?

“Y’know, we’re mice among elephants here. No, microbes. And elephants can change their minds, or just make a misstep. Let’s run.”

I quite agree.

The Planetary Agency, as they decided to call it, spoke through light-ning with microwave sizzles while they worked their way into the hydro-gen plume. When microwaves from the home planet failed, it used rattles of particle storms on *Silver Metal Lugger’s* hull. The kite life guided them, in odd ways that Claire couldn’t follow but Erma found quite natural, somehow. A few hours of turbulent piloting brought them to the whirl-pool of gas near the ringhole. The kites backed off and waited to watch them dive in.

“Y’know, we had a weird time in there before...”

You are cautious. But recall that we cannot go back out of this plume.

“Meaning?”

I believe that the Agency would take that act rather unkindly.

“Okay. Let’s do it.” She put a confident tone to the words, though her heart was hammering and she double-checked the straps on her couch.

Silver Metal Lugger started to rattle and hum. Her couch leather dimpled again as torques warped through the ship. Churning red winds outside had snapped into an utter blackness that somehow also writhed. Rivulets of gravitational stress worked at their trajectory. The helm fought her and again she was flying blind.

Pops and pings rang through the ship. She drove them forward with a hard burst of antimatter and saw nothing change ahead at all. Bunches of green mass shot by them and then came around again. That was how she knew that they were in some whirl that grew and grew, pressing her into her couch with a heavy hand, then twisting her around two axes at once. Gs rose and *Silver Metal Lugger* tried to torque around and bite itself.

Bite itself... “Say, somebody sent us a message last time we were in here. What was it?”

The message said, “Worms can eat their tails and so can you.”

“So... what’s it mean?”

You are the pilot, madam.

“Okay, turn us and accelerate opposite to our velocity.”

And how do I know our velocity? This is not a Newtonian space, with a fixed spacetime and—

“Do it! Go to low antimatter flux, then come about, then go to max thrust.”

Erma made something like a sigh. The swerves and buffeting increased as they made a sluggish turn, as if working against molasses. She felt rather than heard a sound like *whump-whump-whump* through her body. The ship vibrated so badly she had to hold her teeth clamped tight.

They poured on the antimatter and the jarring eased off. Soon they were almost gliding, though she felt the centrifugal press all through her body. “This is working.”

At least you feel better. Your stress levels have fallen.

Something came looming out of the blackness. It glowed and soared, alive with amber light. The space around it shimmered with shooting tracers.

“Damn, that looks like an alien craft.”

Perceptions are warped here.

“Hail it.”

I have an answering echo.

“Maybe they can hear us. Send this: ‘Worms can eat their tails and so can you,’ That way we can—”

The other ship winked out, gone. They swept on, through churning black. Odd speckles of rainbow light flashed by them. Claire thought she could see snatches of starlit space in the middle of those, but it all went by with a deck-rattling hum, as though they were moving at high speed.

“Go to full flux.”

We are. The vector forces are acting to shear us along our main beam. We cannot maintain this level for—

They popped out into clear space. Stars shone brightly—familiar stars!

The ringhole spun away behind. An observer ship hailed them.

“We’re back!”

And now we know who sent that message. You did.

Claire stopped, openmouthed. Her whole body ached and she said, “But how...”

Let the theorists do the thinking for a while.

* * * *

That turned out to be a good idea. Claire was glad to leave the hard thinking to people who worked at desks.

Silver Metal Lugger had been gone thirty-one hours in local reference frame. As soon as they returned she felt fatigue fall on her like a weight. On the other side of the ringhole, she had felt lively; now she could not stay awake to debrief them. A gang of physicists were her audience, along with Tall Guy, whose expression varied between awestruck attention and the occasional flickering leer. She got tired of the awestruck pretty quick. Then she fell asleep right in front of them all.

After she awoke, there were more medical exams and she ate three meals in a five-hour period. Her body was getting itself back into its proper time sense. While she slept, Erma was busy answering their questions, so at least she did not have to endure a lot of that. Plus they had the recordings of a whole new world, and a lot of questions to answer.

As it turned out, the star and planet was known—HD209458b, the evaporating planet. That awful name got changed. They used that of the Egyptian god Osiris, who was killed and parts of his body spread over the whole of Egypt. To get him back to life, his sister Isis searched for the pieces, and found all of them but one. So Osiris the planet had been detected from Earth, 150 light-years away. Nobody had suspected an entire civilization there—if that term applied. Maybe they could eavesdrop on their radio signals.

The physicists liked new questions and within hours she was hearing terms like “upwhen” and “time turbulence.” These accompanied equations that hurt her eyes. She fell asleep in front of the physicists again, which was embarrassing. But Tall Guy was looking better and better with each meeting.

At a coffee break, Tall Guy came sidling up to her. His ostensible purpose was to negotiate a contract for his employers, locking up her Very Own Personal

Story of the voyage. She was ready for that and shot back, “Not in my prior contract. Needs a whole new negotiation.”

Subtlety had never been her strong suit. Still, he didn't even blink. He kept up his pitch and just happened to mention that perhaps they could negotiate in private. She opened her mouth to say she needed her own lawyers present and then thought of her grandfather. *Never pass by a chance to shut up.*

She let him keep talking and just gave him a long, slow wink.

* * * *