

*Shades of Roger's "The Graveyard Heart" and Isle of the Dead combine with Greg Benford's singular talent of scientific extrapolation to create a fevered chase through mass and time that is anything but "slow."*

# **SLOW SYMPHONIES OF MASS AND TIME**

## **GREGORY BENFORD**

THE CHASE ACROSS AN ENTIRE GALAXY STARTED AT A swanky private party.

Think of the galaxy as a swarm of gaudy bees, bright colors hovering in a ball. Then stomp them somehow in midair, so they bank and turn in a compressed disk. Dark bees fly with them too, so that somber lanes churn in the swiftly-rotating cloud.

Angry bees, buzzing, stingers out. Churning endlessly in their search.

That is the galaxy, seen whole and quick. Stars have no will, but their courses and destinies were now guided by small entities of great pretension: humans, now lording it over the All.

Or such is the viewpoint of the lords and ladies of a galactic empire that stretches across that bee swarm disk: they loom above it all, oblivious. Stars do their bidding. The bees swarm at the lift of an Imperial eyebrow.

Until one lord turns upon another. Then they are as their origins made them: savvy omnivores, primates reared up and grimacing, teeth bared at each other. Across the span of a hundred billion worlds, ancient blood sings in pound-ing vessels.

Despite appearances, some of these primordial creatures were present at the party, yet seeming mild and splendid in their finery.

Of course, it all began innocently enough.

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An ample, powerful woman named Vissian grasped his sleeve and tugged

him back to the ornate reception. “Sir Zeb, you are the *point* of this affair! Sir Zeb, my guests have so much to *tell* you.”

And to think that he had *wanted* to come here! To get the scent of change. But already he was tiring of this world, Syrna. Sir Zeb, indeed. He truly did not enjoy travel all that much, a fact he often forgot.

Even here, in a distant Sector, the heavy hand of the Imperium lay upon style and art. The Imperium’s essence lay in its solidity; its taste ran to the monumental. Rigorous straight lines in ascending slabs, the exact parabolas of arching purple water fountains, heavy masonry—all entirely proper and devoid of embarrassing challenge. He sniffed at the hyperbolic draperies and moved toward the crowd, their faces terminally bland.

Vissian nattered on. “—and our most brilliant minds are waiting to meet you! Do come!”

He suppressed a groan and looked beseechingly at Fyrna, his consort now of a full decade; something of a record in Imperial circles. She smiled and shook her head. From this hazard she could not save him.

“Sir Zeb, what of the mysteries at galactic center?”

“I savor them.”

“But are those magnetic entities a threat? They are huge!”

“And wise. Think of them as great slumbering libraries.”

“But they command such energies!”

“Then think of them as natural wonders, like waterfalls.”

This provoked a chorus of laughter in the polite half-moon crowd around him. “Some on the Council believe we should take action against them!” a narrow woman in flocked velvet called from the crowd’s edge.

“I would sooner joust with the wind,” Zeb said, taking a stim from a passing dwarf servant.

“Sir Zeb, surely you cannot take lightly—”

“I am on holiday, sir, and can take things as they are.”

“But you, Sir Zeb, have seen these magnetic structures?”

“Filaments, hundreds of light-years long—yes. Lovely, they are.”

Wide-eyed: “Was it dangerous?”

“Of course. Nobody goes to the galactic center. Hard protons sleet through it, virulent X rays light its pathways.”

“Why did you risk it?”

“I am a fool, madam, who works for you, the people.”

And so on.

If Vissian had begun as a grain of sand in his shoe, she became a boulder. An hour later, Fyrna whisked him into an alcove and said curtly, “I am concerned about someone tracking us here. We’re just one worm-jump away from fleet’s quadrant assembly point.”

Zeb had allowed himself to forget about politics: the only vacation a statesman had. “My protection should be good here. I can get a quick message out, using a worm-link to—”

“No, you can’t work using a link. The Speculists could trace that easily.”

Factions, factions. The situation had shifted while he was idling away here. As Governor of another Sector, he was a guest here, given nominal protection. He had his own bodyguards, too, salted among the crowd here. But the Speculists had strong support in this region of the galaxy and were quite blithely ruthless. Zeb stared out at the view, which he had to admit was spectacular. Great, stretching vistas. Riotous growth.

But more fires boiled up on the horizon. There was gaiety in the streets here—and angst. Their laboratories seethed with fresh energies, innovation bristled every-where, the air seemed to sing with change and chaos.

The extremes of wealth and destitution were appalling. Change brought that, he knew.

As a boy he had seen poverty—and lived it, too. His grandmother had insisted on buying him a raincoat several sizes too large, “to get more use

out of it.” His mother didn’t like him playing kickball because he wore out his shoes too quickly.

Here, too, the truly poor were off in the hinterlands. Sometimes they couldn’t even afford fossil fuels. Men and women peered over a mule’s ass all day as it plodded down a furrow, while overhead starships screamed through velvet skies.

And here . . . Among these fast-track circles, body lan-guage was taught. There were carefully designed poses for Confidence, Impatience, Submission (four shadings), Threat, Esteem, Coyness, and dozens more. Codified and understood unconsciously, each induced a specific desired neurological state in both self and others. The rudiments lay in dance, politics, and the martial arts, but by being systematic, much more could be conveyed. As with lan-guage, a dictionary helped.

Zeb felt an unease in the reception party. Reading some veiled threat-postures? Or was he projecting?

Quickly he adjusted his own stance—radiating confi-dence, he hoped. But still, he had picked up a subcon-scious alarm. And he knew enough from decades of politics to trust his instincts.

“Governor!” Vissian’s penetrating voice snatched away his thoughts.

“Uh, that tour of the precincts. I, I really don’t feel—”

“Oh, that is not possible, I fear. A domestic disturbance, most unfortunate.”

Zeb felt relief but Vissian went right on, bubbling over new ventures, balls, and tours to come tomorrow. Then her eyebrows lifted and she said brightly, “Oh yes—I do have even more welcome news. An Imperial squadron has just come to call.”

“Oh?” Fyrna shot back. “Under whose command?”

“An Admiral Kafalan. I just spoke to him—”

“Damn!” Fyrna said, “He’s a Speculist henchman.”

“You’re sure?” Zeb asked. He knew her slight pause had been to consult her internal files.

Fyrna nodded. Vissian said gaily, "Well, I am sure he will be honored to return you to your sector when you are finished with your visit here. Which we hope will not be soon, of—"

"He mentioned us?" Fyrna asked.

"He asked if you were enjoying—"

"Damn!" Zeb said.

"An Admiral commands all the wormlinks, if he wishes—yes?" Fyrna asked.

"Well, I suppose so." Vissian looked puzzled.

"We're trapped," Zeb said.

Vissian's eyes widened in shock. "But surely you, Governor, need fear no—"

"Quiet." Fyrna silenced the woman with a stern glance. "At best this Kafalan will bottle us up here."

Fyrna pushed them both into a side gallery. Vissian seemed startled by this, though Fyrna was both consort and bodyguard. Indeed, she and Zeb might as well have been married, but for the social impossibilities.

This side gallery featured storm-tossed jungles of an unnamed world lashed by sleeting rain, lit by jagged purple lightning. Strange howls called through the lashing winds.

"Note that if Imperial artists do show you an exterior, it is alarming," Fyrna said clinically as she checked her detectors, set into her spine and arms.

"They're still nearby?" Zeb asked, shushing Vissian.

"Yes, but of course they are beards."

To his puzzled look she said, "Meaning, the disguise we are meant to see."

"Ah." They strolled into the next gallery, trying to look casual. This sensor was milder, a grandiose street-scape and hanging gardens.

“Ummm, still poorly attended. And the real shadows?”

“I have spotted one. There must be more.”

Vissian said, “But surely no one would dare kidnap you from my reception—”

“No, probably there will be an ‘accident,’” Zeb said.

“Why has this Admiral moved to block you just now?”

“Nova triggers,” Zeb said.

Once invented, triggers had made war far more dangerous. A solar system could be “cleansed”—a horrifyingly bland term used by aggressors of the time—by inducing a mild nova burst in a balmy sun. This roasted worlds just enough to kill all but those who could swiftly find caverns and store food for the few years of the nova stage. Fleet wanted a supply of them, and Zeb led opposition to the weapon.

“Admirals love their toys,” he said sourly, fingering a stim but not inhaling it. They returned to the main party, not wanting to seem perturbed by the news.

“Is there no other way to get off Syrna?” Fyrna demanded of Vissian.

“No, I can’t recall—”

“Think!”

Startled, Vissian said, “Well, of course, we do have privateers who at times use the wild worms, an activity that is at best quasi-legal, but—”

\* \* \* \*

In Zeb’s career he had discovered a curious little law. Now he turned it in his favor.

Bureaucracy increases as a doubling function in time, given resources. At the personal level, the cause is the persistent desire of every manager to hire at least one assistant. This provides the time constant for growth.

Eventually this collides with the carrying capacity of society. Given the

time constant and the capacity, one could predict a plateau level of bureaucratic overhead—or else, if growth persists, the date of collapse. Predictions of the longevity of bureaucracy-driven societies fit a pre-cise curve. Surprisingly, the same scaling laws worked for micro-societies such as large agencies.

The corpulent Imperial bureaus on Syrna could not move swiftly. Admiral Kafalan's squadron had to stay in planetary space, since it was paying a purely formal visit. Niceties were still observed. Kafalan did not want to use brute force when a waiting game would work.

"I see. That gives us a few days," Fyrna concluded.

Zeb nodded. He had done the required speaking, negoti-ating, dealing, promising favors—all activities he disliked intensely. Fyrna had done the background digging. "To . . . ?"

"Train."

\* \* \* \*

The wormhole web had built the galactic empire. Made in the first blaring instant of the Great Emergence, found (rarely) floating between stars, they now were the most precious resources of all.

Of course, worms ended and began as they liked. A worm jump could bring you to a black vacuum still many years from a far-flung world. Hyperships flitted through wormholes in mere seconds, then exhausted themselves hauling their cargoes across empty voids, years and de-cades in the labor.

Wormholes were labyrinths, not mere tunnels with two ends. The large ones held firm for perhaps billions of years—none larger than a hundred meters across had yet collapsed. The smallest could sometimes last only hours, at best a year. In the thinner worms, flexes in the worm-walls *during* passage could alter the end point of a travel-er's trajectory.

Worse, worms in their last stages spawned transient, doomed young—the wild worms. As deformations in space-time, supported by negative energy-density "struts," all wormholes were inherently rickety. As they failed, smaller deformations twisted away.

Syrna had seven wormholes. One was dying in gor-geous agonies.

It hung a light-hour away, spitting out wild worms that ranged from a hand's-width size up to several meters. In the spongy space-time of the negative-energy-density struts, time could crawl or zip, quite unpredictably. This worm was departing our universe in molasses-slow torment.

A fairly sizable wild worm had sprouted out of the side of the dying worm several months before. The Imperial squadron did not know of this, of course. All worms were taxed, so a fresh, free wormhole was a bonanza. Reporting their existence, well . . . often a planet simply didn't get around to that until the wild worm had fizzled away in a spray of subatomic surf.

Until then, pilots carried cargo through them. That wild worms could evaporate with only seconds' warning made their trade dangerous, highly paid, and legendary.

Wormriders were the sort of people who as children liked to ride their bicycles no-handed, but with a difference—they rode off rooftops.

By an odd logic, that kind of child grew up and got trained and even paid taxes—but inside, they stayed the same.

Only risk takers could power through the chaotic flux of a transient worm and take the risks that worked, *not* take those that didn't, and live. They had elevated bravado to its finer points.

"This wild worm, it's tricky," a grizzled woman told Zeb and Fyrna. "No room for a pilot if you both go."

"We must stay together," Fyrna said with finality.

"Then you'll have to pilot."

"We don't know how," Zeb said.

"You're in luck." The lined woman grinned without humor. "This wildy's short, easy."

"What are the risks?" Fyrna demanded stiffly.

"I'm not an insurance agent, lady."

"I insist that we know—"



“Look, lady, we’ll teach you. That’s the deal.”

“I had hoped for a more—”

“Give it a rest or it’s no deal at all.”

\* \* \* \*

In the men’s room, above the urinal he used, Zeb saw a small gold plaque: *Senior Pilot Joquan Beunn relieved himself here Octdent 4, 13,435.*

Every urinal had a similar plaque. There was a washing machine in the locker room with a large plaque over it, reading *The Entire 43d Pilot Corps relieved themselves here Marlass 18, 13,675.*

Pilot humor. It turned out to be absolutely predictive. He messed himself on his first training run.

As if to make the absolutely fatal length of a closing wormhole less daunting, the worm flyers had escape plans. These could only work in the fringing fields of the worm, where gravity was beginning to warp, and space-time was only mildly curved. Under the seat was a small, powerful rocket that propelled the entire cockpit out, automatically heading away from the worm.

There is a limit to how much self-actuated tech one can pack into a small cockpit, though. Worse, worm mouths were alive with electrodynamic “weather”—writhing forks of lightning, blue discharges, red magnetic whorls like tornadoes. Electrical gear didn’t work well if a bad storm was brewing at the mouth. So most of the emergency controls were manual. Hopelessly archaic, but unavoidable.

He and Fyrna went through a bail-out training program. Quite soon it was clear that if he used the EJECT command he had better be sure that he had his head tilted back. That is, unless he wanted his kneecaps to slam up into his chin, which would be unfortunate, because he would be trying to check if his canopy had gone into a spin. This would be bad news, because his trajectory might get warped back into the worm. To correct any spin he had to yank on a red lever, and if that failed he had to then very quickly—in pilot’s terms, this meant about half a second—punch two blue knobs. When the spindown came, he then had to be sure to release the automatic actuator by pulling down on two yellow tabs, being certain that he was sitting up straight with his hands between his knees to avoid . . .

. . . and so on for three hours. Everyone seemed to assume that since he was this famous politician trained in intricate galactic protocols he could of course keep an entire menu of instructions straight, timed down to fractions of seconds.

After the first ten minutes he saw no point in destroying their illusions, and simply nodded and squinted to show that he was carefully keeping track and absolutely enthralled. Meanwhile he solved chess puzzles in his head for practice.

\* \* \* \*

He was taking a stroll with his bodyguards when the Admiral sent a greeting card.

The guard nearest him, one Ladoro, was saying something into his wrist comm as they ambled through a park. It was an Imperial distraction, with babbling brooks that ran uphill, this artful effect arising from intricately charged electrodynamic streams that countered gravity. His guards liked the effect; Zeb found it rather obvious.

He chanced to be looking toward Ladoro, his oldest guard, a stout fellow whose personal service went back a full century. Later Zeb reflected that the Admiral probably knew that. It made what happened more pointed.

Ladoro went down with his head jerked back, as if he were looking up at the sky, a quizzical expression flickering. Over backwards, twisting, then down hard. He hit face first on the carpet-moss. Ladoro had not lifted his hands to break the fall.

Two other guards had Zeb behind a wall within two seconds. There was too much open space and too little shelter to try a move. He squatted and fumed and could not see who had fired the shot. Zeb risked a quick look over the wall's low edge and saw Ladoro sprawled flat without a twitch.

Then a lot of nothing happened. No following pulses.

Zeb replayed the image. From Ladoro had spouted rosy blood from a punch high in the spine. Absolutely dead center, four centimeters below the neck. Kilojoules of energy focused to a spot the size of a fingernail.

That much energy delivered so precisely would have done the job even if it hit the hip or gut. Delivered so exactly, it burst the big bony axis of the man, massive pressures in the spinal fluid, a sudden breeze blowing

out a candle, the brain going black in a millisecond.

Ladoro had gone down boneless, erased. A soft, liquid thump, then eternal silence.

Zeb held up his hand and watched it tremble for a while. Enough waiting. “Let’s go. They can lob anything they want here.”

A guard said, “Sir Zeb, I don’t advise—”

“I’ve been shot at before, kid.”

“Well, I suppose we could fire as we move—”

“You do that. Go.”

They worked their way along a creek frothing uphill. More guards arrived and spilled out across the park. The pulse had come from behind Ladoro. Zeb kept plenty of rock between him and that direction. He got to Ladoro and studied the face from behind a boulder nearby. The head was cocked to one side, eyes still open, mouth seeping moisture into the dry dirt. The eyes were the worst, staring into an infinity nobody glimpses more than once.

*Goodbye, friend. We had our time, some laughs and light-years. You saved my ass more than once. And now I can’t do a damn thing for you.*

Something moved to his right, a gossamer ball of motes. Cops, or rather, a local manifestation of them.

It flickered, spun, and said in a low, bass voice, “We regret.”

“Who did this?”

“We suspect an Imperial source. Our defenses were compromised in a characteristic way. Sir.”

“And what can you do?”

“I will protect you.”

“You didn’t do a great job for Ladoro.”

"I arrived here slightly late."

"*Slightly?*"

"You must forgive errors. We are finite, all."

"Damn finite."

"No place is safe. This is safer, however. I extend the apologies of Madame Vissian—"

"Tell the Admiral I got his calling card."

"Sir?"

\* \* \* \*

"I'm sure you will be all right," Vissian said fulsomely to them in the departure lounge.

Zeb had to admit this woman had proven better than he had hoped. She had cleared the way, stalled the Imperial officers. Probably she shrewdly expected a payoff from him, and she had every right to do so.

"I hope I can handle a wormship," Zeb said.

"And I," Fyrna added.

"Our training is the very best," Vissian said, brow fur-rowing. "I do hope you're not worried about the wild worm, Governor?"

"It's a tight fit," he said.

They had to fly in a slender cylinder, Fyrna co-piloting. Splitting the job had proved the only way to get them up to a barely competent level.

"I think it's *marvelous*, how courageous you two are."

"We have little choice," Fyrna said. This was artful understatement. Another day and the Admiral's officers would have Zeb and Fyrna under arrest, then dead.

"Riding in a little pencil ship. *Such* primitive means!"

“Uh, time to go,” Zeb said behind a fixed smile. She was wearing thin again.

“I agree with the Emperor. Any technology distinguish-able from magic is insufficiently advanced.”

Zeb felt his stomach flutter with dread. “You’ve got a point.”

\* \* \* \*

He had brushed off the remark.

Four hours later, closing at high velocity with the big wormhole complex, he saw her side of it.

He spoke on suitcomm to Fyrna. “In one of my classes—Nonlinear Philosophy, I believe—the professor said something I’ll never forget. ‘Ideas about existence pale, beside the fact of existence.’ Quite true.”

“Bearing oh six nine five,” she said rigorously. “No small talk.”

“Nothing’s small out here—except that wild worm mouth.”

The wild worm was a fizzing point of vibrant agitation. It orbited the main worm mouth, a distant bright speck.

Imperial ships patrolled the main mouth, ignoring this wild worm. They had been paid off long ago, and expected a steady train of slimships to slip through the Imperial guard.

The galaxy was, after all, a collection of debris, swirling at the bottom of a gravitational pothole in the cosmos. The worms made it traversable.

Below, the planet beckoned with its lush beauties.

At the terminator, valleys sank into darkness while a chain of snowy mountains gleamed beyond. Late in the evening, just beyond the terminator, the fresh, peaked mountains glowed red-orange, like live coals. Mountain-tops cleaved the sheets of clouds, leaving a wake like that of a ship. Tropical thunderheads, lit by lightning flashes at night, recalled the blooming buds of white roses.

The glories of humanity were just as striking. The shin-ing constellations of cities at night, enmeshed by a glitter-ing web of highways.

His heart filled with pride at human accomplishments. Here the hand of his fellow Empire citizens was still casting spacious designs upon the planet's crust. They had shaped artificial seas and elliptical water basins, great squared plains of cultivated fields, immaculate order arising from once-virgin lands.

"So beautiful," he mused. "And we are fleeing for our lives from it."

Fyrna sniffed. "You are losing your taste for politics."

"You have no poetry left in your soul?"

"Only when I'm not working."

He saw distant ships begin to accelerate, their yellow exhausts flaring. "Many believe that the early Empire was a far better affair, serene and lovely, with few conflicts and certainly fewer people."

"Fine feelings and bad history," Fyrna said, dismissing all such talk.

"No doubt you are correct. Note the Admiral's approach."

Fyrna saw them now. "Damn! They've spotted us already."

"We'll have one chance to make the worm run."

"But they know—and they'll follow."

Zeb had passed through worm gates before, but always in big cruisers plying routes through wormholes tens of meters across. Every hole of that size was the hub of a complex which buzzed with carefully orchestrated traffic. He could see the staging yards and injection corridors of the main route gleaming far away.

Their wild worm, a renegade spinoff, could vanish at any moment. Its quantum froth advertised its mortality. *And maybe ours . . .* Zeb thought.

"Vector null sum coming up," he called.

"Convergent asymptotes, check," Fyrna answered.

Just like the drills they had gone through.

But coming at them was a sphere fizzing orange and purple at its rim.

A neon-lit mouth. Tight, dark at the very center—

Zeb felt a sudden desire to swerve, not dive into that impossibly narrow gullet.

Fyrna called numbers. Computers angled them in. He adjusted with a nudge here and a twist there.

It did not help that he knew some of the underlying physics. Wormholes were held open with onion-skin layers of negative energy, sheets of anti-pressure made in the first convulsion of the universe. The negative energy in the “struts” was equivalent to the mass needed to make a black hole of the same radius.

So they were plunging toward a region of space of un-imaginable density. But the danger lurked only at the rim, where stresses could tear them into atoms.

A bull’s-eye hit was perfectly safe. But an error—

*Don't hit the walls . . .*

Thrusters pulsed. The wild worm was now a black sphere rimmed in quantum fire.

Growing.

Zeb felt suddenly the helpless constriction of the pencil ship. Barely two meters across, its insulation was thin, safety buffers minimal. Behind him, Fyrna kept murmur-ing data and he checked...but part of him was screaming at the crushing sense of confinement, of helplessness.

He had never really liked travel all that much. ... A sudden swampy fear squeezed his throat.

“Vectors summing to within zero seven three,” Fyrna called.

Her voice was calm, steady, a marvelous balm. He clung to its serene certainties and fought down his own panic.

“Let’s have your calculation,” she called.

He was behind! Musing, he had lost track.

With a moment's hard thought he could make his mind bicameral. The two liberated subselves did their tasks, speaking back and forth only if they wished. The results merged when each was done.

"There." He squirted her the answers, last-moment computations of the changing tidal stresses into which they now plunged.

Squeals of last-second correction echoed in his cramped chamber. A quick kick in the pants—

Lightning curling snakelike blue and gold at them—

—Tumbling. Out the other end, in a worm complex fifteen thousand light-years away.

"That old professor . . . damn right, he was," he said.

Fyrna sighed, her only sign of stress. "Ideas about existence pale...beside the fact of existence. Yes, my love. Living is bigger than any talk about it."

\* \* \* \*

A yellow-green sun greeted them. And soon enough, an Imperial picket craft. The Admiral had been right behind them and he had called ahead somehow.

So they ducked and ran. A quick swerve, and they angled into the traffic-train headed for a large wormhole mouth. The commercial charge-computers accepted his Imperial override without a murmur. Zeb had learned well. Fyrna corrected him if he got mixed up.

Their second hyperspace jump took a mere three minutes. They popped out far from a dim red dwarf.

By the fourth jump they knew the drill. Having the code-status of the Imperial court banished objections.

But being on the run meant that they had to take whatever wormhole mouths they could get. Kafalan's people could not be too far behind.

A wormhole could take traffic only one way at a time. High-velocity ships plowed down the wormhole throats, which could vary from a finger's length to a star's diameter.



Zeb had known the numbers, of course. There were a few billion wormholes in the galactic disk, spread among several hundred billion stars. The average Imperial Sector was about fifty light years in radius. A jump could bring you out still many years from a far-flung world.

This influenced planetary development. Some verdant planets were green fortresses against an isolation quite profound. For them the Empire was a remote dream, the source of exotic products and odd ideas.

The worm web had many openings near inhabitable worlds, but also many near mysteriously useless solar systems. By brute force interstellar hauling the Empire had positioned the smaller worm mouths—those massing perhaps as much as a mountain range—near rich planets. But some worm mouths of gargantuan mass orbited near solar systems as barren and pointless as any surveyed.

Was this random, or a network left by some earlier civilization? Archaeologists thought so. Certainly the wormholes themselves were leftovers from the Great Emergence, when space and time alike began. They linked distant realms which had once been nearby, when the galaxy was young and smaller. The differential churn of the disk had redistributed the wormholes. But someone—or rather, something—had made sure they at least orbited reasonably near a star.

They developed a rhythm. Pop through a worm mouth, make contact, get in line for the next departure. Imperial watchdogs would not pull anyone of high class from a queue. So their most dangerous moments came as they negotiated clearance.

At this Fyrna became adept. She sent the WormMaster computers blurts of data and—*whisk*—they were edging into orbital vectors, bound for their next jump.

They caught a glimpse of Admiral Kafalan's baroque ship winking forth from a wormhole mouth they had left only minutes before. In the scurry-scurry of commerce they lost themselves, while they waited their turn. Then they ducked through their next hole, a minor mouth, hoping Kafalan had not noticed.

For once, the snaky, shiny innards of the worm were almost relaxing to Zeb. This one was small of mouth but long of throat; their journey took dragging, heart-thumping moments.

Matter could flow only one way at a time in a worm-hole. The few experiments with simultaneous two-day transport ended in disaster. No matter how ingenious engineers tried to steer ships around each other, the sheer flexibility of worm-tunnels spelled doom. Each worm mouth kept the other “informed” of what it had just eaten. This information flowed as a wave, not in physical matter, but in the tension of the wormhole itself—a ripple in the “stress tensor,” as physicists termed it.

Flying ships through both mouths sent stress waves propagating toward each other, at speeds which depended on the location and velocity of the ships. The stress constricted the throat, so that when the waves met, a clenching squeezed down the walls.

The essential point was that the two waves moved differently after they met. They interacted, one slowing and the other speeding up, in highly nonlinear fashion.

One wave could grow, the other shrink. The big one made the throat clench down into sausages. When a sausage neck met a ship, the craft *might* slip through—but calculating that was a prodigious job. If the sausage neck happened to meet the two ships when they passed—*crunch*.

This was no mere technical problem. It was a real limitation, imposed by the laws of quantum gravity. From that firm fact arose an elaborate system of safeguards, taxes, regulators, and hangers-on—all the apparatus of a bureaucracy which does indeed have a purpose, and makes the most of it.

Zeb learned to dispel his apprehension by watching the views. Suns and planets of great, luminous beauty floated in the blackness.

Behind the resplendence, he knew, lurked necessity.

From the wormhole calculus arose blunt economic facts. Between worlds A and B there might be half a dozen wormhole jumps—the Nest was not simply connected, a mere astrophysical subway system. Each worm mouth imposed added fees and charges on each shipment.

Control of an entire trade route yielded the maximum profit. The struggle for control was unending, often violent. From the viewpoint of economics, politics, and “historical momentum”—which meant a sort of imposed inertia on events—a local empire which controlled a whole constellation of nodes should be solid, enduring.

Not so. Time and again, regional satrapies went toes-up. As Governor, he had been forced to bail some of them out. That amounted to local politics, where he had proved reasonably adept. Alas, Kafalan pursued them for global, galactic reasons.

Many worlds that feasted on the largesse of a wormhole mouth perished, or at least suffered repeated boom-and-bust cycles, because they were elaborately controlled. It seemed natural to squeeze every worm passage for the maximum fee, by coordinating every worm to optimize traffic. But that degree of control made people restive.

The system could not deliver the best benefits. Over-control failed.

On their seventeenth jump, they met a case in point.

\* \* \* \*

“Vector aside for search,” came an automatic command from an Imperial vessel.

They had no choice. The big-bellied Imperial sentry craft scooped them up within seconds after their emergence from a medium-sized wormhole mouth.

“Transgression tax,” a computerized system announced. “Planet Alacaran demands that special carriers pay—” A blur of computer language.

“Let’s pay it,” Zeb said.

“I wonder if it will provide a tracer for Kafalan’s use,” Fyrna said over comm.

“What is our option?”

“I shall use my own personal indices.”

“For a wormhole transit? That will bankrupt you!”

“It is safer.”

Zeb fumed while they floated in magnetic grapples beneath the Imperial picket ship. The wormhole orbited a heavily industrialized world.

Gray cities sprawled over the continents and webbed across the seas in huge hexagonals.

The Empire had two planetary modes: rural and urban. Farm worlds were socially stable because of its time-honored lineages and stable economic modes. They, and the similar Femo-rustics, lasted.

This planet Alacaran, on the other hand, seemed to cater to the other basic human impulse: clumping, seeking the rub of one's fellows, a pinnacle of city-clustering.

Zeb had always thought it odd that humanity broke so easily into two modes. Now, though, his political experience clarified these proclivities. Most people were truly primates, seeking a leader. Countless planets congealed into the same basic Feudalist attractor groups—Macho, Socialist, Paternal. Even the odd Thanatocracies fit the pattern. They had Pharaoh-figures promising admission to an afterlife, and detailed rankings descending from his exalted peak in the rigid social pyramid.

"They're paid off," Fyrna sent over comm. "Such corruption!"

"Ummm, yes, shocking." Was he getting cynical? He wanted to turn and speak with her, but their pencil ship allowed scant socializing.

"Let's go."

"Where to?"

"To . . ." He realized that he had no idea.

"We have probably eluded pursuit." Fyrna's voice came through stiff and tight. He had learned to recognize these signs of her own tension.

"We could work a route back to our Sector."

"They would expect that and block it."

He felt a stab of disappointment. But she was the professional bodyguard and she was undoubtedly right. "Where, then?"

"I took advantage of this pause to alert a friend, by wormlink," she said. "We may be able to return, though through a devious route."

"The Speculists—"

“May not expect such audacity.”

“Which recommends the idea.”

\* \* \* \*

Dizzying indeed—leaping about the entire galaxy, trapped in a casket-sized container.

They jumped and dodged and jumped again. At several more wormhole yards Fyrna made “deals.” Payoffs, actu-ally. She deftly dealt combinations of his cygnets, the Im-perial passage indices, and her private numbers.

“Costly,” Zeb fretted. “How will I ever pay—”

“The dead do not worry about debts,” she said.

“You have such an engaging way of putting matters.”

“Subtlety is wasted here.”

They emerged from one jump in close orbit about a sublimely tortured star. Streamers lush with light raced by them.

“How long can this worm last here?” he wondered.

“It will be rescued, I’m sure. Imagine the chaos in the system if a worm mouth begins to gush hot plasma.”

Zeb knew the wormhole system, though discovered in pre-Empire ages, had not always been used. After the un-derlying physics of the wormhole calculus came to be known, ships could ply the galaxy by invoking wormhole states around themselves. This afforded exploration of reaches devoid of wormholes, but at high energy costs and some danger. Further, such ship-local hyperdrives were far slower than simply slipping through a worm.

And if the Empire eroded? Lost the worm network? Would the slim attack fighters and snakelike weapons fleets give way to lumbering hypership dreadnoughts?

The next destination swam amid an eerie black void, far out in the

halo of red dwarfs above the galactic plane. The disk stretched in luminous splendor. Zeb remembered holding a coin and thinking of how a mere speck on it stood for a vast volume, like a large Zone. Here such human terms seemed pointless. The galaxy was one serene entity, grander than any human perspective.

“Ravishing,” Fyrna said.

“See Andromeda? It looks nearly as close.”

The spiral, twin to their own galaxy, hung above them. Its lanes of clotted dust framed stars azure and crimson and emerald. A slow symphony of mass and time.

“Here comes our connection,” Zeb warned.

This wormhole intersection afforded five branches. Three black spheres orbited closely together like circling leopards, blaring bright by their quantum rim radiation. Two cubic wormholes circled further out. Zeb knew that one of the rare variant forms was cubical, but he had never seen any. Two together suggested that they were born at the edge of galaxies, but such matters were beyond his shaky understanding.

“We go—there,” Fyrna pointed a laser beam at one of the cubes, guiding the pencil ship.

They thrust toward the smaller cube, gingerly inching up. The wormyard here was automatic and no one hailed them.

“Tight fit,” Zeb said nervously.

“Five fingers to spare.”

He thought she was joking, then realized that if any-thing, she was underestimating the fit. At this less-used wormhole intersection slow speeds were essential. Good physics, unfortunate economics. The slowdown cut the net flux of mass, making them backwater intersections.

He gazed at Andromeda to take his mind off the piloting. No wormholes emerged in other galaxies, for arcane reasons of quantum gravity. Or perhaps by some ancient alien design?

They flew directly into the flat face of a cubic worm. The negative-energy-density struts which held the worm-hole open were in the

edges, so the faces were free of tidal forces.

A smooth ride took them quickly to several wormyards in close orbit about planets. One Zeb recognized as a rare type with an old but rained biosphere. There are plenty of ways to kill a world. Or a man, he reflected.

Another jump—into the working zone of a true, natural black hole. He watched the enormous energy-harvesting disks glow with fermenting scarlets and virulent purples. The Empire had stationed great conduits of magnetic field around the hole. These sucked and drew interstellar dust clouds. The dark cyclones narrowed toward the brilliant accretion disk around the hole. Radiation from the friction and infalling of that great disk was in turn captured by vast grids and reflectors.

The crop of raw photon energy itself became trapped and flushed into the waiting maws of wormholes. These carried the flux to distant worlds in need of cutting lances of light, for the business of planet-shaping, world-raking, moon-carving.

“Time to run,” she said.

“We can’t get back to our home Sector?”

“I have eavesdropped on the signals sent between worm sites. We are wanted at all domains adjacent to our Sector.”

“Damn!”

“I suspect they have many allies.”

“They must, to get this quick cooperation. They’ve staged a fine little manhunt.”

“Perhaps the nova trigger issue is but a pretext?”

“How so?”

“Many like the present system of wormhole use,” she said delicately. She never let her own views of politics seep into their relationship. Even this oblique reference plainly made her uncomfortable. Her concern was for him as a breathing man, not as a bundle of political abstractions.

She had a point, too. Zeb wanted free wormholes, gov-erned only by market forces. The Speculists wanted tariffs and favors, preferences and

paybacks. And guess who would control all that bureaucracy?

He floated and thought. She waited for the decision.

“Precious little running room left.”

“I do not urge compromise. I merely advise.”

“Ladoro ...”

“They would not have bothered to kill him unless they wanted to deal.”

“I don’t like dealing with a knife at my throat.”

“We need to decide,” she said edgily.

Time ran against them. He bit his lip. Give up? He couldn’t, even if it seemed smart. “Our Sector is pretty far out. What if we run inward?”

“To what end?”

“I’ll be working on that. Let’s go.”

\* \* \* \*

Pellucid, a mere dozen light-years from Galactic Center, had seventeen wormhole mouths orbiting within its solar system—the highest hole density in the galaxy. The system had originally held only two, but a gargantuan technology of brute interstellar flight had tugged the rest there, to make the nexus.

Each of the seventeen spawned occasional wild worms. One of these was Fyrna’s target.

But to reach it, they had to venture where few did.

“The galactic center is dangerous,” Fyrna said as they coasted toward the decisive wormhole mouth. They curved above a barren mining planet. “But necessary.”

“The Admiral pursuing us worries me more—” Their jump cut him off.

—and the spectacle silenced him.



The filaments were so large the eye could not take them in. They stretched fore and aft, shot through with immense luminous corridors and dusky lanes. These arches yawned over tens of light-years. Immense curves descended toward the white-hot True Center. There matter frothed and fumed and burst into dazzling fountains.

“The black hole,” he said simply.

The small black hole they had seen only an hour before had trapped a few stellar masses. At True Center, three million suns had died to feed gravity’s gullet.

The orderly arrays of radiance were thin, only a light-year across. Yet they sustained themselves along hundreds of light-years as they churned with change. Zeb switched the polarized walls to see in different frequency ranges. Though the curves were hot and roiling in the visible, human spectrum, the radio revealed hidden intricacy. Threads laced among convoluted spindles. He had a powerful impression of layers, of labyrinthine order ascending beyond his view, beyond simple understanding.

“Particle flux is high,” Fyrna said tensely. “And rising.”

“Where’s our junction?”

“I’m having trouble vector-fixing—ah! There.”

Hard acceleration rammed him back into his flow-couch. Fyrna took them diving down into a mottled pyramid-shaped wormhole.

This was an even rarer geometry. Zeb had time to marvel at how accidents of the universal birth-pang had shaped these serene geometries, like exhibits in some god’s Euclidean museum of the mind.

The wild worm they had used fizzled and glowed behind them. Something emerged on their tail.

Fyrna sped them toward a ramshackle, temporary wormyard. He said nothing, but felt her tense calculations.

The sky filled with light.

“They have detonated the worm!” Fyrna cried.

Breaking hard, veering left—

—into a debris cloud. Thumps, crashes.

Zeb said, “How could the Admiral blow a *worm*?”

“He carries considerable weaponry. Evidently the Em-pire knows how to trigger the negative-energy-density struts inside a worm mouth.”

“Can they see us?”

“Not inside this cloud—I hope.”

“Head for that bigger cloud—there.”

A huge blot beckoned, coal-sack sullen. They were close in here, near the hole’s accretion disk. Around them churned the deaths of stars, all orchestrated by the mag-netic filaments.

Here stars were ripped open, spilled, smelted down into fusing globs. They lit up the dark, orbiting masses of debris like tiny crimson match heads flaring in a filthy coal sack.

Amid all that moved the strangest stars of all. Each was half-covered by a hanging hemispherical mask. The mask gave off infrared from this strange screen, which hung at a fixed distance from the star. It hovered on light, gravity just balancing the outward light pressure. The mask reflected half the star’s flux back on it, turning up the heat on the cooker, sending virulent arcs jetting from the corona.

Light escaped freely on one side while the mask bottled it up on the other. This pushed the star toward the mask, but the mask was bound to the star by gravitation. It adjusted and kept the right distance. The forlorn star was able to eject light in only one direction, so it recoiled oppositely.

The filaments were herding these stars: sluggish, but effective. Herded toward the accretion disk, stoking the black hole’s appetite.

“The Admiral is after us.”

Zeb could see nothing, but she had the instruments to peer through the dust cloaking them. “Can he shoot?”

“Not if we damp engines.”

“Do it.”

Drifting . . . into a narrow gulf, overlooking the splendor below.

Blackness dwelled at the core, but friction heated the infalling gas and dust. These brimmed with forced radiation. Storms worried the great banks; white-hot tornadoes whirled. A virulent glow hammered outward, shoving incessantly at the crowded masses jostling in their doomed orbits. Gravity's gullet forced the streams into a disk, churning ever inward.

Amid this deadly torrent, life persisted. Of a sort.

Zeb peered through the gaudy view, seeking the machine-beasts who ate and dwelled and died here.

Suffering the press of hot photons, the grazer waited. To these photovores, the great grinding disk was a source of food. Above the searing accretion disk, in hovering clouds, gossamer herds fed.

“Vector that way,” Zeb said. “I remember seeing these on my visit. ...”

“We run a risk, using our drive.”

“So be it.”

Sheets of the photovores billowed in the electromagnetic winds, basking in the sting. Some were tuned to soak up particular slices of the electromagnetic spectrum, each species with a characteristic polish and shape, deploying great flat receptor planes to maintain orbit and angle in the eternal brimming day.

Their ship slipped among great wings of high-gloss moly-sheet spread. The photovore herds skated on winds and magnetic torques in a complex dynamical sum. They were machines, of course, descended from robot craft which had explored this center billions of years before. More complex machines, evolved in this richness, prowled the darker lanes further out.

“Let's hide here.”

“We're over-heating already,” she said.

“Duck into the shade of that big-winged one.”

She called, "Our own ship magnetic fields are barely able to hold back the proton hail."

"Where's the nearest worm?"

"Not far, but—"

"The Admiral will be covering it."

"Of course." A chess game with obvious moves.

A bolt seared across the dust ball behind them and struck some photovores. They burst open and flared with fatal energies.

"He's shooting on spec," Zeb said.

"Perhaps as he does not like the weather here."

They hugged the shadow and waited. Moments tiptoed by.

The Admiral's ship emerged from a dust bank, baroquely elegant and foppishly ornate, glowing with purpose, spiraling lazily down.

Zeb saw a spindly radiance below the photovore sheets. "A magnetic filament."

"Looks dangerous," she said.

"Let's head for it"

"What?"

"We're doomed if we stay here. If you're losing at a game, change the game."

They slipped below vast sheets of photovores with out-stretched wings, banking gracefully on the photon breeze. Lenses swiveled to follow the human ship: prey? Here a pack of photovores had clumped, caught in a magnetic flux tube that eased down along the axis of the galaxy itself.

Among them glided steel-blue gamma-vores, feeders on the harder gamma-ray emission from the accretion disk. They sometimes came this far up, he knew, perhaps to hunt the silicate-creatures who dwelled in the

darker dust clouds. Much of the ecology here was still unknown.

He stopped musing. Nature red in tooth and claw, after all. Time to move. Where?

“Slip into the magnetic tube.”

She said sharply, “But the electrodynamic potentials there—”

“Let’s draw a little cover.”

She swooped them forward toward the filament. This also took them angling toward a huge sailcraft photovore. It sighted them, pursued.

Here navigation was simple. Far below them, the rotational pole of the Eater of All Things, the black hole of three million stellar masses, was a pinprick of absolute black at the center of a slowly revolving incandescent disk.

The photovore descended after them, through thin planes of burnt-gold light seekers. They all lived to ingest light and excrete microwave beams, placid conduits, but some—like the one gliding after the tiny human ship— had developed a taste for metals: a metallovore. It folded its mirror wings, now angular and swift, accelerating.

“The Admiral has noticed us,” she announced in flat tones.

“Good. Into the flux tube. Quick!”

“That big alien machine is going to reach us first.”

“Even better.”

He had heard the lecture, while on his “tour” here. Fusion fires inside the photovores could digest the ruined carcasses of other machines. Exquisitely tuned, their in-nards yielded pure ingots of any alloy desired.

The ultimate resources here were mass and light. The photovores lived for light, and the sleek metallovore lived to eat them, or even better, the human ship, an exotic variant. It now gave gigahertz cries of joy as it followed them into the magnetic fields of the filament.

“These magnetic entities are intelligent?” she asked.

“Yes, though not in the sense we short-term thinkers recognize. They are more like fitfully sleeping libraries.” A glimmer of an idea. “But it’s their thinking processes that might save us.”

“How?”

“They trigger their thinking with electrodynamic potentials. We’re irritating them, I’m sure, by flying in hell-bent like this.”

“How wonderful.”

“Watch that metallovore. Let it get close, then evade it.”

Banks, swoops, all amid radiance. Magnetic strands glowed like ivory.

It would ingest them with relish, but the metal-seeker could not maneuver as swiftly as their sleek ship. Deftly they zoomed through magnetic entrails—and the Admiral followed.

“How soon will these magnetic beings react?”

Zeb shrugged. “Soon, if experience is a guide.”

“And we—”

“Hug the metallovore now. Quick!”

“But don’t let him grab us?”

“That’s the idea.”

The metallovore, too, was part of an intricate balance. Without it, the ancient community orbiting the Eater would decay to a less diverse state, one of monotonous simplicity, unable to adjust to the Eater’s vagaries. Less energy would be harnessed, less mass recovered.

The metallovore skirted over them. Zeb gazed out at it. Predators always had parasites, scavengers. Here and there on the metallovore’s polished skin were limpets and barnacles, lumps of orange-brown and soiled yellow that fed on chance debris, purging the metallovore of unwanted elements—wreckage and dust which can jam even the most robust mechanisms, given time.

It banked, trying to reach them. The Admiral’s glossy ship came

angling in, too, along the magnetic strands.

“Let it get closer,” Zeb ordered.

“It’ll grab us!”

“True, unless the Admiral kills it first.”

“Some choice,” she said sardonically.

A dance to the pressure of photons. Light was the fluid here, spilling up from the blistering storms far below in the great grinding disk. This rich harvest supported the great sphere which stretched for hundreds of cubic light-years, its sectors and spans like armatures of an unimaginable city. Why had he gone into politics, Zeb asked him-self—he was always rather abstract when in a crisis— when all *this* beckoned?

All this, centered on a core of black oblivion, the dark font of vast wealth.

“I’m getting a lot of electrodynamic static,” she called.

“Ah, good.”

“Good? My instruments are sluggish—”

The metallovore loomed. Pincers flexed forth from it.

The jolt came first as a small refraction in the howling virulence. Slow tightening arced along the magnetic filament, annihilating riding down.

“It’ll fry us!”

“Not us,” he said. “We’re a minor mote here. Much bigger conductors will draw this fire.”

Another jarring jolt. The metallovore arced and writhed and died in a dancing fire.

No differently could the laws of electrodynamics treat an ever bigger conductor, closing in. The Admiral’s fine glowing ship drew flashes of discharge, dancing ruby-red and bile-green.

It coasted, dead. The larger surface areas of both metallovore and

starship had intercepted the electrical circuitry of the filaments.

“I ... You really did know what you were doing,” she said weakly.

“Not actually. I was just following my intuition.”

“The one that got you the Governorship?”

“No, something more primitive.”

Coasting now, out of the gossamer filaments. There might be more bolts of high voltage.

“Is everyone on that ship dead?” she asked.

“Oh no. You have forgotten your elementary physics. A charge deposits only on the outside of a conductor. Electrons will not enter it.”

“But why are they drifting then?”

“Any antenna will draw the charge in, if the line is active; that’s its job. Like having your hand on the knob of a radio in a lightning storm, a chancy act.”

“So they’re inert?”

“A few may have been standing too close to the instruments.”

“They would be . . . ?”

He shrugged. “Fried. Luck of the game.”

“The Admiral—”

“Let us hope he was unlucky. Even if not, I suspect the Speculists will not look kindly upon one who has raised such a rowdy chase and then caught nothing.”

She laughed. They coasted in the gorgeous splendor.

Then he yawned, stretched, and said, “Getting cramped in here. Shall we find that wormhole you mentioned?”

He really didn’t like travel all that much, indeed.



\* \* \* \*

Think of the galaxy as a swarm of gaudy bees, bright colors hovering in a ball. Stomp them somehow in midair, so they bank and turn in a furious, compressed disk. Yet their courses and destinies are now guided by small entities of great pretension: humans, at times no better than bees. Across the span of a hundred billion worlds, rich and ancient blood sings in pounding vessels. Even on so great a scale, the hunt is always on.

\* \* \* \*

## AFTERWORD

I so loved Roger Zelazny's liquid grace, his fervent sense of narrative momentum, that I have tried in this piece to emulate some of his moments and moves.

Like many, my first Zelazny story was "A Rose for Ecclesiastes." Who can forget reading that opening voice? It evoked a romantic, daring world seen through a poet's eyes. I followed his career eagerly, through novels and novellas of great power. He was the brightest light in a burning decade, the sixties.

When I met Roger in the 1970s he proved to be an affable, witty, wiry man. We became friends and I visited him and family, often having dinner in Santa Fe when I was consulting at Los Alamos. Restless of mind, he always probed for the latest from the grand canvas of science.

I saw him twice in the last year and a half of his life, when we were both guests of honor at two cons. The last time, in Idaho, I found him as quick and funny, eyes glittery, as ever, though gaunt and at times sobered. His spirit was so firm I did not seriously suppose that he would falter and vanish from us so quickly.

Deaths diminish us all. Among the science fiction community, I missed terribly Robert Heinlein and Terry Carr and had persistent dreams about them for over a year after they departed. For Roger it was the same: dreams of flying somewhere with him, always in air sunny and resplendent with long, high perspectives.

So when asked to write a story in tribute to him, I took from my stock of ideas at hand, using pieces of ideas I was working on, and tried to see what Roger would like to fashion from them. He loved the bare and the

swanky alike, so I thought of a rather Roger-like character, comfortable in his opulent world, who gets to flee and fight across the sort of wondrous galaxy Roger would have enjoyed. It's been fun to go along with him this one last time.