

## OLYMPIADS SCHOOL/GRADE 9 ENGLISH/HANDOUT 7

### Thesis / Introductory Statements

Since your essays must focus on a central idea or thesis, developing a sophisticated thesis or introductory sentence is critical. The organization of your body paragraphs and the evidence which you select to incorporate into your body paragraphs must all relate back to your thesis or introductory statement. Therefore, it makes sense to explore the elements of a good thesis / introductory statement.

**1. THINK FIRST.** Formulating a thesis or introductory statement is not the first thing that you do. You can only develop your ideas after you understand the question, review what you know and organize your thoughts.

**2. Understand the question.** Since the purpose of your essay is to answer a question, you must understand the prompt before you do anything else. To help you understand what you are being asked to do, please see the following chart.

**3. Review.** Once you have a general idea of what you are trying to accomplish, review your notes, readings, etc.. As you review, look for significant patterns that will help you answer the question asked.

**4. Organize your thoughts.** After looking over all of your material and identifying potential patterns or sub-topics, consider your options and narrow your thoughts onto a manageable amount of material.

**5. Develop your thesis.** Once you have organized your thoughts; turn your idea into a sentence. You should then critically review your sentence and test its strength. Some good questions for you to consider as you review your thesis are:

- ***Do I answer the question?*** Re-reading the question after constructing a working thesis can help you fix an argument that misses the focus of the question.
- ***Have I taken a position that others might challenge or oppose?*** If your thesis simply states facts that no one would, or even could, disagree with, it's possible that you are simply providing a summary, rather than making an argument.
- ***Does my thesis pass the “So what?” test?*** If a reader's first response is, “So what?” then you need to clarify, to forge a relationship, or to connect to a larger issue.
- ***Does my thesis pass the “how and why?” test?*** If a reader's first response is “how?” or “why?” your thesis may be too open-ended and lack guidance for the reader. See what you can add to give the reader a better take on your position right from the beginning.

**There will be a mid-term assessment during the next class. You will be writing a three-paragraph essay, containing an introduction, a body paragraph, and a conclusion. To prepare for it, respond to these questions.**

1. To what extent are the Gladers successful in creating a civilized environment for themselves? Write an essay that takes a stand but balances between two perspectives.
2. If you were a Glader, would you prefer to follow Alby or Thomas? Write an essay that takes a stand but balances between two perspectives.
3. Are Thomas' actions heroic or foolish? Write an essay that takes a stand but balances between two perspectives.

Which question would you choose? Explain your choice.

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What would your thesis statement look like? (In other words, what will you argue?) You may modify your thesis statement for the mid-term essay.

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What evidence would you use to support your thesis statement?

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# CHAPTER 33

## CLOSE READING

They went through the West Door into Section Eight and made their way down several corridors, Thomas right beside Minho as he turned right and left without seeming to think about it, running all the while.

The early-morning light had a sharp sheen about it, making everything look bright and crisp—the ivy, the cracked walls, the stone blocks of the ground. Though the sun had a few hours before hitting the noon spot up above, there was plenty of light to see by. Thomas kept up with Minho as best he could, having to sprint every once in a while to catch back up.

They finally made it to a rectangular cut in a long wall to the north that looked like a doorway without a door. Minho ran straight through it without stopping. “This leads from Section Eight—the middle left square—to Section One—the top left square. Like I said, this passage is always in the same spot, but the route here might be a little different because of the walls rearranging themselves.”

Thomas followed him, surprised at how heavy his breaths had already become. He hoped it was only jitters, that his breathing would steady soon.

They ran down a long corridor to the right, passing several turns to the left. When they reached the end of the passage, Minho slowed to barely more than a walk and reached behind him to pull out a notepad and pencil from a side pocket in his backpack. He jotted a note, then put them back, never fully stopping. Thomas wondered

what he’d written, but Minho answered him before he could pose the question.

“I rely . . . mostly on memory,” the Keeper huffed, his voice finally showing a hint of strain. “But about every fifth turn, I write something down to help me later. Mostly just related to stuff from yesterday—what’s different today. Then I can use yesterday’s Map to make today’s. Easy-peasy, dude.”

Thomas was intrigued. Minho *did* make it sound easy.

They ran for a short while before they reached an intersection. They had three possible choices, but Minho went to the right without hesitating. As he did so, he pulled one of his knives from a pocket and, without missing a beat, cut a big piece of ivy off the wall. He threw it on the ground behind him and kept running.

“Bread crumbs?” Thomas asked, the old fairy tale popping into his mind. Such odd glimpses of his past had almost stopped surprising him. “Bread crumbs,” Minho replied. “I’m Hansel, you’re Gretel.”

On they went, following the course of the Maze, sometimes turning right, sometimes turning left. After every turn, Minho cut and dropped a three-foot length of ivy. Thomas couldn’t help being impressed—Minho didn’t even need to slow down to do it.

“All right,” the Keeper said, breathing heavier now. “Your turn.” “What?” Thomas hadn’t really expected to do anything but run and watch on his first day.

“Cut the ivy now—you gotta get used to doing it on the run. We pick ‘em up as we come back, or kick ‘em to the side.”

Thomas was happier than he thought he’d be at having something to do, though it took him a while to become good at it. First couple of times, he had to sprint to catch up after cutting the ivy, and once he nicked his finger. But by his tenth attempt, he could almost match Minho at the task.

On they went. After they'd run awhile—Thomas had no idea for how long or how far, but he guessed three miles—Minho slowed to a walk, then stopped altogether. "Break time." He swung off his pack and pulled out some water and an apple.

Thomas didn't have to be convinced to follow Minho's lead. He guzzled his water, relishing the wet coolness as it washed down his dry throat.

"Slow down there, fishhead," Minho yelped. "Save some for later." Thomas stopped drinking, sucked in a big satisfied breath, then burped. He took a bite of his apple, feeling surprisingly refreshed. For some reason, his thoughts turned back to the day Minho and Alby had gone to look at the dead Griever—when everything had gone to klunk. "You never really told me what happened to Alby that day—why he was in such bad shape. Obviously the Griever woke up, but what *happened*?"

Minho had already put his backpack on. He looked ready to go. "Well, shuck thing wasn't dead. Alby poked at it with his foot like an idiot and that bad boy suddenly sprang to life, spikes flaring its fat body rollin' all over him. Something was wrong with it, though—didn't really attack like usual. It seemed like it was mostly just trying to get out of there, and poor Alby was in the way."

"So it ran away from you guys?" From what Thomas had seen only a few nights before, he couldn't imagine it.

Minho shrugged. "Yeah, I guess—maybe it needed to get recharged or something. I don't know."

"What could've been wrong with it? Did you see an injury or anything?" Thomas didn't know what kind of answer he was searching for, but he was sure there had to be a clue or lesson to learn from what happened.

Minho thought for a minute. "No. Shuck thing just looked dead—like a wax statue. Then boom, it was back to life."

Thomas's mind was churning, trying to get somewhere, only he didn't know where or which direction to even start in. "I just wonder where it *went*. Where they always go. Don't you?" He was quiet for a second, then, "Haven't you ever thought of following them?"

"Man, you *do* have a death wish, don't you? Come on, we gotta go." And with that Minho turned and started running.

As Thomas followed, he struggled to figure out what was tickling the back of his mind. Something about that Griever being dead and then not dead, something about where it had gone once it sprang to life . . .

Frustrated, he put it aside and sprinted to catch up.

Thomas ran right behind Minho for two more hours, sprinkled with little breaks that seemed to get shorter every time. Good shape or not, Thomas was feeling the pain.

Finally, Minho stopped and pulled off his backpack once more. They sat on the ground, leaning against the soft ivy as they ate lunch, neither one of them talking much. Thomas relished every bite of his sandwich and veggies, eating as slowly as possible. He knew Minho would make them get up and go once the food disappeared, so he took his time.

"Anything different today?" Thomas asked, curious.

Minho reached down and patted his backpack, where his notes rested. "Just the usual wall movements. Nothing to get your skinny butt excited about."

Thomas took a long swig of water, looking up at the ivy-covered wall opposite them. He caught a flash of silver and red, something he'd seen more than once that day.

"What's the deal with those beetle blades?" he asked. They seemed to be everywhere. Then Thomas remembered what he'd seen in the Maze—so much had happened he hadn't had the chance to mention it.

"And why do they have the word *wicked* written on their backs?"

"Never been able to catch one," Minho finished up his meal and put his lunch box away. "And we don't know what that word means—probably just something to scare us. But they have to be spies. For *them*. Only thing we can reckon."

"Who is *them*, anyway?" Thomas asked, ready for more answers. He hated the people behind the Maze. "Anybody have a clue?"

"We don't know jack about the stupid Creators." Minho's face redened as he squeezed his hands together like he was choking someone. "Can't wait to rip their—"

But before the Keeper could finish, Thomas was on his feet and across the corridor. "What's that?" he interrupted, heading for a dull glimmer of gray he'd just noticed behind the ivy on the wall, about head high.

"Oh, yeah, that," Minho said, his voice completely indifferent.

Thomas reached in and pulled apart the curtains of ivy, then stared blankly at a square of metal riveted to the stone with words stamped across it in big capital letters. He put his hand out to run his fingers across them, as if he didn't believe his eyes.

### WORLD IN CATASTROPHE: KILLZONE EXPERIMENT DEPARTMENT

He read the words aloud, then looked back at Minho. "What's this?" It gave him a chill—it had to have something to do with the Creators.

"I don't know, shank. They're all over the place, like freaking labels Solid."

for the nice pretty Maze they built. I quit bothering to look at 'em a long time ago."

Thomas turned back to stare at the sign, trying to suppress the feeling of doom that had risen inside him. "Not much here that sounds very good. Catastrophe. Killzone. Experiment. Real nice."

"Yeah, real nice, Greenie. Let's go."

Reluctantly, Thomas let the vines fall back into place and swung his backpack over his shoulders. And off they went, those six words burning holes in his mind.

An hour after lunch, Minho stopped at the end of a long corridor. It was straight, the walls, solid, with no hallways branching off.

"The last dead end," he said to Thomas. "Time to go back."

Thomas sucked in a deep breath, trying not to think about only being halfway done for the day. "Nothing new?"

"Just the usual changes to the way we got here—day's half over," Minho replied as he looked at his watch emotionlessly. "Gotta go back." Without waiting for a response, the Keeper turned and set off at a run in the direction from which they'd just come.

Thomas followed, frustrated that they couldn't take time to examine the walls, explore a little. He finally pulled in stride with Minho.

"Just shut it, dude. Remember what I said earlier—can't take any chances. Plus, think about it. You really think there's an exit anywhere? A secret trapdoor or something?"

"I don't know . . . maybe. Why do you ask it that way?"

Minho shook his head, spat a big wad of something nasty to his left. "There's no exit. It's just more of the same. A wall is a wall is a wall. Solid."

Thomas felt the heavy truth of it, but pushed back anyway. "How do you know?"

"Because people willing to send Grievers after us aren't gonna give us an easy way out."

This made Thomas doubt the whole point of what they were doing. "Then why even bother coming out here?"

Minho looked over at him. "Why *bother*? Because it's here—gotta be a reason. But if you think we're gonna find a nice little gate that leads to Happy Town, you're smokin' cow klunk."

Thomas looked straight ahead, feeling so hopeless he almost slowed to a stop. "This sucks."

"Smartest thing you've said yet, Greenie."

Minho blew out a big puff of air and kept running, and Thomas did the only thing he knew to do. He followed.

The rest of the day was a blur of exhaustion to Thomas. He and Minho made it back to the Glade, went to the Map Room, wrote up the day's Maze route, compared it to the previous day's. Then there were the walls closing and dinner. Chuck tried talking to him several times, but all Thomas could do was nod and shake his head, only half hearing, he was so tired.

Before twilight faded to blackness, he was already in his new favorite spot in the forest corner, curled up against the ivy, wondering if he could ever run again. Wondering how he could possibly do the same thing tomorrow. Especially when it seemed so pointless. Being a Runner had lost its glamour. After one day.

Every ounce of the noble courage he'd felt, the will to make a difference, the promise to himself to reunite Chuck with his family—it all vanished into an exhausted fog of hopeless, wretched weariness.

He was somewhere very close to sleep when a voice spoke in his

head, a pretty, feminine voice that sounded as if it came from a fairy goddess trapped in his skull. The next morning, when everything started going crazy, he'd wonder if the voice had been real or part of a dream. But he heard it all the same, and remembered every word.  
*Tom, I just triggered the Ending.*



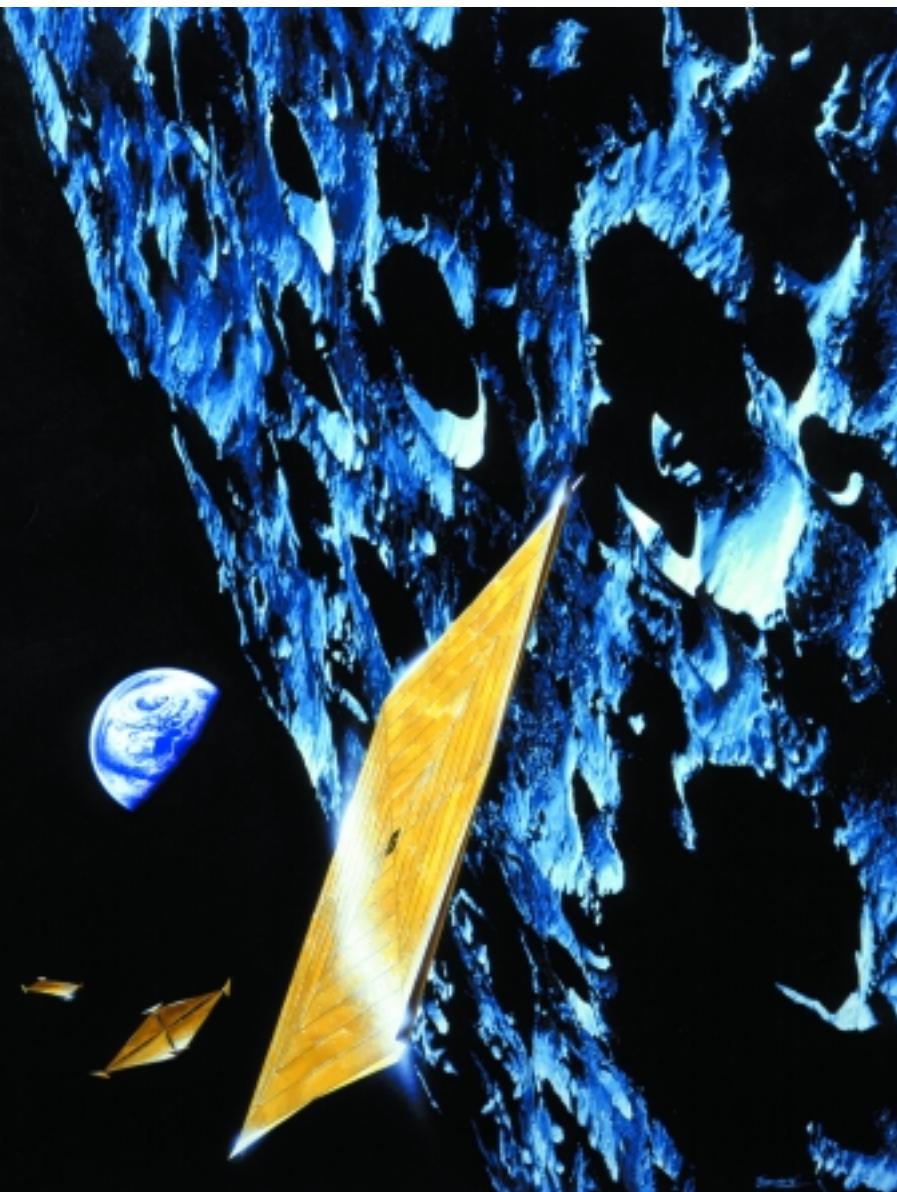
# Solar- or Light-Sails

The idea of leaving the engine of a craft behind and using the endless fuel supply of solar or star light seems like a great way of reducing the mass of a craft. The obvious disadvantage is the dependence on a high flux of photons to give the craft the needed acceleration. For interstellar travel, light-sail craft have to depend on extremely large-scale constructions such as huge solar-power relays around Mercury and enormous Fresnel zones in the outer Solar System.

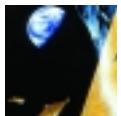
Since light applies pressure to surfaces, the stream of photons can be used for propulsion in a near-frictionless environment. This concept is the background for light (or solar) sails. It is a method of space travel that negates the need for onboard fuel. Sails using the solar wind or only the light from stars are less efficient at larger distance from the Sun.

In science fiction, solar sails are encountered from the 1920s, with early models being giant, multiple-sail craft. In other works, light sails are used to propel ramjets up to ram speeds. To increase efficiency, ground based lasers can be used to push the craft – using monochromatic light increases the reflectivity of the sail material and gives more acceleration. The efficiency decreases with distance, but much slower than if the craft was riding sunlight alone. The laser beam can be refocused by gigantic Fresnel zones. Light sails will have enormous areas, but the craft will carry no fuel or bulky engines. Alternatives to light sails include microwave sails, particle sails, magnetic sails, and laser or solar thermal or electrical propulsion.

Basically, the light sail is a use of James C. Maxwell's discovery in 1873 that light reflected in a mirror applied pressure to the mirror. Since photons according to Einstein have mass then, by using the rather low friction coefficient of space, a craft is able to travel from A to B without having to carry bulky propulsion devices and especially without the need for onboard fuel. This is a large plus in terms of logistics. The fuel is supplied from nearby stars or by high-power lasers.



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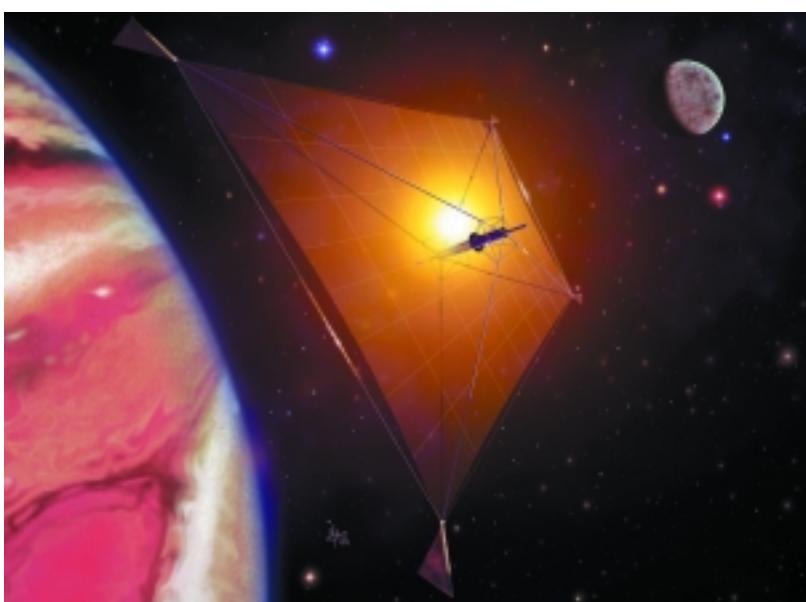
Arthur C. Clarke wrote "Sunjammer" in the early 1960s, but one of the earliest sources of light sails is a compilation of works by Cordwainer Smith, the name under which Dr. Paul M. A. Linebarger wrote science fiction in the 1950s. In this story the first manned interstellar ships are propelled by light sails. The smallest, earliest sails were only about 5000 km<sup>2</sup>. They were made of "tissue metal" – probably a fine mesh to give lightness to these enormous sails. Each ship carried many sails, and was steered by the manipulation of the sails much like sail-carrying ships today. Larry Niven is a later science-fiction writer who uses light sails extensively in his "Tales of Known Space" setting, where they are a way to propel a vessel to speeds where ram scoops can be used. These light sails are almost always pushed by giant lasers, placed either on tracks on Mercury, or on asteroids in the belt between Mars and Earth. In one story, "The Mote in God's Eye", written with Jerry Pournelle and set in Pournelle's own universe, the first encounter with an intelligent alien species is in the form of a meeting with a laser-pushed light sail.

There are several types of light sails – in the basic model the craft uses only light from stars to generate push. This is the model used by Cordwainer Smith. Acceleration is only provided as long as the light is intense, that is in the inner parts of solar systems. In those areas, light sails may be a cheap and efficient way of getting about. Acceleration is low, and the maximum speed is usually guessed to be about 25% of the speed of light. As the distance to the photon source increases, so does the efficiency of the light sail needed to sustain significant acceleration. There might very well be a point where a sail's degree of push is countered equally by the friction of the incoming interstellar matter in the craft's path.

The simplest form of light sail is a big circle or square with the craft dragged along on wires. This model is used in Robert Forward's "Rocheworld", where buckling of the sail occurs, but with no great concern from the crew. The danger of having the sail flap around or collapse in the fluctuating photon stream from the Sun seems to be a problem considered only in the real world, where ways of reinforcing the sail with poles seem popular.

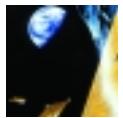
Other forms of sail include the laser-powered light sail, where a giant laser or system of lasers bombards the sail with monochromatic light. This is favourable since it is easier to create efficient reflectors of monochromatic light compared to reflectors of ordinary sunlight composed of a spectrum of wavelengths. To be effective, the laser will have to be enormous and have its beam focused before the light reaches the sail. The laser-powered solar sail is seemingly the only way of getting a light sail to be effective on interstellar journeys. Larry Niven's early "Tales of Known Space" have giant laser batteries on Mercury, surrounded by a loose net of solar collectors.

One proposal by Robert Forward involves a lens the size of Texas (a Fresnel zone) placed between Saturn



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## 16 Propulsion Techniques

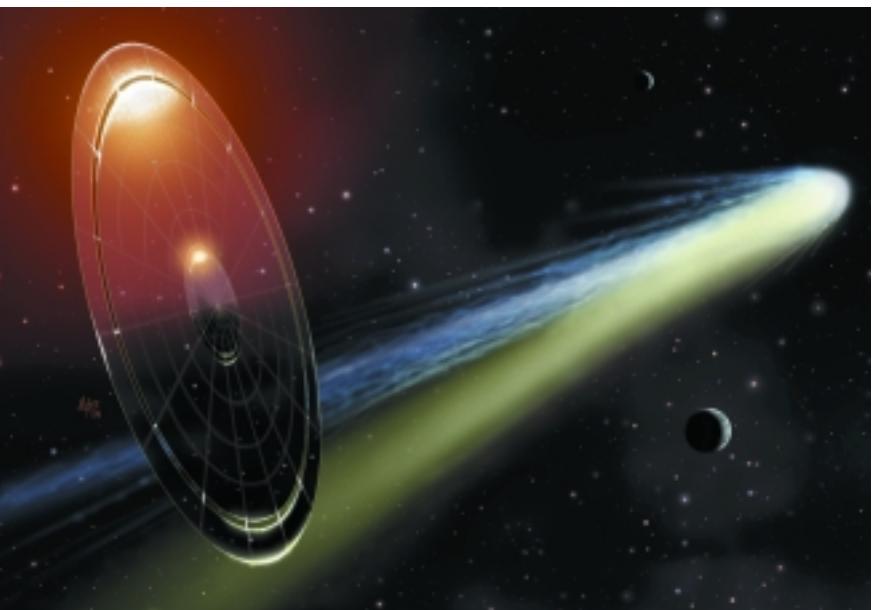


and Neptune, which focuses the lights from several thousand solar collectors in orbit round Mercury. These solar-pumped lasers will have a collective power of 65 GW. The light sail itself is a two-stage one, where the large outer sail is slightly bowl-shaped. It will be separated from (but very likely still connected to) the inner sail, upon arrival at Alpha Centauri (or Barnard's Star?). The large outer sail then focuses the laser beam back onto the inner sail, thus braking the craft. The downside to laser-powered light sails is the tremendous laser power needed to propel the craft over interstellar distances.

Alternatives to light sails have been proposed. The microwave sail is also an idea from Robert Forward. A tiny spacecraft, the Starwisp, is propelled by microwaves transmitted from a solar-powered satellite in Earth orbit. The craft would be mostly a 1 km diameter mesh sail covered with microcircuitry, weighing only a few grams. The beam power should be 65–100 GW, pushing the 4–5 g craft to 20% of the speed of light, using a Fresnel-zone type lens to focus the microwave beam.

Particle sails are not exactly sail craft, but still use the concept of catching a beam from a ground-based emitter to gain acceleration. The beam in this case is a stream of heavier, slower particles like protons, emitted from a fusion reactor as plasma. The beam would disperse quickly, but the push gained could be up to 1000 g propelling the craft to 1/3 of the speed of light before the effect dissipates. The beam-projection limitations would make interstellar missions a one-way venture.

The magnetic sail is a use of Lenz's Law (flux will attempt to remain constant in a electrified wire loop). The loop should be made from superconducting wires, and will expand to a circle when powered. The craft will be attached to this loop. Charged particles meeting the loop or magsail at other angles than parallel to the magnetic field will transfer some of their momentum to the field and thus push the craft. A magsail weighing 36 tons could receive accelerations of  $0.0001 \text{ m/s}^2$  to  $0.009 \text{ m/s}^2$  varying with the orientation of the sails. The mag loop is very small compared to a standard light sail, being only about 10 km in diameter.



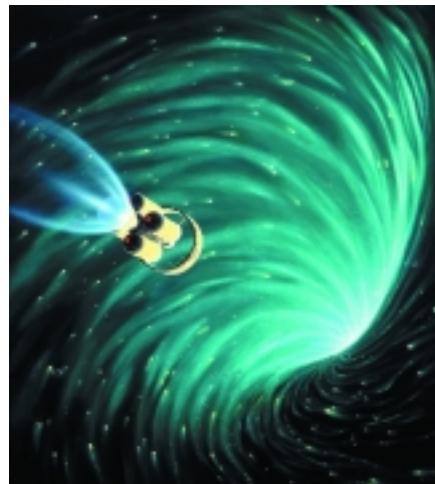
Solar sails are very close to being non-fiction. The Russians have conducted the Znamya tests of light thin-film applications in space. The tests seemed to be for Earth-surface illuminatory purposes, but were also a test of alternative propulsion methods. In the United States, a light, bowl-shaped object was lifted 20 m using a laser beam. In Europe, ESA and DLR have developed solar-sail technology small enough to be carried into space and light enough to enable efficient sailing. A 20 m x 20 m model consisting of aluminium-coated sail segments with carbon-fibre-reinforced plastic hooks has been manufactured and tested.



# Warp Drives

The concept of warping space-time as an advanced propulsion technology is a very common one in science fiction; probably the best known example is found in "Star Trek". This technology would allow faster-than-light travel, and, maybe even more relevant for astronomy, represent a powerful window to the Universe both in terms of space and time.

Ranging from Star Trek's "Voyager" pilot episodes to Larry Niven's "The Mote in God's Eye" and R.J. Sawyer's "Starplex", warping is one of the most common ways of circumventing the enormous travel times which would otherwise render science fiction a very boring genre.



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In the "Star Trek" world, the primary propulsion system used by most faster-than-light interstellar spacecraft is the warp drive. The system used by Federation starships employs the controlled annihilation of matter and anti-matter, regulated by dilithium crystals, to generate the tremendous power required to warp space and travel faster than the speed of light.

A warp drive is basically a mechanism using exotic matter with negative energy density for warping space-time in such a way that an object could move faster than light. In 1994, Miguel Alcubierre worked out a space-time geometry which describes such a warp drive. The warp in space-time makes it possible for an object to go faster than the speed of light while remaining on a time-like curve.

Roddenberry takes full advantage of the concept of the warp drive in his "Star Trek" odyssey to transport us to the edges of our Universe. In the "Avatar", Poul Anderson shows how humankind could travel between stars by using the exotic relativistic effect of massive rotating cylinders on the space-time metric surrounding them, as predicted by the Theory of General Relativity. The latter allows us to consider some orbits around a massive rotating cylinder which are "instantaneously" connected to other orbits around another massive spinning

cylinder located at an arbitrary distance from the first cylinder. From a technological point of view, the main problem is, of course, to build a network of such rotating cylinders spread throughout the entire Universe.

From the physics perspective, the relationships between space and time in a particular region are confined by the realms of General Relativity. A basic example is a "wormhole", which could use exotic matter to causally connect two distant locations in space. A hypothetical spaceship could enter one "mouth" of the wormhole and exit from the other very distant "mouth". Although the travelling issue is certainly the most inspiring aspect, wormholes, if they exist, could prove to be astonishing tools for seeing (in a broader sense) other and older parts of a remote Universe.



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