

# In the Star Trek Universe...

To say that the Star Trek franchise has cultivated a few scientific misconceptions over the years is something of an understatement. Here are four of the most prevalent and fundamental ones among them.

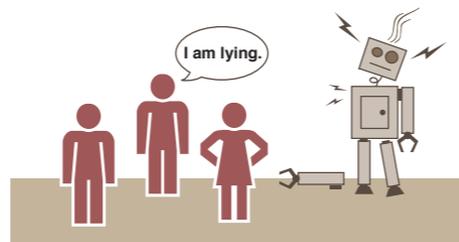
## Energy is a physical substance

The term “energy” is habitually used to refer to a more or less occult physical substance of similar character to electricity. In *Errand of Mercy* (tos1x27), for instance, Spock determines that a race of benevolent transcendental beings, known as the Organians, are “Pure energy. Pure thought. Totally incorporeal.”, as if they were conscious bundles of electrical impulses existing independently of any physical brains. It is unsurprising to find that electricity animated the thinking of screenwriters about energy, given the all-important role it has played in everyday life for over a century. This conception of energy is found in subsequent Star Trek series. One such example occurs in *The Bonding* (tng3x05) when an “energy build up” discharges from the Koinonian homeworld to strike the orbiting Enterprise-D. In other words a lightning bolt.



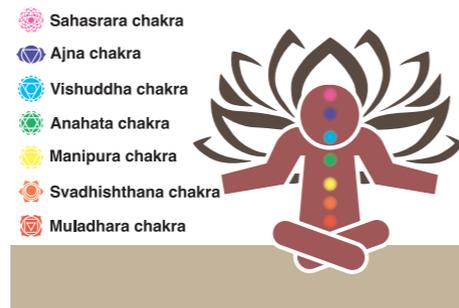
## Logical paradoxes cause computers to self-destruct

Star Trek fans the world over know that the only surefire way to thwart a sentient machine from achieving its cold and calculated objective is to self-destruct it by means of a logical paradox. Captain Kirk successfully employed this technique on the sentient computer Landru in *Return of the Archons* (tos1x22), the space probe Nomad in *The Changeling* (tos2x08), a civilization of androids loyal to interstellar con artist Harry Mudd in *I, Mudd* (tos2x12), and lastly the M-5 multitronic unit, a sophisticated computer system designed by Richard Daystrom to run a starship, in *The Ultimate Computer* (tos2x24). The key idea here is evidently that these machines expended so much computing power on resolving the paradoxes that they catch on fire and explode in a puff of smoke.



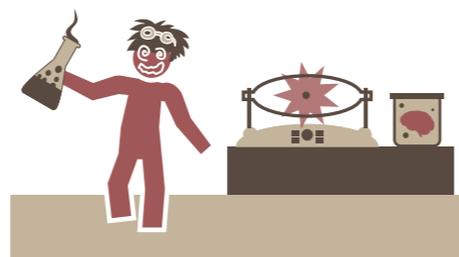
## Life is defined by the vital principle

Vitalism is a superseded scientific theory that attributes the features of life found among biological organisms to a vital principle, or life force, which is not present in ordinary matter. This particular conception of life surfaces again and again in Star Trek. One of the more striking appeals to vitalism occurs in *The Lights of Zetar* (tos3x18). In this episode, the Enterprise encounters an ethereal cloud in space suffused with the desires, hopes, minds, and wills of the last hundred Zetarians. It is revealed this incorporeal assemblage constituted the lone surviving life forces of a “sudden final disaster” that struck down the Zetarian civilization. They had been combing the galaxy ever since in search of a compatible biological host in which to live out their lives.



## Science is advanced by the lone genius

Everyone has heard the story about Isaac Newton suddenly coming up with the law of universal gravitation when an apple fell on his head. This legendary event is supposed to have occurred at some point while he lived in virtual isolation on his estate during the plague years of 1665-66. The Newton of legend epitomizes the lone genius of science fiction: a typically celibate man who shuts himself away from the world at large in pursuit of some monumental scientific discovery. The lone geniuses of Star Trek include, Roger Korby, Zephram Cochrane, Jackson Roykirk, Richard Daystrom, Garth of Izar, Stavos Keniclius, Noonian Soong, Paul Manheim, Ira Graves, Paul Stubbs, Nel Apgar, Hanna Bates, Doctor Farallon, Richard Galen, and Doctor Regya. That is all; see the Characters Appendix for more details.

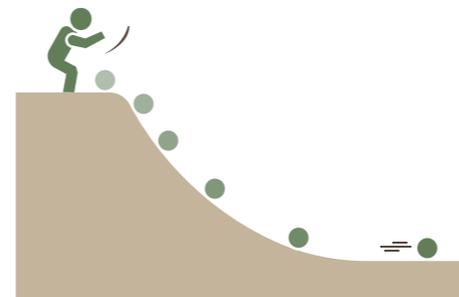


# In the Actually Exiting Universe...

Meanwhile here are the established scientific explanations of the very same concepts. In the screenwriters defense, their fantastical counterparts do sometimes make for more entertaining television.

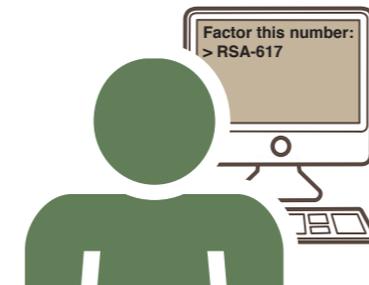
## Energy is an abstract property of systems

In physics energy is a property of a system that can either be transferred to another system or converted into different forms within that same system, but is never observed to be created or destroyed. If that is too much of a mouthful, then the “ability of a system to do work” makes for a reasonable working definition. Either way energy is a property of a physical system akin to length or mass or tastiness and is not a physical substance in its own right. The picture shows the potential energy of a ball in the process of being transformed into the kinetic energy of motion. Energy has many other forms including chemical, electric, gravitational, ionization, magnetic, mechanical, nuclear, radiant, and thermal. But there is no such substance as “pure energy” out of which transcendental beings are assumed to be composed in Star Trek.



## Intensive computation may cause computers to crash

Sentient machines do not presently exist, as far as anybody knows, so what exactly would happen to one in the face of a logical paradox remains open to conjecture. But if modern computers are any guide, then we can be pretty sure that they will not catch fire and explode in a puff of smoke. Though intensive computation may under certain circumstances lead computers to overheat and crash. For instance, there is no shortage of message board threads written by gamers discussing how certain games tend to overheat their graphics cards. In a more fanciful vein, the picture shows a man who is about to crash his personal computer by attempting to factor a colossal 617 digit number that goes by the name of RSA-617 (Google it!). Modern computers are, of course, designed to remain operational even under such circumstances, but it nevertheless serves to illustrate the basic principle.



## Life is defined by physical processes

We are confident that we know what life is when we see it, but coming up with a clear-cut definition to distinguish living from non-living things can be a tricky matter. When Beverly was asked by Data to define life in *Quality of Life* (tng6x09), she proposed that living things are able to “consume food, derive energy from it, grow, adapt themselves to their surroundings, and reproduce.” As a definition it has its limitations: Data, as he himself pointed out, fails to meet all of its criteria. What is important, however, is that this definition, which is the standard scientific one in all the textbooks, characterizes life as a set of processes, rather than as a physical substance or vitalistic force of nature.



## Science is a social enterprise

In reality science is on the whole an extremely social enterprise. No scientist bares examination of the physical world in isolation. The men and women of science operate within a supporting structure of interpersonal relations that is essential for the open exchange of new hypotheses about how the world works. These exchanges of ideas are sometimes undertaken in the spirit of collaboration, and other times in a highly adversarial manner. In either case, however, scientists routinely hit on novel hypotheses about the world by building on or challenging the work of their peers and then developing them in the company of other people.

