

The New York Times: “The Terror of Threes in the Heavens and on Earth” [C1]

Da molto tempo i fisici studiano in che modo i fenomeni in gruppi di tre possono seminare il caos. Il cosiddetto problema dei tre corpi, avvertono, potrebbe persino condurre a una guerra termonucleare mondiale.



Isaac Newton was [baffled](#). He was already famous for discovering how gravity holds the universe together and for using that knowledge to predict the movements of celestial bodies, such as the moon's path around the Earth. Now, by taking the sun's gravitational [tugs](#) into account, he sought to improve his lunar predictions. Instead, it made them worse. The [setback](#), Newton's friend Edmond Halley reported, "made his head [ache](#), and kept him awake so often, that he would think of it no more." Newton felt his defeat so [keenly](#) that he recalled it more than once in his old age. Today it's called the three-body problem. Famous in science and science fiction for orbital perturbations and chaotic phenomena, it's recently become a concern of atomic experts and military planners. As Beijing rapidly expands its nuclear arsenal, they [warn](#) that the world of atomic superpowers is about to escalate to three from two. The [outcome](#), they add, compared with the Moscow-Washington [standoff](#), now 70 years old, could represent a

dangerous new kind of unthinkable. The [looming](#) era could encourage “states [to resort](#) to nuclear weapons in a crisis,” Andrew F. Krepinevich Jr., a senior [fellow](#) at the Center for a New American Security, recently [warned](#). He cited the natural instabilities observed by physicists and astronomers as a [portent](#). Experts say the tripolar age could put human survival at risk. But they also cite a number of three-body lessons from nature — starting with Newton’s — that illuminate the issue and suggest possible ways forward. So far, however, no answer [stands out](#). The world’s nuclear thinkers are finding the [knotty](#) topic to be as intractable as it was for Newton. “We have a conceptual problem,” said Ernest J. Moniz, a physicist who as the secretary of energy in the Obama administration [oversaw](#) the U.S. nuclear arsenal. “We’ve got to change the traditional approach of equalizing weapons or strategic delivery systems, but how to do that is still unclear.” France A. Córdova, an astrophysicist and past director of the National Science Foundation, said the study of three-body phenomena in the natural sciences could [nonetheless](#) help reveal the military risks. “Things are changing very rapidly,” she said. “Anything that helps in understanding that is great.” Security-minded hawks want to expand the American arsenal in response to China’s nuclear rise and the threat of Beijing’s [closing ranks](#) with Moscow. Doves see a window for three-body [downsizing](#). They want to [break the problem into](#) smaller and more manageable parts. For instance, they argue that Washington should deal with the two superpowers independently and seek diplomatic [bonds](#) that reinforce two-body stability. Recently, the Biden administration called for a further simplification. Jake Sullivan, the national security adviser, argued that the American response should focus less on the quantity of the nation’s nuclear arms than on their quality. [To deter](#) attacks successfully, he said in a speech, the American military has no need for arms that “[outnumber](#) the combined total of our competitors.” In everyday life, groups of twos and threes can seem inconsequential. Two friends joining another brings the total to three. It’s the sum of the parts — what scientists call a linear increase. But in many aspects of nature, threes have an almost magical power [to sow](#) chaos, to become more than the sum of their parts. Scientists call them nonlinearities. In short, the interval from two to three can produce a counterintuitive jump in complexity, as Newton found [to his dismay](#). “Our intuitions [fail](#) us,”

Michael Weisberg, a philosopher of science at the University of Pennsylvania, said of the three-body tumult. Steven Strogatz, an applied mathematician at Cornell University, agreed: “Threes are inherently problematic. Things get [tricky](#).” Surprisingly, the jump in disorganization also shows up in the world’s oceans and atmosphere — in [whirlpools](#) and [maelstroms](#), tornadoes and hurricanes. If two of the [swirling](#) bodies get close, they move ahead in straight lines or circle each other. “With three, things immediately get more complicated,” said Michael J. Shelley, a specialist in fluid dynamics at New York University. “They can [collapse into each other](#). It gets very disordered and unpredictable. There’s a huge difference.” Notably, the jump also shows up in human life as groups of three cause social complexities [ties to soar](#) — markedly in young families. Two siblings have one relationship. But a third child results in seven kinds of [ties](#) among the siblings — three one-on-one relationships, three one-on-two relationships and one group relationship. Parents, by definition, are [outnumbered](#), and [bedlam](#) can [ensue](#). In the cosmos, stars also come in chaotic threesomes. The celebrated science fiction novel *The Three-Body Problem*, by Liu Cixin, features three stars that whirl around one another in [unruly](#) orbits. As a result, the planet Trisolaris suffers cycles of [blistering](#) heat and icy cold that can reverse in minutes, producing an alien civilization obsessed with survival. [Clusters](#) of three stars, however, turn out to be relatively rare in the universe because [stragglers](#) in wide orbits often [get ejected](#) or absorbed by passing star systems. “[Roughly](#), for every two binaries, there’s one triple,” said Andrei A. Tokovinin, an astronomer at the Cerro Tololo Inter-American Observatory, which has headquarters in La Serena, Chile. The Cold War — for all its terrors and crises — avoided nuclear war in part because its mature structures echoed the binary stability that astronomers see in the heavens and that young families see in the relatively simple play of two children. The era of most serious nuclear tension began as the world’s first thermonuclear arms were tested by Washington in 1952 and Moscow in 1955. By nature, the weapons could produce [blasts](#) 1,000 times more powerful than the Hiroshima bomb. The ensuing arms race fed the Cold War’s fear of mutual annihilation — ridiculed in *Dr. Strangelove*, the classic 1964 film. Soon, the antagonists [seized on](#) force parity as a way to reduce the risk of conflict. Negotiated accords set Moscow and Washington on roughly equal [footings](#) meant to replace war

with [taut stalemates](#) — as is the case with Russia and the United States today. “We’re at a stable equality,” said William I. Newman, a professor of astrophysics at the University of California, Los Angeles, who aids the University of California’s management of the Los Alamos weapons lab. “Any departure from that will enhance the instability.” The [looming](#) departure is Beijing’s plan to produce 1,500 nuclear warheads by 2035, as the Pentagon estimates. If achieved, the rise would represent a [fivefold increase](#) from the “minimum deterrent” that Beijing possessed for more than a half-century and would make it a nuclear [peer](#) of Moscow and Washington. Newman calls the tripolar state “much less resilient” than the bipolar [standoff](#). Even so, three-body theorists see a number of ways that the unthinkable might be avoided. For instance, Krepinevich, in a Foreign Affairs article last year, argued that Moscow could fade into economic and strategic insignificance, leaving a strong Beijing and Washington to “navigate their way to a new bipolar equilibrium.” [On a different note](#) Siegfried S. Hecker, a former director of the Los Alamos weapons laboratory in New Mexico, argued that Washington should aim to deal with the rival superpowers as separate entities. “I don’t see Russia and China getting together” on atomic strategies, he said. “I see it as two bipolars.” As the Ukraine war [rages](#) and Washington has little interaction with Moscow, Hecker added, now is a good time “to work with the Chinese” in building a two-body relationship. The main worry of military planners is that Beijing will not only achieve weapons parity with Washington but also form a military pact with Moscow. “We’re not seeing yet a [full-fledged](#) really cemented, long-lasting, resilient geopolitical alliance,” Gen. Mark Milley, the [outgoing chairman](#) of the [Joint Chiefs of Staff](#), told Foreign Affairs magazine last month. “Could that happen in the future? It could, and we need to be [wary](#) of that, and we need to do what we can to make sure that doesn’t happen.” Published in The New York Times on June 26, 2023. Reprinted with permission.

Glossary

- **whirlpools** = mulinelli
- **stalemates** = stalli
- **blasts** = esplosioni
- **full-fledged** = a pieno diritto
- **closing ranks** = serrare le fila
- **seized on** = appigliarsi
- **standoff** = stallo, braccio di ferro
- **To deter** = scoraggiare
- **to sow** = seminare
- **collapse into each other** = collassare l'uno nell'altro
- **outgoing chairman** = presidente uscente
- **baffled** = perplesso
- **fivefold increase** = aumento di cinque volte
- **ensue** = seguire
- **Clusters** = gruppi
- **oversaw** = sorvegliare
- **warn** = allertare, avvisare
- **fellow** = membro, ricercatore
- **to his dismay** = con suo sgomento
- **peer** = pari
- **looming** = incombente
- **On a different note** = parlando d'altro
- **blistering** = rovente
- **footings** = basi, situazioni
- **ache** = dolore
- **stands out** = risaltare, emergere
- **maelstroms** = vortici
- **Joint Chiefs of Staff** = Consiglio dei Capi di Stato Maggiore
- **keenly** = profondamente
- **portent** = presagio
- **taut** = tesi, rigidi
- **swirling** = vorticare
- **ties** = vincoli

- **tugs** = spinte
- **outcome** = risultato
- **outnumber** = superare in quantità
- **get ejected** = espellere
- **bonds** = vincoli
- **to soar** = crescere
- **setback** = scacco, passo indietro
- **knotty** = complicato
- **nonetheless** = tuttavia
- **wary** = cauti, attenti
- **to resort** = ricorrere
- **downsizing** = ridimensionare
- **fail** = tradire, non bastare
- **rages** = imperversare
- **bedlam** = baraonda
- **unruly** = ribelle
- **stragglers** = stelle vagabonde
- **Roughly** = all'incirca
- **break the problem into** = dividere
- **tricky** = complesso