

Paper takes swipe at bedrock law of physics

by World-Science.net

A new paper by a self-described hobby physicist challenges what may be the bedrock law of nature. And while skeptics are rolling their eyes, the study has appeared in a professional journal with the apparent consent of leading physicists.

The principle under dispute, central to physics for at least two centuries, is called the law of conservation of energy. It states that nothing can be created or destroyed: you can't get something from nothing, or vice-versa, though converting substances between diverse forms is very possible. A timeline showing estimated cosmic expansion since the Big Bang. Right after that event, a superheated, accelerating expansion is believed to have taken place. It later slowed down. In more recent times, the speedup mysteriously resumed. The tilted gray disk at approximately the middle of the figure represents the present. (Courtesy Lawrence Berkeley National Laboratory). But the paper claims new stuff may be formed continuously, in one special setting: within black holes or similar objects. The idea, the author adds, is testable and would solve several mysteries, including why the universe is expanding ever faster. "Not very plausible," though not impossible, was how the former Cambridge physicist Gary Gibbons of the University of Cambridge, U.K., rated the proposal. Cosmologist Andrei Linde of Stanford University in Stanford, Calif., declared the paper nonsense nine minutes after being emailed a copy. At "first glance," he wrote back, it "does not make any sense." But asked to specify its errors, he declined. The overriding problem, he wrote, was not mistakes, but an overall amateurishness. "Sorry for being so negative," but the study is "not even wrong," he wrote "quoting a stingy phrase scientists sometimes use to dismiss absurd findings. Yet a note published with the paper, in the journal *New Astronomy* this month, indirectly had successfully passed the scrutiny of at least one eminent qualified scholar: co-editor Joseph Silk, head of the University of Oxford, U.K., as a trophics department. That "does make one wonder more" about the work, volunteered Saul Perlmutter of the University of California, Berkeley, one of the acknowledged discoverers of the accelerating expansion. He declined to comment more on the paper, though, saying it was "not" exactly in his field. Silk also declined. As standard practice dictates, *New Astronomy* accepted the paper only after an editorial "Silk" reviewed it in consultation with an anonymous outside expert, the author said. Most scientists say a study's acceptance for publication in a "peer-reviewed" research journal, as *New Astronomy* is, is a mark that it constitutes serious science. This, of course, does "not" at all prove a study correct. Moreover, not all peer-reviewed journals command equal respect among scientists, and *New Astronomy* isn't considered the cream of the crop. Thomson Scientific, a Philadelphia-based organization, rated it as the 16th most influential of 43 astronomy and astrophysics journals worldwide publishing new research last year. Its editorial board includes, alongside Silk, researchers with the University of Cambridge, Harvard University and the Harvard-Smithsonian Center for Astrophysics. For the author, Gregor Bayar of Cedar Hill, Texas, the publication was a breakthrough. "It has been a very hard struggle for me to get anything published," he wrote in an e-mail, though he had another paper in print earlier this year. "Fortunately, some good people are beginning to take me seriously." Bayar attributed his

troubles to the fact that he doesn't work for any scientific institution, so other researchers are reluctant to back his theories. I have a Ph.D. in physics from the University of Chicago, from 1972, he wrote; "but I left the field many years ago. As a career, physics is hell: as a hobby, it is heaven. Ideas come easily to me now." Bay-er's paper on energy conservation considers black holes, stupendously dense celestial bodies that pack so much weight into so little space that their gravity overpowers everything nearby, including light rays. Conditions in black holes are thought to mimic in some ways those prevailing at the origin of the universe. Then, matter was packed into a point; this then exploded in a "Big Bang," spawning the cosmos. If a black hole had an open site, it would be what physicists call vacuum. In plain terms, that means nothingness, though this word is misleading because some minimal level of activity has been found to unfold even in the emptiest space. Vacuum is ubiquitous. Even in solid objects, there is plenty of room for vacuum, between and inside the atoms. In a black hole, vacuum could also conceivably find lodgings. But there, the cramping might become severe even for a guest of such modest demands "forcing" the vacuum, in Bay-er's view, to lead a precarious existence. Within black holes or similar objects, he argues, extreme conditions may inject "instability" into the vacuum, converting parts of it into non-vacuum, or matter. "Matter creation can be said to arise from some new particle interaction which violates energy conservation," he wrote in an email. Gibbons is unconvinced. Bay-er fails to clarify "the dynamics behind" the process, he wrote, adding that standard particle physics already offers a well-supported account of how mass arises, called the Higgs mechanism. Bay-er argued that some vagueness in his account is inevitable, because researchers are still "trying" to figure out what the vacuum really is. But he claims matter creation could explain the accelerated expansion of the universe, which Perlmutter and others identified in the late 1990s. Why the speedup occurs is one of the most vexing scientific mysteries of the past decade. Astronomers provisionally attribute it to a yet-to-be-identified "dark energy," whose nature remains unknown. Bay-er's explanation of this links matter creation to another concept, presure, a measure of how much a given blob of matter is "squeezed" by what's around it. It's why your head hurts if you dive deeply. Negative presure is also conceivable "your head being pulled apart" though we never experience this on Earth. A simplified view is that positive presure is an air hose blowing outward; negative presure, a vacuum cleaner sucking inward. Einstein determined that an object's gravity depends not just on its mass, as was known before, but its presure. If an object has enough negative presure, its gravity can also become negative, and hence repulsive rather than attractive. Bay-er argued that matter creation is as-so-called with repulsive gravity because it's also linked to negative presure. "The flow of energy into the Universe can be described as being caused by an external presure from the vacuum," he wrote in an email. "Viewed from inside the Universe, the positive external presure looks like a negative internal presure." Bringing back the air-hose analogy, imagine an invisible hose blowing air outward and into the mouth of a second tube. That second pipe would appear as though it were sucking in air "negative presure." Negative presure within regions of black holes would create a gravitational repulsion that permeates the cosmos and pushes it outward relentlessly, Bay-er claims. "While matter is being created, there is a gravitational repulsion as-so-called with the energy flow. When the flow stops, only the ordinary gravitational attraction of the created mass remains." All newly minted mass would reside permanently in its home black hole. Matter creation would equate to energy creation because, as Einstein found with the famed equation $E=mc^2$, matter and energy are two forms of the same thing. Whatever you call it, Bay-er said the creation process could explain not only the dark energy puzzle but an array of others: the instability of the "dark matter" that makes up five-sixths of the material in the cosmos,

but is un- seen; why cer- tain cos- mic rays hit Earth with oth- erwise in- ex- pli- ca- bly high en- er- gies; and what caused an "in- fla- tion" be- lieved to have made the uni- verse grow stu- pen- dous- ly big with- in a frac- tion of a sec- ond af- ter the Big Bang. Cos- mol- o- gists be- lieve ac- cel- er- at- ed swell- ing of the cos- mos oc- curred dur- ing two sep- a- rate pe- ri- ods: dur- ing the in- fla- tion ep- och, and more re- cent- ly. Bay- er says that "s" be- cause both episodes wit- nessed mat- ter cre- a- tion. The speedup stopped in be- tween, he ar- gues, be- cause in- i- tial for- ma- tion of the uni- verse was over, but black holes weren't formed yet. Yet Linde, a found- er of the in- fla- tion the- o- ry, dis- agrees. Bay- er said his the- o- ry of en- er- gy non- conservation could be tested us- ing par- ti- cle ac- cel- er- a- tors, which bash sub- a- tom- ic par- ti- cles to- ge- ther to help see what they're made of. Nor- mal- ly, conserva- tion of en- er- gy is used to cal- cu- late prop- er- ties of the par- ti- cles fly- ing out of the bang- up. But the law is as- sumed, rath- er than prov- en, in these ex- per- i- ments, Bay- er ar- gued. "A se- ri- ous test of en- er- gy conserva- tion in high- en- er- gy col- li- sions will re- quire care- ful anal- y- sis of ma- ny com- plex multi- par- ti- cle events," he wrote in his paper. This would be hard, he ad- ded, but it can be done.

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