

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 conforms to serious science. This, of course, does "not" at all prove a study correct. More over, 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

trouâ-bles to the fact that he doesnâ€™t work for any sciâ-enâ-tiâ-fic inâ-stiâ-tuâ-tion, so othâ-er reâ-searchâ-ers are reâ-lucâ-tant to back his theâ-oâ-ries. â€œI have a Ph.D. in physâ-ics from the Uniâ-verâ-siâ-ty of Chicaâ-go,â€• from 1972, he wrote; â€œbut I left the field maâ-ny years ago. As a caâ-reer, physâ-ics is hell: as a hobâ-by, it is heavâ-en. Ideas come easâ-iâ-ly to me now.â€• Bayâ-erâ€™s paâ-per on energy conâ-serâ-vaâ-tion conâ-siâ-ders black holes, stuâ-penâ-dousâ-ly dense ceâ-lesâ-tial boâ-dies that pack so much weight inâ-to so litâ-tle space that their gravâ-iâ-ty overâ-powâ-ers evâ-erything nearâ-by, inâ-cludâ-ing light rays. Conâ-diâ-tions in black holes are thought to mimâ-ic in some ways those preâ-vailâ-ing at the orâ-iâ-gin of the uniâ-verse. Then, sciâ-enâ-tists beâ-lieve, all matâ-ter was packed inâ-to a point; this then exâ-plodâ-ed in a â€œBig Bang,â€• spawnâ-ing the cosâ-mos. If a black hole had an opâ-poâ-site, it would be what physâ-iâ-cists call vacâ-uâ-um. In plain terms, that means nothâ-ingâ-ness, though this word is misâ-leadâ-ing beâ-cause some minâ-iâ-mal levâ-el of acâ-tivâ-iâ-ty has been found to unâ-fold even in the empâ-tiest space. Vacâ-uâ-um is ubiqâ-uiâ-tous. Even in solâ-id obâ-jects, there is plenâ-ty of room for vacâ-uâ-um, beâ-tween and inâ-side the atoms. In a black hole, vacâ-uâ-um could alâ-so conâ-ceivâ-aâ-bly find lodgâ-ings. But there, the crampâ-ing might beâ-come sevâ-ere even for a guest of such modâ-est demaâ-ndsâ€”forcâ-ing the vacâ-uâ-um, in Bayâ-erâ€™s view, to lead a preâ-carâ-iâ-ous exâ-istâ-ence. Withâ-in black holes or siâ-mâ-iâ-lar obâ-jects, he arâ-gues, exâ-treme conâ-diâ-tions may inâ-ject â€œinâ-staâ-bilâ-iâ-tyâ€• inâ-to the vacâ-uâ-um, conâ-vertâ-ing parts of it inâ-to non-vacâ-uâ-um, or matâ-ter. â€œMatâ-ter creâ-aâ-tion can be said to arise from some new parâ-tiâ-cle inâ-terâ-acâ-tion which viâ-oâ-lates enâ-erâ-gy conâ-serâ-vaâ-tion,â€• he wrote in an email. Gibâ-bons is unâ-conâ-vinced. Bayâ-er fails to clarâ-iâ-fy â€œthe dyâ-namâ-ics beâ-hindâ€• the proâ-cess, he wrote, adding that standâ-ard parâ-tiâ-cle physâ-ics alâ-ready ofâ-fers a well-supâ-portâ-ed acâ-count of how mass arises, called the Higgs mechâ-anâ-ism. Bayâ-er arâ-gued that some vagueâ-ness in his acâ-count is inâ-eâ-viâ-taâ-ble, beâ-cause reâ-searchâ-ers are still â€œtryâ-ing to figâ-ure out what the vacâ-uâ-um realâ-ly is.â€• But he claims matâ-ter creâ-aâ-tion could exâ-plain the acâ-celâ-erâ-atâ-ing exâ-panâ-sion of the uniâ-verse, which Perlâ-mutâ-ter and othâ-ers idenâ-tiâ-fied in the late 1990s. Why the speedup ocâ-curs is one of the most vexâ-ing scientifâ-ic mysâ-terâ-ies of the past decâ-ade. Asâ-troâ-noâ-mers proâ-viâ-sionâ-alâ-ly atâ-tribâ-ute it to a yet-to-be-iâ-denâ-tiâ-fied â€œdark enâ-erâ-gy,â€• whose naâ-ture reâ-mains unâ-known. Bayâ-erâ€™s exâ-plaâ-naâ-tion of this links matâ-ter creâ-aâ-tion to anothâ-er conâ-cept, presâ-sure, a measâ-ure of how much a givâ-en blob of matâ-ter is â€œsqueezedâ€• by whatâ€™s around it. Itâ€™s why your head hurts if you dive deepâ-ly. Negâ-aâ-tive presâ-sure is alâ-so conâ-ceivâ-ableâ€”your head beâ-ing pulled apartâ€”though we nevâ-er exâ-peâ-riâ-ence this on Earth. A simâ-pliâ-fied view is that posâ-iâ-tive presâ-sure is an air hose blowâ-ing outâ-ward; negâ-aâ-tive presâ-sure, a vacâ-uâ-um cleanâ-er suckâ-ing inâ-ward. Einâ-stein deâ-terâ-mined that an obâ-jectâ-tâ€™s gravâ-iâ-ty deâ-pends not just on its mass, as was known beâ-fore, but its presâ-sure. If an obâ-ject has enough negâ-aâ-tive presâ-sure, its gravâ-iâ-ty can alâ-so beâ-come negâ-aâ-tive, and hence reâ-pulâ-sive rathâ-er than atâ-tracâ-tive. Bayâ-er arâ-gued that matâ-ter creâ-aâ-tion is asâ-soâ-ciâ-atâ-ed with reâ-pulâ-sive gravâ-iâ-ty beâ-cause itâ€™s alâ-so linked to negâ-aâ-tive presâ-sure. â€œThe flow of enâ-erâ-gy inâ-to the Uniâ-verse can be deâ-scribed as beâ-ing caused by an exâ-terâ-nal presâ-sure from the vacâ-uâ-um,â€• he wrote in an email. â€œViewed from inâ-side the Uniâ-verse, the posâ-iâ-tive exâ-terâ-nal presâ-sure looks like a negâ-aâ-tive inâ-terâ-nal presâ-sure.â€• Bringâ-ing back the air-hose analâ-oâ-gy, imâ-agâ-ine an inâ-visâ-iâ-ble hose blowâ-ing air outâ-ward and inâ-to the mouth of a secâ-ond tube. That secâ-ond pipe would apâ-pear as though it were suckâ-ing in airâ€”negâ-aâ-tive presâ-sure. Negâ-aâ-tive presâ-sure withâ-in leâ-gions of black holes would creâ-ate a gravâ-iâ-taâ-tionâ-al reâ-pulâ-sion that perâ-meâ-ates the cosâ-mos and pushes it outâ-ward reâ-lentâ-lessâ-ly, Bayâ-er claims. â€œWhile matâ-ter is beâ-ing creâ-atâ-ed, there is a gravâ-iâ-taâ-tionâ-al reâ-pulâ-sion asâ-soâ-ciâ-atâ-ed with the enâ-erâ-gy flow. When the flow stops, onâ-ly the orâ-diâ-nary gravâ-iâ-taâ-tionâ-al atâ-tracâ-tion of the creâ-atâ-ed mass reâ-mains.â€• All newâ-ly minted mass would reâ-side permaâ-nently in its home black hole. Matâ-ter creâ-aâ-tion would equate to enâ-erâ-gy creâ-aâ-tion beâ-cause, as Einâ-stein found with the famed equaâ-tion $E=mc^2$, matâ-ter and enâ-erâ-gy are two forms of the same thing. Whatever you call it, Bayâ-er said the creation proâ-cess could exâ-pâ-lain not onâ-ly the dark enâ-erâ-gy puzâ-zle but an arâ-ray of othâ-ers: the idenâ-tiâ-ty of the â€œdark matâ-terâ€• that makes up five-sixths of the maâ-teâ-riâ-al in the cosâ-mos,

but is un- Λ -seen; why cer- Λ -tain cos- Λ -mic rays hit Earth with oth- Λ -erwise in- Λ -ex- Λ -pli- Λ -ca- Λ -bly high en- Λ -er- Λ -gies; and what caused an $\hat{\epsilon}$ in- Λ -fla- Λ -tion $\hat{\epsilon}$ • be- Λ -lieved to have made the uni- Λ -verse grow stu- Λ -pen- Λ -dous- Λ -ly big with- Λ -in a frac- Λ -tion of a sec- Λ -ond af- Λ -ter the Big Bang. Cos- Λ -mol- Λ -o- Λ -gists be- Λ -lieve ac- Λ -cel- Λ -er- Λ -at- Λ -ed swell- Λ -ing of the cos- Λ -mos oc- Λ -curred dur- Λ -ing two sep- Λ -a- Λ -rate pe- Λ -ri- Λ -ods: dur- Λ -ing the in- Λ -fla- Λ -tion ep- Λ -och, and more re- Λ -cent- Λ -ly. Bay- Λ -er says that $\hat{\epsilon}$ ™s be- Λ -cause both episodes wit- Λ -nessed mat- Λ -ter cre- Λ -a- Λ -tion. The speedup stopped in be- Λ -tween, he ar- Λ -gues, be- Λ -cause in- Λ -i- Λ -tial for- Λ -ma- Λ -tion of the uni- Λ -verse was over, but black holes weren- $\hat{\epsilon}$ ™t formed yet. Yet Linde, a found- Λ -er of the in- Λ -fla- Λ -tion the- Λ -o- Λ -ry, dis- Λ -agrees. Bay- Λ -er said his the- Λ -o- Λ -ry of en- Λ -er- Λ -gy non-conservation could be tested us- Λ -ing par- Λ -ti- Λ -cle ac- Λ -cel- Λ -er- Λ -a- Λ -tors, which bash sub- Λ -a- Λ -tom- Λ -ic par- Λ -ti- Λ -cles to- Λ -ge- Λ -ther to help see what they $\hat{\epsilon}$ ™re made of. Nor- Λ -mal- Λ -ly, conserva- Λ -tion of en- Λ -er- Λ -gy is used to cal- Λ -cu- Λ -late prop- Λ -er- Λ -ties of the par- Λ -ti- Λ -cles fly- Λ -ing out of the bang-up. But the law is as- Λ -sumed, rath- Λ -er than prov- Λ -en, in these ex- Λ -per- Λ -i- Λ -ments, Bay- Λ -er ar- Λ -gued. $\hat{\epsilon}$ œA se- Λ -ri- Λ -ous test of en- Λ -er- Λ -gy conserva- Λ -tion in high-en- Λ -er- Λ -gy col- Λ -li- Λ -sions will re- Λ -quire care- Λ -ful anal- Λ -y- Λ -sis of ma- Λ -ny com- Λ -plex multi-par- Λ -ti- Λ -cle events, $\hat{\epsilon}$ • he wrote in his paper. This would be hard, he ad- Λ -ded, but it can be done.

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