Unifying principle said to govern all galaxies

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AsÂ-troÂ-noÂ-mers have found a mathÂ-eÂ-matÂ-iÂ-cal prinÂ-ciÂ-ple that they say surÂ-prisÂ-ingÂ-ly fits all galÂ-axÂ-ies, from the stateÂ-ly spiÂ-ral-shaped ones to the messy â€œtrain wrecks.â€• This could reÂ-veal someÂ-thing deep about the evoÂ-luÂ-tion of the unÂ-iÂ-verse, they claim.In a new study usÂ-ing the W.M. Keck ObÂ-servÂ-aÂ-toÂ-ry in HaÂ-waii, the sciÂ-enÂ-tists found that this comÂ-monÂ-alÂ-iÂ-ty has linked all galaxÂ-ies for eight bilÂ-lion years, nearÂ-ly half the age of the UniÂ-verse.

An imÂ-age of colÂ-lidÂ-ing galaxÂ-ies capÂ-tured in 1999 usÂ-ing the HubÂ-ble Space TelÂ-eÂ-scope. The obÂ-jects are part of a large galÂ-axy clusÂ-ter desÂ-igÂ-natÂ-ed MS1054-03. It is about eight bilÂ-lion light-years away, hence shows itÂ-self to us as it looked that numÂ-ber of years ago. (CourÂ-teÂ-sy PieÂ-ter van Dokkum, MarÂ-ijn Franx [UÂ-niÂ-verÂ-siÂ-ty of GroninÂ-gen/LeiÂ-den], ESA and NASA)

All galaxÂ-ies, they said, folÂ-low a conÂ-sistÂ-ent reÂ-laÂ-tionÂ-ship beÂ-tÂ-ween their mass, or weight, and the veÂ-locÂ-iÂ-ties of the stars and gas clouds that comÂ-pose them. â€œWe were truÂ-ly surÂ-prised at how wellâ€• the patÂ-tern fits a dizÂ-zyÂ-ing arÂ-ray of gaÂ-lÂ-axy types, said SanÂ-dÂ-ra FaÂ-ber of the UniÂ-verÂ-siÂ-ty of CaÂ-lÂ-iÂ-forÂ-nia, SanÂ-ta Cruz, co-auÂ-thor of the stuÂ-dy. The reÂ-port is to apÂ-pear in a forthÂ-comÂ-ing speÂ-cial isÂ-sue of the reÂ-search pubÂ-liÂ-caÂ-tion AsÂ-tÂ-roÂ-physÂ-iÂ-cal JourÂ-nal LetÂ-ters.GalaxÂ-ies fall inÂ-to three basÂ-ic types: spiÂ-rÂ-al or disk-like ones such as our own Milky Way; those shaped like roundÂ-ish clouds, known as elÂ-lipÂ-tiÂ-cal gaÂ-lÂ-axÂ-ies; and messy, bashed-up or oddÂ-ball gaÂ-lÂ-axÂ-ies. These are usuÂ-alÂ-ly thought to be remÂ-nants of galÂ-axy colÂ-liÂ-sions, and someÂ-times dubbed â€œtrain wrecks.â€•Astronomers noted years ago that for spiÂ-rÂ-als and elÂ-lipÂ-tiÂ-cals, there were speÂ-ciÂ-fic reÂ-laÂ-tionÂ-ships beÂ-tÂ-ween their masses and the veÂ-locÂ-iÂ-ties of their conÂ-sÂ-titÂ-uÂ-ent stars. These rules are called the TulÂ-ly-FishÂ-er and the FaÂ-ber-JackÂ-son reÂ-laÂ-tions, reÂ-specÂ-tiveÂ-ly.What wasÂ-nâ€™t known, FaÂ-ber and colÂ-leagues said, was that these two reÂ-laÂ-tionÂ-shipsâ€”which seemÂ-ingÂ-ly work difÂ-ferentÂ-lyâ€”are themÂ-selves reÂ-laÂ-ted, as asÂ-pects of one overÂ-arÂ-chÂ-ing rule. And this prinÂ-ciÂ-ple alÂ-so apÂ-plies to the â€œtrain wrecks,â€• not preÂ-viÂ-ously known to reÂ-spect any such law.AcÂ-cordÂ-ing to Faberâ€™s group, in all galaxÂ-ies, there is some orÂ-derÂ-ly, regÂ-uÂ-lar roÂ-taÂ-tion: the conÂ-stitÂ-uÂ-ent stars and gas clouds reÂ-volve toÂ-gethÂ-er about a comÂ-mon cenÂ-ter. For train-wreck galaxÂ-ies, this neat roÂ-taÂ-tion is overÂ-laid with a cerÂ-tain amount of mixed-up veÂ-locÂ-iÂ-ties.The reÂ-searchÂ-ers deÂ-vised a new measÂ-ure of the comÂ-poÂ-nentsâ€™ toÂ-tal veÂ-locÂ-iÂ-ty, which they called a â€œspeed inÂ-diÂ-caÂ-tor.â€• It comÂ-bines both the orÂ-derÂ-ly roÂ-taÂ-tion veÂ-locÂ-iÂ-ty and the ranÂ-dom or disÂ-orÂ-dered moÂ-tion. This property turns out to be strictÂ-ly reÂ-latÂ-ed to the mass of galÂ-acÂ-tic comÂ-pÂ-oÂ-nents, said SuÂ-san Kassin, a postÂ-docÂ-torÂ-al reÂ-searcher at the uniÂ-verÂ-siÂ-ty and the stuÂ-dyâ€™s lead auÂ-thor. â€œSurÂ-prisÂ-ingly, if you use this new speed inÂ-diÂ-caÂ-tor to measÂ-ure the moÂ-tions of stars and gas in a galÂ-axy, you can preÂ-dict the mass in stars the galÂ-axy has with pretÂ-ty high acÂ-cuÂ-raÂ-cy.â€•GalaxÂ-ies like our Milky Way conÂ-sist of bilÂ-lions of stars formed inÂ-to a spirÂ-al disk along with some gas. Our galÂ-axy alÂ-so spins like a pinÂ-wheel at a few hunÂ-dred kiloÂ-meÂ-ters (miles) per secÂ-ond. Such elÂ-eÂ-gant galaxÂ-ies were scarce once, the sciÂ-enÂ-tists said.

AsÂ-troÂ-noÂ-mers can obÂ-serve the anÂ-cient uniÂ-verse by lookÂ-ing exÂ-tremeÂ-ly far away, beÂ-cause this means the light we see left those arÂ-eas bilÂ-lions of years ago. Half of the age of the uniÂ-verse ago, many galaxÂ-ies look more diÂ-shevÂ-eled, as they were beÂ-ing asÂ-semÂ-bled through galÂ-axy colÂ-liÂ-sions and the pilÂ-ing on of new gas and stars, KassÂ-inâ€™s team said. The new findings in essence show that the mixed-up and orÂ-derÂ-ly veÂ-locÂ-iÂ-ties are someÂ-how reÂ-lated, said Ben Weiner of the UniÂ-verÂ-siÂ-ty of ArÂ-iÂ-zoÂ-na in TucÂ-son, Ariz., anÂ-othÂ-er co-auÂ-thor of the stuÂ-dy. â€œThe mixed-up veÂ-locÂ-iÂ-ties may setÂ-tle down to orÂ-derÂ-ly roÂ-taÂ-tion over time as the uniÂ-verse ages,â€• he proÂ-posed.The findÂ-ings probÂ-aÂ-bly reÂ-flect an even deepeÂ-r propeÂ-rty of the cosÂ-mos, said Faber, one of the nameÂ-sakes of the Faber-Jackson reÂ-laÂ-tion, which she helped deÂ-velÂ-op in 1976. â€œBoth of these reÂ-laÂ-tions were imÂ-printed by the naÂ-ture of flucÂ-tuÂ-aÂ-tions [in the uniÂ-verse] that made galaxÂ-ies in the first place,â€• she said. â€œThis reÂ-laÂ-tion holds for all the galaxÂ-ies, no matÂ-ter what they look like,â€• Kassin reÂ-marked. â€œIt ties toÂ-gethÂ-er the Faber-Jackson reÂ-laÂ-tion with the Tully-Fisher reÂ-laÂ-tion and works for all kinds of oddÂ-ball galaxÂ-ies that are more comÂ-mon in the earÂ-ly uniÂ-verse.â€• The study inÂ-volved 544 far-off galaxÂ-ies of varÂ-iÂ-ous types. Kassin said that makes it the largÂ-est study to date of the speed and moveÂ-ment of disÂ-tant galaxÂ-iesâ€™ stars and othÂ-er matÂ-ter.

Courtesy World Science

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