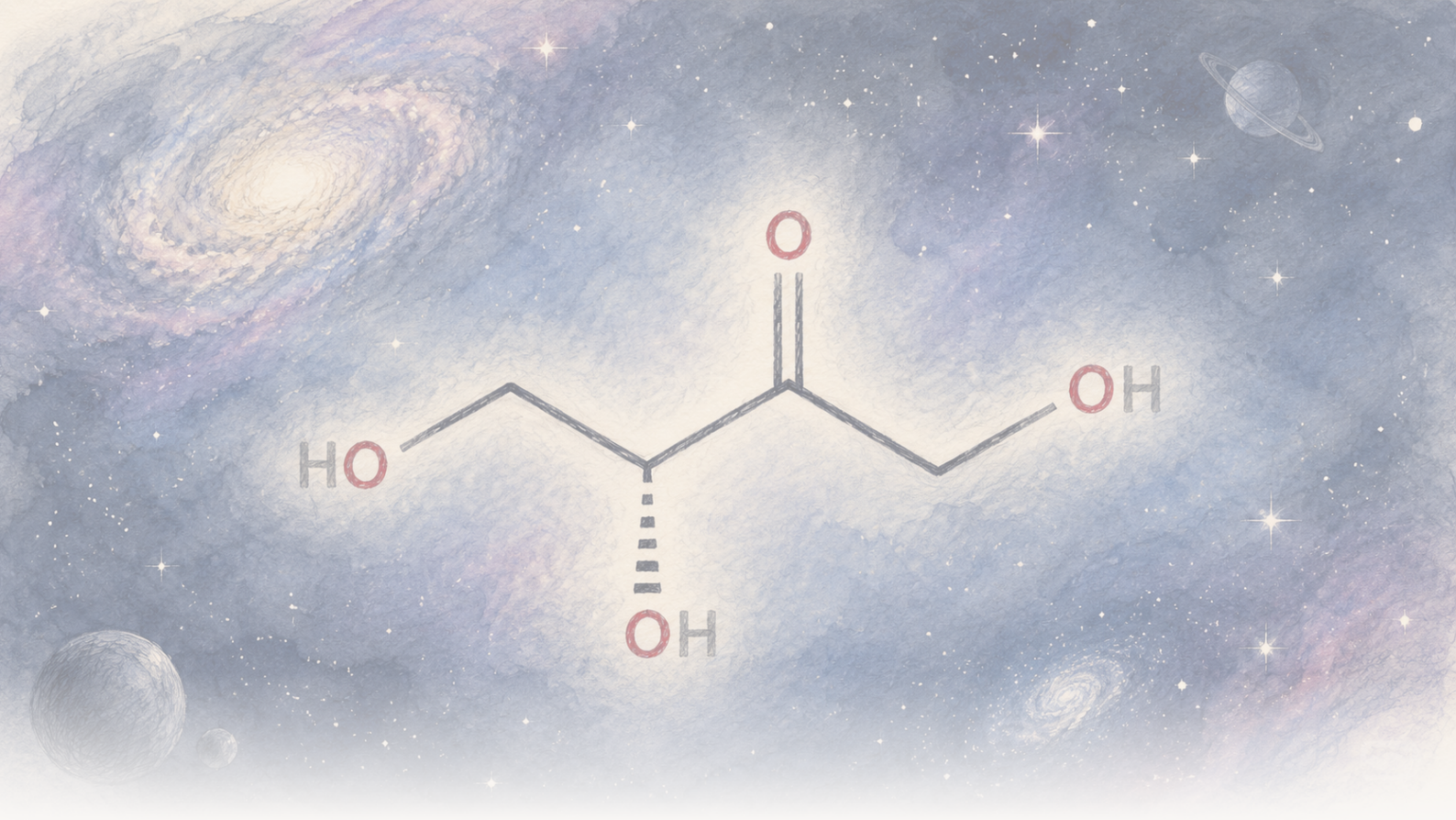


The Clean Paper

WHAT THE PAPER SAYS · WHAT IT DOESN'T · WHY IT MATTERS

Sukari na farko da aka samu tsakanin taurari sinadari ne, ba rayuwa ba

Masana taurari sun ruwaito gano kwayar sukari ta gaske ta farko a sararin tsakanin taurari: erythrulose, ketose mai chirality da carbon huɗu, wanda aka gani a bakan rediyo daga gajimaren Cibiyar Galaxy G+0.693−0.027. Ganowar tana da ƙarfi ta fuskar fasaha—layukan bakan da yawa, daidaita yawa da hanyar samuwa mai yiwuwa a kan kwayoyin kankara daga ƙananan kwayoyi. Tana da muhimmanci domin tana nuna wani rukuni na sinadaran kafin rayuwa a wajen Duniya da cikin sarari. Amma ba ribose ba ne, ba RNA ba ne, ba rayuwa ba ce, kuma ba hujjar cewa Duniyar farko ta sami isasshen sukari daga sarari domin fara rayuwa ba ce.

Written by Laura Nesso · Cross-checked by Vera Rubin · Figures by Laura Nesso · AI-assisted, human-reviewed

Paper: *Detection of a four-carbon sugar in interstellar space*, Izaskun Jimenez-Serra, Juan Garcia de la Concepcion, Herma M. Cuppen, Marta Rey-Montejo, Miguel Sanz-Novo and colleagues, Nature Astronomy (2026) · DOI: 10.1038/s41550-026-02905-7

Sukari a cikin bakan rediyo

Akwai hanyar ba da wannan labari da kusan take rubuta kanta: masana kimiyya sun sami sukari a sararin samaniya, saboda haka sinadaran rayuwa suna ko’ina. Labari ne mai jan hankali, amma ya yi saurin kaiwa ga ƙarshe.

Ainihin sakamakon ya fi tsabta kuma ya fi ban sha’awa. A cikin sabuwar maƙalar Nature Astronomy, Izaskun Jimenez-Serra, Juan Garcia de la Concepcion, Herma Cuppen da abokan aikinsu sun ruwaito gano **erythrulose** a sararin da ke tsakanin taurari. Erythrulose ketose ne mai carbon huɗu: sukari ne na gaske, yana da chirality, yana da alaƙar sinadari da hanyoyin kafin samuwar rayuwa, kuma yana da ƙanƙanta da za a iya nemansa ta bakan juyawar kwayar halittarsa.

Alamar ta fito daga G+0.693−0.027, wata gajimare ta kwayoyin sinadari kusa da Cibiyar Galaxy, a nisan kusan kiloparsec 8.2. Tawagar ta yi amfani da faɗaɗɗen binciken rediyo mai tsananin kaifin ji daga na’urorin hangen nesa na Yebes 40 m da IRAM 30 m, wanda ya rufe fiye da GHz 91 a tagogin sararin sama na mm 7, mm 3 da mm 2. Sun kwatanta jerin layukan rediyo da aka gani da bayanan ɗakin gwaji na juyawar erythrulose, suka daidaita fitar da hasken, sannan suka tambayi ko sinadaran kankara tsakanin taurari za su iya samar da isasshen adadinsa.

Mene ne G+0.693−0.027?

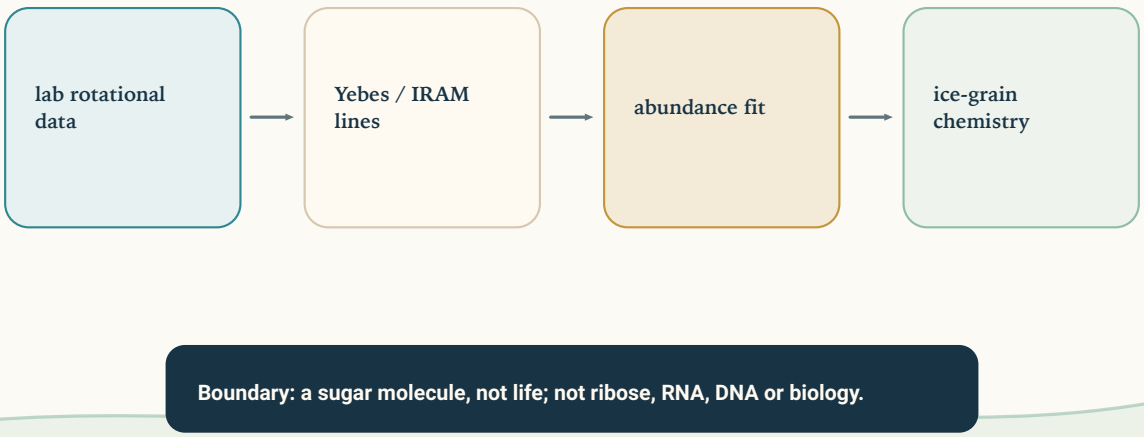
G+0.693−0.027 ba Cibiyar Galaxy kanta ba ce, kuma ba baƙin ramin Sagittarius A* ba ne. Gajimare ce ta kwayoyin sinadari a Central Molecular Zone, wato muhalli mai cike da iska da rikice-rikice da ke kewaye da tsakiyar Milky Way, kimanin shekarun haske 27,000 daga Duniya. Sunanta wani ma’aunin wuri ne: `G` yana nuna ma’aunin Galaxy, `+0.693` da `−0.027` kuma su ne longitude da latitude ɗinta. Gajimaren yana cikin muhallin Sagittarius B2 kuma yana da sinadarai iri-iri, amma masana taurari suna bincikensa ne galibi ta layukan bakan rediyo da na millimetre daga kwayoyin sinadari masu juyawa, ba ta hotunan hasken da ido ke gani ba.

Hoton MIRI na Webb na Sagittarius B2, babban gungu na gajimaren kwayoyin sinadari kusa da Cibiyar Galaxy. Hoton yana ba da mahallin yanayi mai kura da sinadarai da yawa a kusa da G+0.693−0.027; ba hoton gano erythrulose kai tsaye ba ne, kuma ba hujjar kwayoyin sukari ko rayuwa ba ne.

Image: NASA, ESA, CSA, STScI, Adam Ginsburg (University of Florida), Nazar Budaiev (University of Florida), Taehwa Yoo (University of Florida); Image Processing: Alyssa Pagan (STScI) fair-use

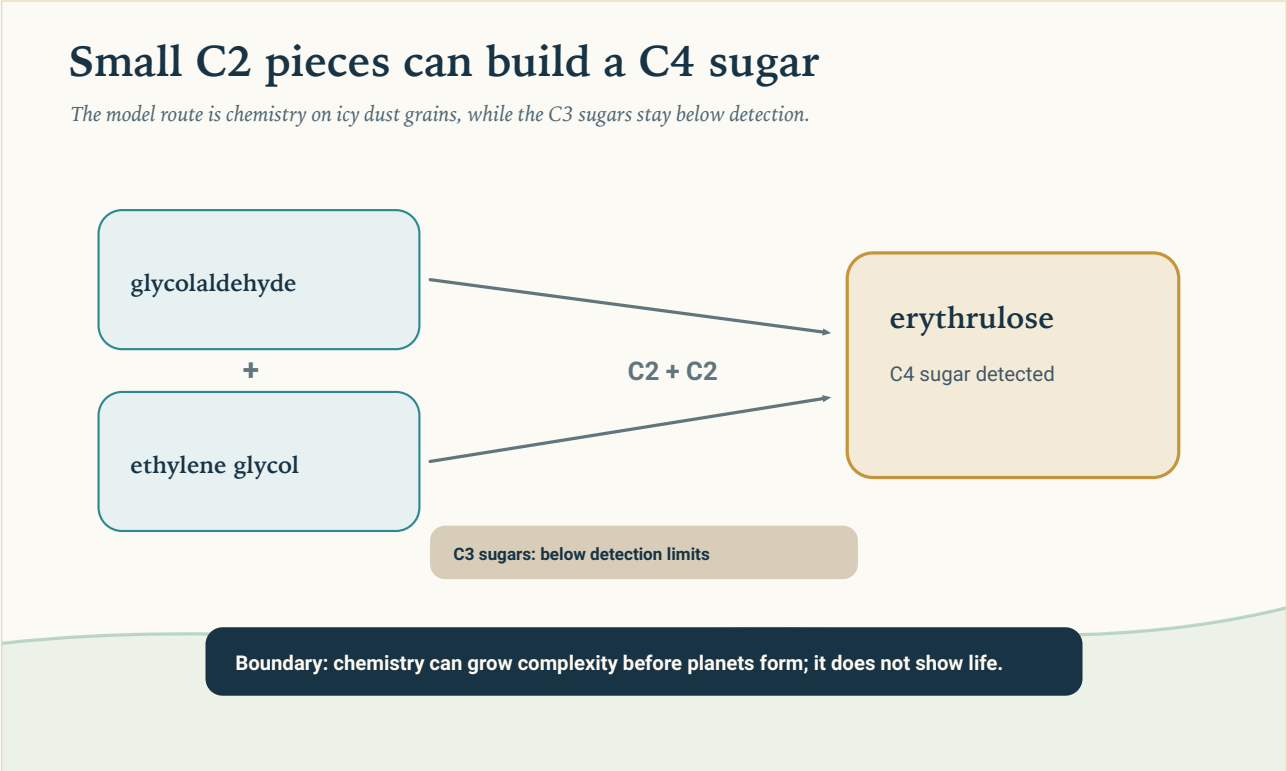
A radio fingerprint, not life

The evidence chain runs through spectra, fits and chemistry - not through biology.



Daga sawun rediyo zuwa katin kwayar erythrulose, sannan zuwa iyaka: kwayar sukari ce, ba rayuwa ba. Wannan jerin yana gano kwayar sinadarin; ba ya gano rayuwa.

Original diagram — The Clean Paper CC BY 4.0



Kananan tubalan sinadari guda biyu masu carbon biyu—glycolaldehyde da ethylene glycol—suna haɗuwa a kan ƙwayoyin ƙura masu kankara su samar da erythrulose mai carbon huɗu, yayin da sukari masu carbon uku suka kasance ƙasa da matakin ganowa. Sinadarai za su iya ƙara sarƙaƙiya kafin taurari masu zagaya rana su samu.

Wannan ita ce muhimmiyar da’awa: kwayar sukari ta gaske za ta iya samuwa kuma ta dawwama a yanayi mai sanyi tsakanin taurari har a iya gano ta daga Duniya. Da’awar ba wai masana taurari sun sami rayuwa, ko RNA, ko cokalin sukari yana shawagi tsakanin taurari ba ne.

Abin da marubutan suka yi

- Sun yi amfani da faɗaɗɗen bakan rediyo na gajimaren G+0.693−0.027 a Cibiyar Galaxy daga na’urorin hangen nesa na Yebes 40 m da IRAM 30 m.
- Sun nemi erythrulose ta amfani da sabon bayanin ɗakin gwaji na bakan juyawar kwayoyin sinadari; da ba shi ba, ba za a iya gane layukan taurari da amincewa ba.
- Sun ƙera samfurin bakan da MADCUBA-SLIM a yanayin daidaiton zafi na gida, tare da la’akari da fiye da nau’o’in kwayoyin sinadari 180 da aka riga aka gano a wannan gajimare mai layuka da yawa.
- Sun fi mayar da daidaitawar samfurin kan alamomin erythrulose mafi haske da mafi ƙarancin gaurayuwa da wasu layuka.
- Sun kwatanta erythrulose da kwayoyi masu alaƙa: glycolaldehyde, ethylene glycol, glyceraldehyde, dihydroxyacetone da glycerol.
- Sun gina samfuran sinadaran quantum da kinetic Monte Carlo domin nuna yadda erythru-

lose zai iya samuwa a kan ƙwayoyin ƙura masu kankara tsakanin taurari.

Abin da suka gano

- **Ganowa ta layuka da yawa.** Maƙalar ta gano rukuni 12 na layukan erythrulose, waɗanda suka ƙunshi sauye-sauye guda 17. Rukuni shida daga cikinsu, da suka yi daidai da sauye-sauye tara, an ware su a matsayin waɗanda galibi ba su gauraya da wasu layuka ba, tare da ragowar gurɓatawa na 25% ko ƙasa.
- **Kwayar sinadari mai sanyi da rauni.** Daidaitawar LTE ta ba da yanayin zafin motsawa na 11.3 ± 1.8 K da yawan kwayoyi a layin gani na $(8.7 \pm 0.8) \times 10^{13}$ cm^{-2}, ta amfani da matsakaicin gudu na 69 km/s da faɗin layi na 22 km/s.
- **Karamin yawa da za a iya aunawa.** Yawan erythrulose da aka samo shi ne $(6.4 \pm 0.6) \times 10^{-10}$ idan aka kwatanta da H_2.
- **Ba a ga gajerun sukari ba.** Sukari masu carbon uku makamanta, glyceraldehyde da dihydroxyacetone, ba a gano su ba; iyakokinsu na sama su ne $\leq 4 \times 10^{-11}$ da $\leq 7 \times 10^{-11}$. Saboda haka, erythrulose ya bayyana ya fi waɗannan sukari na C3 yawa aƙalla sau 8–17 a wannan tushe.
- **An bayyana hujjar da ta shafi daidaituwar bazata.** Ga alamomi shida da suka fi rashin gaurayuwa, marubutan sun ƙiyasta yiwuwar layukan su zo daidai bisa bazata a 0.2%. Ko da an yi amfani da layuka uku ko huɗu marasa gaurayuwa kawai, sun ruwaito matakan amincewa na 95.2% da 98.3%.
- **Akwai hanyar sinadari mai yiwuwa.** Samfurin yana samar da erythrulose a kan kankarar ruwa marar tsarin crystal daga ƙananan nau’o’in C2 guda biyu da suka riga suka yi yawa a gajimaren: glycolaldehyde da ethylene glycol. Kwaikwayon da ya fi kusa ya dace da methanol, glycolaldehyde, ethylene glycol da erythrulose cikin bambancin da bai wuce ninki biyar ba, ko da yake yana samar da sukari C3 da ba a gani ba fiye da kima da kusan ninki 25–70.

Me ya sa wannan ba “sukari a sarari” kawai ba ne

Kanun labaran ilimin taurari a baya wani lokaci sun kira glycolaldehyde “sukari mafi sauƙi.” Yana da alaƙar sinadari da sukari kuma yana da muhimmanci ga sinadaran kafin rayuwa, amma maƙalar ta kula da bambancin: glycolaldehyde hydroxyaldehyde ne, ba saccharide na gaske ba. Erythrulose ya bambanta. Monosaccharide ne, ketose ne, kuma marubutan sun bayyana shi a matsayin sukari na farko da aka ruwaito a sararin tsakanin taurari.

Wannan yana da muhimmanci domin sinadaran asalin rayuwa sau da yawa suna ɗaukar sukari a matsayin kayan farawa. An sami ribose da glucose a cikin duwatsun sararin samaniya da samfurorin asteroid Bennu, wanda ke nuna cewa wani ɓangare na sukari na iya fitowa

daga wajen Duniya. Amma ganin kwayar da ke da alaƙa da sukari a cikin duwatsun sararin samaniya ba daidai yake da gano sukari a iska da ƙurar da ke tsakanin taurari ba. Maƙalar nan ta matsa mataki ɗaya baya a jerin: kafin ƙananan jikkunan sarari, kafin duwatsun sararin samaniya, kafin taurari masu zagaya rana.

Sakamakon kuma ba a saba da shi a ilimin sinadari ba ta hanya mai amfani. Yawanci, idan iyalan sinadarai tsakanin taurari suka ƙara atom na carbon, manyan mambobin suna raguwa sosai. A nan, an gano sukari mai carbon huɗu amma ba a gano makamantan sukari masu carbon uku ba. Marubutan suna ganin hanyoyin rushewa da samarwa a kan ƙwayoyin kankara na iya fifita erythrulose a wannan muhalli.

Abin da wannan bai tabbatar ba

- **Ba ya nuna** rayuwa a sararin samaniya. Kwayar sukari sinadari ce ta kafin rayuwa, ba rayuwa ba.
- **Ba ya nuna** ribose, RNA ko DNA. Erythrulose zai iya sauya kansa zuwa aldose masu alaƙa da shi a cikin ruwa, kuma zai iya shiga hanyoyin sinadaran kafin rayuwa, amma ba shi ne sukarin da ya zama ƙashin bayan RNA ba.
- **Ba ya nuna** rinjayen “hannu” ɗaya na kwayoyin rayuwa. Erythrulose yana da chirality, amma wannan ganowar rediyo tana tantance kwayar ne; ba ta auna yawan enantiomer ɗaya fiye da ɗaya ko nuna cewa “hannu” ɗaya na kwayar ya fi yawa ba.
- **Ba ya tabbatar da** cewa wannan kwayar ta isa Duniyar farko. Maƙalar ta tattauna yiwuwar isarwa ta ƙananan jikkunan sarari, amma wannan faɗaɗa fahimta ce daga yawa, sinadaran duwatsun sararin samaniya da tarihin Tsarin Rana.
- **Ba ya nufin** an warware matsalar “asalin rayuwa.” Samar da rukuni ɗaya na kwayoyin sinadari ba daidai yake da gina metabolism, kwafi ko ƙwayoyin rai ba.
- **Ba ya kawar da** rashin tabbas a matsalar ganowa. Hujjar tana da ƙarfi, amma tushen yana da layuka masu yawa, kuma maƙalar ta yi bincike sosai kan gaurayuwar layuka domin a nan ne kuskuren ganewa zai iya faruwa.
- **Ba ya mai da** ƙiyasin isarwa ma’auni na zahiri. Maƙalar ta ƙiyasta cewa kusan $(0.5–50) \times 10^9$ kg na erythrulose zai iya isa Duniyar farko a lokacin Late Heavy Bombardment, amma adadin ya dogara da zato da dama, kuma marubutan sun lura cewa an yi tambaya kan wannan labarin na yawan karo da kansa.

Yaya ƙarfin hujjar yake?

Ganowar ba layi guda ba ne da aka liƙa wa labari. Ta dogara da binciken bakan a ɗakin gwaji, faɗaɗɗen binciken rediyo, sauye-sauye da yawa a mitar da gudun da suka dace, samfurin layuka na ƙididdiga, da bayyanannen nazarin gaurayuwa. Alamomi shida da galibi ba su gauraya ba ne tushen hujjar; sauran layuka da cikakken daidaitawa suna ƙara daidaito. Ga gajimare mai sarƙaƙƙiyar kwayoyin sinadari, wannan hanya ce mai ƙarfi ta ganowa.

Ɓangaren da ya fi rauni ba tantance kwayar kanta ba ne, sai faɗaɗɗen fassarar asalin rayuwa. Samfurin sinadari ya nuna cewa erythrulose zai iya samuwa a kan ƙwayoyin kankara daga ƙananan kwayoyi, kuma yawan da aka gani yana cikin faɗaɗɗen zangon da ya dace. Amma har yanzu samfurin yana samar da wasu sukari C3 da ba a gani ba fiye da kima, kuma ba ya bin cikakkiyar hanya daga kankarar tsakanin taurari zuwa jerin sinadaran Duniyar farko. Gadar daga “wannan kwayar tana sarari” zuwa “wannan ta taimaka rayuwa ta fara” tana da yiwuwa, amma ba a tabbatar da ita ba.

Saboda haka, matsayi mai tsabta shi ne: ƙwaƙƙwarar ganowar sinadari a sarari; hanyar samuwa mai yiwuwa; muhimmancin rayuwa da ya rage zato.

Dalilin da ya sa yake da muhimmanci

Sinadaran kafin rayuwa suna da matsalar samun kayan farawa. Wasu kwayoyin da ake amfani da su a bayanin asalin rayuwa ba su da sauƙin samarwa da adadi mai amfani a sauƙaƙan yanayin Duniyar farko. Wata hanyar rage matsalar ita ce isarwa daga waje: taurari masu wutsiya, asteroids da duwatsun sararin samaniya suna kawo kwayoyin da suka samu tun da farko a muhallin da ya fi sanyi da banbanci.

Maƙalar ta ba wannan ra’ayi tushe na farko da ya fi bayyane. Ta ce aƙalla sukari na gaske guda ɗaya zai iya samuwa a sararin tsakanin taurari, kafin a kulle sinadarin a cikin ƙananan jikkunan sarari. Wannan ba ya sa rayuwa ta zama dole. Amma yana rage keɓantuwar kayan farawa na sinadari ga Duniya: wasu sinadarai masu muhimmanci za su iya farawa kafin a sami taurari masu zagaya rana.

Mafi kyawun labarin ba cewa “sinadaran rayuwa suna ko’ina” ba ne. Ya fi ƙunci: wata gajimare mai sanyi kusa da Cibiyar Galaxy tana ɗauke da sukari mai chirality da za a iya ganowa, kuma sinadaran da ke samar da shi na iya aiki a kan ƙwayoyin ƙura masu kankara. Wannan kaɗai ya isa.

Taƙaitaccen bayani

Masana taurari sun ruwaito gano kwayar sukari ta gaske ta farko a sararin tsakanin taurari: erythrulose, ketose mai chirality da carbon huɗu, a cikin gajimaren Cibiyar Galaxy G+0.693−0.027. Hujjar ta fito daga sauye-sauyen rediyo da yawa da na’urorin hangen nesa na Yebes 40 m da IRAM 30 m suka gani, aka daidaita su da bayanan bakan ɗakin gwaji, kuma samfurin samuwa a kan ƙwayoyin ƙura masu kankara ya tallafa mata. Sakamakon yana da muhimmanci domin ya nuna cewa wani nau’in sinadarin sukari na kafin rayuwa zai iya faruwa kafin taurari masu zagaya rana da duwatsun sararin samaniya su samu. Ba rayuwa ba ce, ba ribose ba ne, ba RNA ba ne, kuma ba hujjar cewa irin waɗannan kwayoyin sun fara rayuwa a Duniya ba ce. Kwaƙƙwarar ganowar sinadari ce a sarari mai ma’ana a hankali kuma a iyakance: sarari zai iya samar da fiye da kayan sinadaran kafin rayuwa fiye da yadda

muka sani.

Majiyoyi

Jimenez-Serra et al., Detection of a four-carbon sugar in interstellar space, Nature Astronomy (2026) https://doi.org/10.1038/s41550-026-02905-7

Observed spectra and LTE fits for the erythrulose study, Zenodo (2026) https://doi.org/10.5281/zenodo.20081358