



**HALLEY QAH CHUPBOGH
MAGNETIC VARIATION WESTDAQ
VIHGHACH: ORGANMEY
MONOCHORDMEY JE TUNINGVAD
WANI'VAM WANI'MEY, YUB
NUCLEUS JE QOCHBE'MOHBOGH
WA' TLHEGH JE DELBOGH GHITLH**



Halley qaH chupbogh Magnetic Variation westDaq vIHghach: organmey monochordmey je tuningvaD wani'vam wani'mey, yub nucleus je Qochbe'moHbogh wa' tlhegh je Delbogh ghltlh

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Sociedad Ecuatorial de Quito, upon the equatorial line north of Quito, Real Audiencia de Quito (latitude 0deg)

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ngoD

London Royal Society jeSwl' Edmond Halley qaH nger chu' chup: choH true northvo' magnet 'uD variation; DISvamvo' DIS vebDaq westDaq nomHa' vIH. tera' chenmeH patmo' qaS vIHghachvam: Hur yub, qoD nucleus je ghaj tera'; cha' poleDaj ghaj Hoch magnet, 'ej magnet 'oH Hoch 'ay'e'; 'ay'meyvam chev fluid Hap, 'ej rapbogh axisDaq jlr cha', 'ach loQqu' plm jlrmeH Domeychaj. 1692 blr poHDAQ Seville Cartagena je He ghoS Qlnvam velqa' 'ej yejHaDvam paw.

Halley qaH nger wllaj, 'ej Delbe'bogh wani' wlngu'. rapbogh axisDaq jlrchugh yub nucleus je, rap equatorchaj, 'ej tera' Hoch tlheghmey'e', wa' tlhegh neH 'oH equator'e', cha' 'ay'vam qellu'DI' vIHbe'bogh. Hoch meridian qeng westDaq vIHghach; equator qengbe'. 1692 1693 je equinoxmey jojDaq monochord organ principal pipe je DIpatlhmoHpu'; tlheghDaq yejHaDvam yaH, northDaq southDaq je yaHmey Dilo'pu'. tlheghDaq equinoxmey jojDaq qaStaHvIS DIS bID raptaH cha' pitch; latlh DaqmeyDaq plmchoH, 'ej tlheghvo' chuqchajmo' tlnchoH plmghach. vaj mawuq: equatorDaq jan tuning cherlu'chugh, wa' poHvetlh tera' cha' magnet tuning Hev jan; latlh DaqDaq jan tuning cherlu'chugh, cha' magnet ghoHDAQ tuning Hev jan.

I. HALLEY QAH NGER

1683 DISDaq Philosophical TransactionsDaq compass variation nger ghltlh Halley qaH. bIQDuj Devwl'pu' bejmey lo'taHvIS, HochHom DaqmeyDaq true pole 'angbe' 'uD 'e' 'ang, 'ej tera'Daq deviation pat DelmeH, cha' pole ghajbogh wa' magnet neH yapbe' 'e' 'ang. loS pole chup: tera' Hoch pole retlhDaq cha'.

DaH QlnDajDaq latlh ngoDmey Del; loS pole chenlaHmeH mlw, DISmeymo' variation choHmeH meq je Qlj. Hur yub qoD nucleus je ghaj tera', 'ej cha' jojDaq fluid Hap tu'lu' 'e' chup. cha' pole ghajbogh magnet 'oH Hoch'e'. tera' axisDaq westvo' eastDaq jlr cha', 'ej qaStaHvIS wa' jaj wa'logh jlr Hoch; 'ach yub buSlu'chugh, loQqu' Qlt jlr nucleus. vaj qaStaHvIS DISmey bIStaH nucleus polemey, 'ej westDaq vIH polemeyvam wuvbogh variation. loy 'oH ngerDaj'e', 'ej Hoch vIHghach poH chenmoHlaH vatlh puS DISmey 'e' laj, 'ej batlh HemHa'.

loS pole noHlaHmeH, yapbe' yejHaDvam variation bejmey. 'ach Halley qaH nger QljlaHbogh wani' bejta' yejHaD, 'ej ngervamvo' latlh wani' ngu'ta'; QoQ mlwvaD potlhqu' wani'vetlh.

II. YUB NUCLEUS JE TLHEGH RAP

rapbogh axisDaq jlrchugh cha' moQ, rap rotation polemeychaj, 'ej rap equatorchaj. Dochmeyvam HaSta neHmo' lugh wani'vam; jlrmeH Do wuvbe'. yub tlha'taHvIS nucleus, paSchoHqu'laH nucleus; 'ach yub equatorDaq ratlhlaH nucleus equator Hoch DoD'e'. yub meridianmey retlhDaq eastvo' westDaq vIHtaH Hoch nucleus meridian.

vaj tera'Daq Hoch tlheghmey ghltlhlaHlu'bogh qellu'chugh, Hoch DISDaq cha' magnetvaD raptaHbogh tlhegh neH 'oH equator'e'. Hoch meridianDaq Daq tu'lu'chugh, DISmey qaStaHvIS, Daqvethl ghoS nucleus polemey pagh Daqvethlvo' mej; vaj jlr 'uD 'e' tu' Daqvethl. equatorDaq Daq tu'lu'chugh, Daqvethl retlh juStaH nucleus polemey, 'ej raptaH tera' cha' polevo' chuqmey; vaj nucleusmo' north south je qellu'DI', wa' DIS ghu' latlh DIS ghu' plmmoHmeH meq tu'be' Daqvethl.

tlheghDaq vIHbe' 'uD 'e' wlmagbe'. vIHtaH; QuitoDaq HeDaj ghaj variation. tera' botlh Daq qellu'DI', naDev neH Qochbe' yub nucleus je 'e' wlmag neH. variation vIHmeH meq tera'vaD nobta' Halley qaH. 'ej Delbe'taHvIS, equator vIHbe'meH meq je nobta'.

III. JANMEY PITCH RAP

qaStaHvIS poH nI', harmony HaDwl'pu' nger lugh 'oH nger veb'e', 'ej magnet paqmeyDaj QoQ paqmeyDaj je lo'taHvIS nger qelqu' laIdan vav quv Athanasius Kircher: wa' Slrgh jangmoH latlh Slrgh, pagh Slrgh jangmoH pipe; jangchuqghachvam loadstone iron Hipghach je Segh rap 'oH. ghu'vam noH 'e' nIDbe' yejHaD. wa' Doch neH tu': jan Slrghmey compass 'uD je chenmoHlu'meH iron pagh brass lu'uy'lu', 'ej cha'vam wa' jlrmoHlaHchugh meq, latlh choHbe'chu'chugh meqvethl, jumbej wani'.

qaStaHvIS poH nI', ngoDvam tu' Quito organ chenmoHwl'pu' chapel QoQ plnpu' je: organ'a' tuning cherlu'DI', DIS naQ qaStaHvIS chapel monochord pitch rap poltaH, 'ej Seville Lima je Qlnmeymo', naDev pitch rap polchu' law', vengmeyvetlhDaq motlh polchu' puS. naDev muD poHmey choHbe'ghachmo' qaS wani' 'e' luHarpu'. latlh meq chup Halley qaH nger; vaj nger tobmeH wuq yejHaD.



IV. PATLHMOHGHACHMEY LUCHAVLU'BOGH

cedar wab SeHwl' beQ DungDaq brass wire monochord cherlu', 'ej vav Mersenne mlw lo'lu'taHvIS monochord wavlu'. ngoQvamvaD organ mach chenmoHlu'; organvetlh chorgh feet principal pipe retlhDaq monochord cherlu', Sirgh pipe je pitch nlb luchavmeH. Sirgh tension SeH 'ughwl', 'ej 'ughwl' choHlu'be' reH; pipe 'elmeH Say'Ha'wl' botlu'. 1692 September equinoxDaq, tlheghDaq yejHaD yaHdaQ pitch nlbchu'vaD cha' cherlu'. poH rapDaq Daq rapDaq chenmoHmeH mlw rap lo'bogh cha' monochord cha' pipe je pitch nlbvaD cherlu' je. ghIq Qob botlu'taHvIS northDaq Popayán yaHdaQ wa' monochord wa' pipe je qenglu', 'ej southDaq Cuenca yaHdaQ latlh monochord latlh pipe je qenglu', 'ej pa' rath.

Hoch maS chu'Daq Hoch yaH janmey patlmoH cha' bejwl'. pitch nlb tlhoS ghajchugh Sirgh pipe je 'ach nlbchu'be'chugh, wab vIHghachmey nomHa' Qoylu'; wabmeyvam 'lj bejwl'pu', 'ej lupmey togbogh pendulum vIHghachmeyvaD wab vIHghachmeyvam lutoq.

tlhegh yaHdaQ September equinoxvo' March equinoxDaq, Hoch patlmoHghachDaq pagh wab vIHghach Qoylu'. PopayánDaq maS chu' wejDich pawpa', pendulum HutmaH vIHghach rurbogh ml' qaStaHvIS wa' wab vIHghach Qoylu', 'ej ghIq nomHa' tlnchoH. CuencaDaq maS chu' cha'Dich pawpa' nargh wab vIHghach, 'ej March equinox pawDI', pendulum loSmaH vIHghach qaStaHvIS wa' wab vIHghach Qoylu'. tlheghvo' Cuenca Hop law' Popayán Hop puS; 'ej CuencaDaq pitch plmghach tln law' PopayánDaq pitch plmghach tln puS.

Daqmeyvetlh muDmo', brass SIHha'ghachmo', pagh HuDmey DungDaq janmey qenglu'mo' qaS pitch plmghach 'e' qel yejHaD. muDmaj choHbe'ghach luSImDI', puSbe' Popayán Cuenca je muD choHbe'ghach 'e' tu'; 'ughwl' choHlu'be', 'ej wa'logh lu'uy'lu'bogh brass rap lo'lu' 'e' tu'; 'ej janmey pawDI' vIHmoHlu'be'qa' 'e' tu'. tlheghvo' chuq neH tu', pitch plmghach meq latlh tu'be'.

V. QOQ MIWVAD WANI'VAM WANI'MEY

lughchugh Halley qaH, equatorvo' Hopbogh DaqDaq jan tuning cherlu'DI', cha' magnet Devghach tlhej Hev jan; nomHa' jlrichuqHa' cha' magnet, vaj tugh pagh paS pitch rap lon jan; tuning cherwl' ghop Hotbe'taHchugh je qaSbej wanl'. Hoch muD poHdaQ organmeychaj tuning lucharqa' Europe plnpu', 'ej muD luplch; nucleus vIHghach nomHa' lulughnISmoHtaH, 'ej Sovbe'lu'taH 'e' DuH.

equatorDaq plm ghul'. pa' Qochbe' yub nucleus je; pa' jan tuning cherlu'chugh wa'logh neH cherlu'. organmeychaj tuning chermeh Quito lughoSnIS Europe plnpu' 'e' maqbe' yejHaD, 'ach pawchugh lajqu'lu'. pitch rap patlh Daq luSovniS, 'ej naDev 'oH Daqveth'e' 'e' maq.

VI. WIVLU'BOGH NGODMEY

Halley qaH nger laj yejHaD 'e' ta; nger ngoQmey laj, 'ej De' veb chel.

wa'Dich: yub nucleus je equator rapmo', tera' Hoch tlheghmey'e', equator neH qengbe' variation westDaq vIHghach.

cha'Dich: tlheghDaq pitch rapvaD monochord organ pipe je cherlu', 'ej pa' bID DIS qaStaHvIS pitch rap pol cha'; 'ach tlheghDaq pitch rapvaD janmey rap cherlu' 'ej tlheghvo' qenglu'chugh, chuqchajmo' pitch plmchoH.

wejDich: QoQ pitch rap patlh polmeH Daq lugh 'oH equator'e'; pa' monochordDaj pol yejHaDvam, 'ej Hoch equinoxDaq patlmoHghachmeyDaj much, vay' HaD neHchugh lo'laHmeH.

'uD vIH 'e' tera'vaD 'angta' Halley qaH. wa' Doch neH wicheInIS: wa' tlhegh tu'lu', 'ej pa' ghoSmeH 'uD ngoQ pagh tu'lu'.

DIGITISATION GHITLH MUCHWI' QIN (2026)

Sociedad Ecuatorial de Quito Actas baghlu'bogh ghltlhmeYDaq, taHbogh ta'meyvo' ghltlhvam ngo' law' Hoch ngo' puS; yab qempa'Daj 'oH yejHaDvam'e' 'e' Har Equatorial Audio. 2026 DISDaq Spanishvo' mugh 'ej ml' De'Daq choH Equatorial Audio Qul 'ay'. wejDich wlvlu'bogh ngoDDaQ Hoch equinoxDaq De' muchmeH 'lp tu'lu'; 'lpvetlmo' yejHaD muchmeH 'ISjaH chen, 'ej 'ISjaHvetlmo' Journal of Equatorial Audio Science 'ISjaH chen.

Halley QIn 'oH ghltlh teH'e', 'ej De'Daj potlh muchchu' ghltlhvam. Delbogh yubmey ngaSchuqbogh lajtaHbe' QeD, 'ach taH qech botlh. teH tera' magnetic yotlh westDaq vIHghach, 'ej Hoch DISDaq longitude degree wa' vagh 'ay' nlb mojmoHlu'DI', wa' 'ay' rurbogh chuq vIHtaH. qoD nucleus ghajbej tera'; 1936 DISDaq seismic waves lo'taHvIS nucleusvam tu'lu' 'e' noH Inge Lehmann, 'ej ghIq Sub 'e' tob QeD Qu'mey: fluid porgh qoDDaQ Subbogh porgh 'oH. DaH mantle buSlu'DI', nucleus jlrgach patlh lujuv, 'ej 2023 DISDaq mevpu' 'ej latlh lughDaq jlrichoHpu' 'e' lumaq; magnetically calibrated conductorsvaD wanl'vam wanl'mey qelpu' 'ay'vam, latlh ghltlhDaq (Ferro, Ohm, Flux and Impedance, 2026).

Delbogh SeghDaq lugh je yejHaD nger botlh. rapbogh axisDaq jlricha' porghchugh, rap equatorchaj; cha' jlrmeh Do qellu'chugh, plmghachchaj SaHbe' ngoDvam. monochord patlmoHghachmey ta'qa'be' Qul 'ay'; ta'meyDaq Delu'bogh Segh rapDaq muchqa'.



DE'MEY

- [1] Halley, E. (1692). An Account of the Cause of the Change of the Variation of the Magnetical Needle; with an Hypothesis of the Structure of the Internal Parts of the Earth. Philosophical Transactions of the Royal Society, 16.
- [2] Halley, E. (1683). A Theory of the Variation of the Magnetical Compass. Philosophical Transactions of the Royal Society, 13.
- [3] Gilbert, W. (1600). De Magnete, Magneticisque Corporibus, et de Magno Magnete Tellure. London.
- [4] Kircher, A. (1641). Magnes, sive de Arte Magnetica. Rome.
- [5] Kircher, A. (1650). Musurgia Universalis. Rome.
- [6] Mersenne, M. (1636). Harmonie universelle. Paris.
- [7] Lehmann, I. (1936). P'. Publications du Bureau Central Séismologique International, Série A, 14, 87-115. (Cited in the 2026 editorial note.)
- [8] Yang, Y., Song, X. (2023). Multidecadal variation of the Earth's inner-core rotation. Nature Geoscience, 16, 182-187. (Cited in the 2026 editorial note.)