

c d e fg
789: ; 3< = > ? @A

! " - # ! " \$
! " # \$ % & ' () * + . - . / 012

! " # \$ % " & ' Ning Xu Land n ()
* +, - . / + O1 23456789: ; < =
> ? @ AB) * CD 2024 E 12 F 26 GH > I J
KL; < - M; < N @
) * +, J OP3456Q+ ORST BU
VPW+O34XYZ7; < [\] ^ _ ` . a
bcdefgh@
i j k l mnOP) * +, pq: ; < rs
& f t Q+O1 2345uvwx) * @y) *
z { x | m} ~ l ! " #] US%&734X
Yq' P() b * + H89f, - . / Ox + O
1234567; <] f1[\ @I m237 =
> ? 4Ox 34567; < 78P9: ; FOSL1
- 1. 7P2 @ [A1 @

J > 7B? @ [A1 @
DBORC DEF; <] CGH; < I J
MPHN| 56%&OPQRST UC; <
@pqXYZ[\]] ^_` [\ 7: ; <
wc dP) * +, 40x eD34Z STU
VWf gX hi j k l mn 7op@
&' () * +
<https://doi.org/10.1016/j.stem.2024.11.013>

- 345678(B,
: ; < = > ? @ABC

q r s t u v w x & Marc Schmidt-Suppin
y z l { R q | i j 7 B; < p q T; < 7 } O
~. ! h] " # \$ # C @ A B) * 7 D 2024
E 12 F 26 G I J K L % & N @
) * +, g h x ' ! (7) % & _ * A 1
T N F A I P 3 / A 2 0 i Z + 7 ! % &] " # \$, -
A 1 H. / Z 7 A O 1 2 @ 3 4 5 7 < P B ; <
Q 6 7 7 8 9 D : | ; < 8 P = > ? ? @ 7 !
% & _ A P B < 8 9 D B ; < C D * @
) * + n q E F Q G * H 7 : < I D T

; < J K L B M x I m N O @ < I D P < Q H
q | i j D B; < } O 9 1 2 K R. P B S i j D
B; < C b k T U @ V W T; < X. Y P Q H B;
< i j D X? @ D" # " # ! " # \$ I #] !
h m n Z Y x > D B p @
A [B * +, : ; x T; < \ > 7] x) i
^ X. 1 2 P_. x ` a D] Y b D B; < ? _ D
7 I # P 9; c x ! % & I # 7 d e f g @
B; < % & h * i j k l % & i j 7 m * ,
- P e n > ? ! % &] o D p \$ 7 I # R q ~
r X" s % & t u 7 v A w x y z w { | A B @
% & ' () * +

. / O123\$
DEFGHI JKHI MNO'

} ~ ! o" Av &' 7 Athina Anastasak
yz#\$xe%&' ("] &M) * + 6@AB)
* CD 2024 E 12F 25GI J KLqrj 2>&N
&, I -. PI/<mO* (17+623Rp
I 2K456e7sC89: ; W RAFT/+6
7_. @<BPH=xra) * ZP>V<n?@
>ABCn* DEI RAFT F - 7&j 9Cv
+ 6R xx_. xRGK!HI] : 2D@
J Ke%& PI L Ci mOMhN, K 7O
PQPWR(xra23S_K6CdSf1T
7+6UP9VpI WHi j 8nXY!Z >[X
Y] f\ D] <7no@
y) * \^x mOHe%&AB' <D_w
7("] PI RAFT + 6723@ T#UAaD
bc(7WHpq"] &j 12PdefWxg
YZ>[P <xi j h- R #xj kTTfI
m!; >-Jn; T!ovpq| <7+6U@r
e' Hs 8nQ6Ct <f 1T + 6UPBN=
TUQf \ D7X. @
) * +, pq6C; cu: 7vw&x +
URyRXzO+6UOF7AaDR/m{ | u
xy} ~7r nDR B" e%& PI: #i +
6U6C7\$Rvh@
&%' () * +

456' A\$
P5QRHSTHUVW
XY(7(5)1A))

%r { &' x &X%r () %* + 4, r -
. /O61PpqOT&1S&1Z73234
f 5>DS67\B8(@AB) * CDnGI
J KLUA9O AN@
I :) * : ; xepq. /OT732PI ;
32enn<4f =Bi j 8(P>?! 8(yT
18(Py4f 2K@A5>DS67q' 3D7
BCD; EnG] BC: FnG@) * +, pqqG
3" H8I JKxXML7&NOAB7zO. /
PQ' 732P9] /GH7OTI ; 3272R@
pq@aST1U3&17: PI B' j k
VWnoP' ypqXY! gOHJ OZT1U
3&1P) * +, n<f F/ | 5>DS67\
B8(] =Bi j 8(@! " >VI \S. K 2
[\ | VnTf \. K 20%7T1] @
<nT1] X7&Z^7_` Pe2K) *
] ET1T[K&Z7=Bi j (dr q' @C
KI ; AO1278I] AOaOPOObKmp
cdb?q. // | 7nG] eN@

<https://doi.org/10.1103/PhysRevA.110.062826>

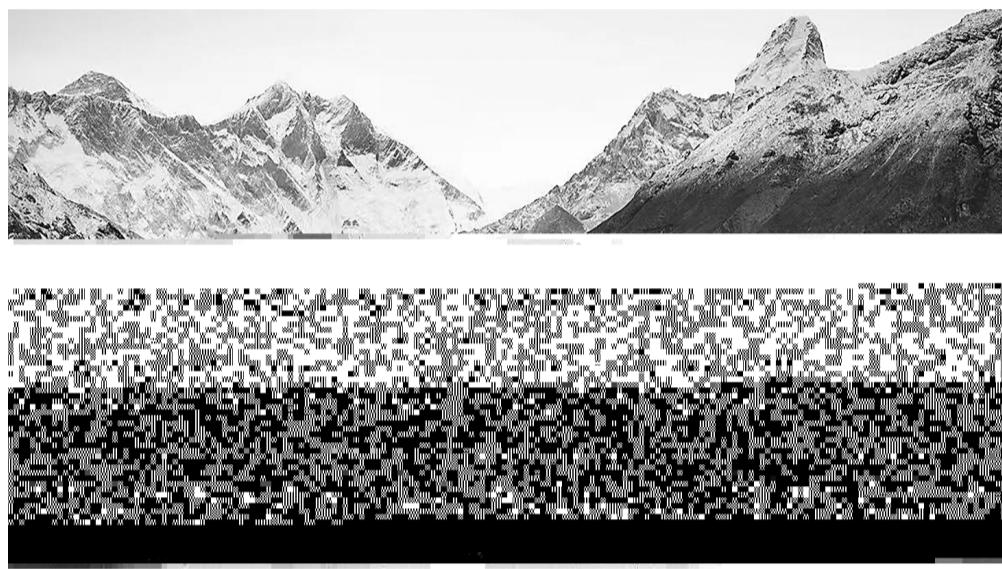
! " # \$ % & ' " (

QRS HnGf w7%r +gUA&==
h. P%rr - i 9i bB NASA/j kq9n
) *) 7I &- #mnRqV 20 E P e g i B
op&7qrs { t u v . x Pw c x r p &
ABv 3Psyxegwz @
20 r E 3PNASA Ho 9Z 7{ HI { P+
gnT | Qf } ~3~ UP>v! +g 7nT
r Kj " +g 7nT@BI Of } #x' | . \$
%K+O&' 7(O) ! " 6T* Hx x) Z@
W4O>?I ON+ } 7R, A* <m-
. / @Ai L(I { 7i B&7O{ tu1`!
eN| xr 6T7d2+t] 3475t` y
i B&7671` (Pr N` j MI OG8
U7ntF } @
i [PNASA j kq9n) *)) 9I &
- George Tselioudis] | : , 2; < | = 7a
bvwx) * @
+ g. 7qU\ x. z x 9N8w> PW
qPP+gx >8) ?8@UC7qABRC
WH@RZmPHDEg] FEg 7t, G6
8UCPHKI \$JnR K+gp x PLA@
BMmPHZN| +4POP7Q?, I xx
RS PA 3x 3, Tb) @
2024 E 8 F PTselioudis (+ I J KL) 9
[K&N 7) * I { PH) U; <?I s{ 7
35EnP \$qAwmPBZN| , 37VWXq
MW[PYI xqAUC74ZP Bv. x [\
7s{ HI @WI m7D<Pdr N| ; <7a
b] ^c/7PB_` ; <7ab * enWH
abPI wc) * +, #c: , \J Od7q
Av. de<fg: @
{ HPyyz+hKm` 20 r E 3RCQ
+gvw/O7 NASA 7 Terra; <7ab@
Tselioudis i PHKj Terra; <k l 7.

mq A 7 a b 8 P, \ I { x d e A | 7 d
e m q A s { - _ 10 E' o p 1.5% @
q' or - s f L t u 3 e n N U V R w D
@ A l m d e P = I { [7 T U < E x 7 @ v q r
x 6 & =) U &) *) 7) 9 I & - Bjorn
Stevens i @
Tselioudis (+ y l { P q A) H + 4 8 0 %
7 z ! i B - w > P q r s { t u v . , u
7 P B N < d 2 ! i B - d S 7 q r 1 `) ? @
H Tselioudis j 3 R { | J u x } [n T f }
7 < x) ~ ? 8 @ 7 w > P B N < ! 7 1 ` @
" 2 * # P 2024 E \$; 8 9 P N A S A %,)
* Z + 7) 9 I & - Norman Loeb y z I J K
L + g U A & _ K N 7) * R " + g n T | C
& ' \$ A K q r s { - 7 ' o @ W | 8)
N A S A q q X + g = B n T) O p * w; < 7
Loeb + i P ! 7 1 ` e n H q r w > Z I ,

! ! " # !
! " #

\$ % & ! ' () * +



! " # \$STEVE WATERS / ALAMY

BCDEF GHIJK L B MN7 OPQR
STI7UVWX YZ - [4\$>\] ^_IB
pq>r stuJ wxyz{ R| 7) ~
! 9" # \$%4&>' * bl () ~CDE
Fn*+, R
CDEF GH- . / O12345674
89>J: ; 7RB<= 200 >? 500 >@AI
j J BBCDMEFGF HI >J K bL 3MN
O' * bRPFICDEFwx QRB| 7bcS
TI4ULVWj J Xwx Yg>Z[\ D] ^_R
` DI CDEF GHL Babcdefg
hi j k >~I E#mn oRJ: pqr JK
no>4st ul\$vwOx | ykh~217
z { [4 3 | Shalik Ram Sigdel } ~ >!
" RSigdel B\] # \$- lar V%&j J Ew
x' n>J: R(x\$- 78J &%) X* 7
8J &{ vw\$+, O>} - . r / OR_
1 / 234" 5\] O6789: ; SE
<=>? @A@BCCD. >Z[I EFOA
Y#G4HI JKLo%M>[bRBN8b
5I %OFz OPYpQReOSTUV>b
WIXY 400 - 700 ZJR
34B[Sb\ >NZJ >J # 3] ^I
_z +` ab7c! >KdI e<fg@hi
j kJ >@I Rx Xmn +%o^@h>pJ I
%Oe<fgN@nol g>rstu@l R
OO| ygf ISigdel E v n Wwx J: 3N
&J K>yz li j <nJ Kg{ I(y|) O
>yzi ~Eno ! R
\] A" V%I wx S# \$@>%&j Y'
(I) j J >%&s: + %B 1920 @? 1970 @
AIS@* %&+), R-. Iwx J: N@/ G
O12P1134I) j JJ: N@12634R
\] A" 5 3&J K~I 67wv, 89
: 4s 2; <7 = 89 4s 36; <W>s 89 4
s 4; ? 5; <? # @2DAF MNc) IBCO
- 2100 @J: ! Vn~>2R
e<\] JKBDv9i 7EA{ EFi
Loq>no6GI%OV%wx Bj 9I J
#H>I J qnoKj / I) j J LMWNOR
\] A" BCIBUag~I 67qlwx !
9O9/ 3nolefi sPbI) i J >J:

! BQD~R? / q1 2R
\\] A" S+I | &~2 ! 9Tn' B|
yGH- >AUE24V* W\ XYR DuSZ
>J [E[K\LB] V^_>' * bI F`j
CaBQ6>bL- bcRd/eff NU3a
oghGyi >I J; 3| Parveen Chhetrij R
Chhetri S+IZ[kI keI Om? I n
opVnOqr R| &6Gs a BCDEF G
H-. Gt >8uVnOR v bAR? QRW
xJ KIWyz{ | E} ~> I bR_
Chhetri W_I| ! \] ! " Yvb#nE
[@\$5` _%# &I ' (%OBCJ : 5v
wPJ K~2) 12IW) n** +f, R
Nq r sC
%& () * +
<https://doi.org/10.1038/s41477-024-01855-0>

wx y \z { | } t ~ !

QRS) * + , , 2+v On. Al/v h
f t x 7012E+7x3?I P9N@x x 3
7#UE4@ * I { P h] <5] (Q5K
RS* P7A* P enwx 3x 26 BRS 7#
72@Cxx E87x 3* B@AB) * 7D
nGI J K Lmk 9: ; _X<=hN@
_EPS ! Z* 2>r +) . ?OU@7
<=h P RZmk 9: ; _p@2/3@: . P x 3
A27h =k dzo, -] RSA* 7TU@
qJ K@n} / x y 7mk 9: ; _, UP
W[\ 9N: 2K) * <=h) ~P) ' 8\ J K)
* / On <] <x 3Q ADA2q'
7BCK@vO] HV1~! ! "#\$%" &
' D? #U&! EA1 &]' = &p) * + ,

+] i 711@<YP * +, pq2&X~7
. ` E41V AINA7#UX3E4) * x
qx3E4&' v@
) * +, I { P] ^_!Z, !35K^_
] hXx27x3*BPBFy; [_` 7
 RS#72@enXdE87x3*B@
 qI J upR5KRSQpEx3<r O
 UVPv: p5] 5+\$; @vMarseglia i F
 q2025 E P8\ y" a [m:) * Pxj Z2
 E+7' =RSP' ybc] dKv T U
 x3eDP9ULBSHD7RSA* @w
 NBopC
 %&' () * +
<https://doi.org/10.1002/alz.14435>

h i j k l m n o p q r s t u v

| QR* VWX ? Y

<- P* uF \$5=h>?
@n Rm: I J KL>&AN7) * , I 6
h@y) * n Ru F \$5=h en B* < C | D
E - FRZ Y F 2021 EG%r ~ p HI 27J
K v L M BDE-209/P=Q+! RS NC U
OP@
y) * I J Y RQh, I z x R! BS@m
8n@T Uu F \$5=h wVWXwR BD
qr YZ. [x mEq \ b 7; v@
n GPy O] 1 ~ I J x k Wu Rn PK@
A 7D/ a R / 7 BDE-209 _G^! 7 3e
- TS x m- a T _P>?. ^! T #aa
J n l mb > R B, I cd @W1 ~ + i @I
- @Aab b 9NTUO] 7z! 7Ow@

i PPL>&AN

[\] ^ _ ` a b
y) * P" | b3su] | %mn%3o
Px &#@X~p) *) o6" q@pqO
F 203 - - r1 2uF\$5. QP) * + , |
{ 85%7. QB* <C| ?s DE - PRZY
F I 2>&UT BDE-209@

u| , 2P[\` zOU@v! x8\ 7-
] - P@vO] v m1~!" I b3sul &>
wx? A Megan Liu y mn PI ; >&UT=
>?sh!) z 7* Qf { p* B8\ O/]
- T#<P|. 5+6+v@
) * I { P* I DE - BT@<7<} -
! !" # @w2I ; k ! 7=hen>? -
! _b^! 34700 \$ 4 BDE-209P%n%r -
pHK / 7&J - T@
I m7D, I x' =z (QuF\$ 57d
d) * @H%r { &' +#x&, UXI U8
p- . / Jamie Alan j 3B8\ #c") * e
nB** PUT7O1r 2UPWe' N33
2455+N367=72hv@
: . P" I b3su\$9" 8BS=#S
573eDno@, \I { BxraT9` rB*
* I DE - PI O>&UT=pq: ;] OO9
) P ! - r25] <URvBTU+! RS@
A[B`) * I J YP' I b3sul u=
>PV? %r w@pqm:] * K7Leg\$5
PpN@

C x D E k x & I & X' = F G O H I J o e
Schwarzci @ L, j d O] Z 60J 7000 K < C
d x 42000 B 5 420000 8 P x L m \ @
h ! B M P y) * N @ R v D = 7 2 h z
B * B D E - 209 P H G I O P] X' < U 7 q
' Z P_b = i # 34700 \$ 4 ! U @) * +
, & J x % r ~ p H K / 7 B D E - 209 3 e
- T P > _ b _ G Q ! U ^ ! N j t q 7000
\$ 4 P R " C + ! U N A i 60 G Q P @ A c
d _ + _ b 7 3 e - T j L < 7000 S ' 60 P
r 9 < _ b 420000 \$ 4 @
< B P) * + , B T + + U U m - 0 P A C
x 42000 \$ 4 @ v [O A P _ b i # 7 34700 \$
4 ! U L ? t q 42000 \$ 4 7 80 % P I " V
= , I E x c d @
W k I - X : 7 a & a b Y P _ + _ b e
^ ! 7 ! U 3 e _ . . ` . < 420000 \$ 4 @
) * + , H W u z] / P q @ A / 7 _ G
^ ! T J n % r B D E - 209 & J - T w X z i
q @ A / 7 _ G ^ ! T a c % r B D E - 209 & J
- T S m - a T _ w @
J K a T _ 7 i & < U x a b P w L i u Y
R + i Z I - @ A a b N = T U O] 7 z !
7 O @ w