

中國科學報

CHINA SCIENCE DAILY

^OA_Zv ^OA! wqY ^mn, opqYrs CN11t 0084 us 1t 82



Z[\ ^OA_] ^`a_ ^bcdOAEfghi] ^OAj k l i

QR 8695 S 2025 T 2 U 24 V WS, XV 4 Y

x y z { http://weibo.com/kexuebao

OAP www.sciencenet.cn

! " #2030 \$%&' () * +, - . / 0

! \$ % DEF " # \$ % GHI

6de. \$Dr *FsstGH+uv;
a_sd. \$8xG] Xd-; ; V;w' x)
E* +xy# \$HF/Oy[z 4<sd. \$
() O{ Ggl v#sd* Q2030 \$de. \$
q#O9ICM2030: T<] u;<?{ G* OGP
Ohi d9] Q} O{ } &-y rF]
x! OGE" X2T
de. \$q#O=de. \$(#q># +
l' >PG#OT2002\$;> 24\$de. \$q
#O#%A Qtmj <\$#OG>| Ti ?;
2U22V; y[z #PO sdp\$Rc? VW
X; 8Wsd. \$GaN9I `BcT&E(;
?#Oo9[j xsdyE(' AG() T"
^w; 2030 \$-Gsd. \$; 3?5[LFE(
>*+l' pde. \$(>Pb-GZ9[l
)k, l 9) n? . \$(%&') i h&w'
x) r2- . sdT
" 12; 2030 \$#sd Qde. \$q#
OH[j ?@i /; 5# \$OC=OE (>?
<GDmK5\$-;sd31eOSTHI F<
E(. \$) XGo2. \$qTry[zj sd.
\$3+O 2030 \$G456' T

MTN

Nf O/P

[l G\$TPH; ?F8{ PV_F[HE(
?<\$T/FsdTj +OG[j sd9] b
\$T' AG() T
20H\$-GGu; sdGopt 9s\$ t
#. \$spvALFE(*+l' T122030
\$F8wdHI sX; { H\$! =F8a[M
xO/GT
A] ^OA! BNCM2030 /OWXYZ[
\WXY] ^` abFWXcdefghi F
] ^j @WX<kl m. nD1
CDE\F8ao] 5F6sd. \$<
=>, JG\$T; F8G}) hx?K? 40H
C; 2c=, \$uYZN=, s(R/_::
HI F<sdG. \$YZT
8b; } } 8mj sd. \$(G<J C
h; J 5#%H\$OC=(: BYZ; mWm
de. \$Dr Xwsd. \$(Pm@mG>
pl' T
ICMG[F] QPM=E?d. \$YZI
>GRw; u=* 2de\$us1GKL) OT
12Fd, l @FMq; ul j yrs; Km
>Y<SDmT[W] Q} } O9\$u} } O
u=j xNk>Y<? DmT
A] ^OA! B o3p[qrs' /O3

tp[ui YHvwVJKxyz{ F<=<
| } -p[q *UV! " @#" Dv\$%&
' (1
CDE\PN=. \$(acN=r" <=>
Ob; #Pm[\T] \[\, 6?r; l Pw
HEF] XTP. 9Q(R{ u: #Sc; R?;
#ScsUHI xYTFWN" Hp\$ q; ?
Pmwj ; uOj -TEuUsW; ?FRj <
POx[SAGHT
O#O=j xdqLP=j x@CTV
o+VdvA* hx| v; v8^eE* Ru
l; uY+{ VGWS[T<@WX; sd. \$
(6mYZSG; Kml [T

FABGHI ; `O, 30J KLMD

A] ^OA! B`) l - * F2GDp[+
, - * . / O1U2345+, U63D7
8F97: nkl ; <*==5, L10, >?
*i @1
CDE\ \$qG[: tr" \$p%k; ?
[/X; >, JGDm# 30\ /Ol , [x;
{ H, J [\ : = \$OC=GTE. \$qL7;
? [#vwqr -G' } \$aOOC- s; }
] \$a?wH, [?S, J DmT
F, 1966 \$YO# \$F 1976 \$, [>?
S, J Dm; sqR- x 10\$D^TE. \$/
X; >, J G=7#DbY; b~{ H[\ : =
. \$OC, [GT
A] ^OA! BA) ` - * . 5, BfO3C
D<. EFGHI J Kqp[LMDNop[
u3e<4PHQDRS1
CDE\G; FRSw_B8xFd\$O
\$T9\$TGH[T' b; FN_FF8??=
E(?<l' Gs\$T; " 8GH[tFar
G, EHT
A] ^OA! B l J Kqp[LMTUV
vWD>XFY) Zkl [\VvWdK] 1
CDE\o?. \$[\Gb\$ i F: { c
d; l =MxH[?HV+MxO/G\$! ; H
, JTP= _e. [f; uP=AHg) S; L
=MxO/G[\#\$u(?hGH[9, J
B; <=. 6E(*+p\$qi j GT
) QRR2Y

O123456
7829: ; <) = > ? @ABC

! | ; V; sdp\$ { ? < ptp = V
> Y? DY@O# ABCTsdps\$ {
: CcDSEVdOFOG HI TJ { : +
Cc [] KLM* i OGT
Y@O] ; sdp\$ { ptaNH[OP
Rx? < ptp = V. WXDMYX; sdp
\$ { * OGcRp = cROsRr WXST
CUVxptp = V. 9OsWX+ j Dm
YZ9[\VGTYOC]] ^_Ydap=
` VGH[9aF[+a* QLk[V. `b
c () Xyde (Q = p = CU) f V. >
YsxgOh<Y@T
EVd#O; i ; ` j DSX_ / k & l
E (? < ptp = G, J HI & @; j V. E
(? < ptp = # Yx Dm@m+ * xno
opTsdps\$ { mj dqAfpt [\$; J
rRR} V. ? < ptp = G, J B+st

B; ul > vV. ptp = Gwx > \; yz
\$uu{ ; * | Ei dq6< ; ul > YE(
? < ptp = V. T
EVdEsdp\$ { ? < ptp = V.
Dm* O} j J < T? = aF? < g! ; ul
~. M+ ! ; " # \$ % ! HdabK&pt
[\# sdp\$ { * OGp =] ^; ul > Y
ptp = V. de (aY' Tq = (x? < CU
(;) l & l yFY (;) * P64p =
? rCU/! ; /Vptp =, rC} j +;
, - WXY[QLY5#] { T' = VV? <
Os` ; > Y{ aOs` / m] J; PO
%HP4\$ p =; 1N* 2Q = H[93! 1
734T] = 56? <] X} { ul - . d
(Q = G? 3q7; 89(mWH: # G;
< = > ; rR^? + tuT / G] X) @; (
xp = Os + q7 + rLT } - |

(#) * +, - .
/ O123456789

! |] \$% ! " # sdp\$ { AB-
CYZoDNEF567+EFgp# \$A
B# \$+EHI p\$ { | hYZo+sdps\$
tu# \$; YZvwX? K+oJ K HKU5 L
/-C\$ [9HKU5-CoV-2 HI D7C` M
NsO6+P\$ 2ACE2 Qk YOYZ; j (
mL / -CG1hK>Q; < * +x+2RT
; V; WX[\# -] ^_` YZcT
L / -C = ? ` Y? PMHSB91hK
>QH[G-C; J KSRj = HKL / -CG
abT * T / aJ KG Merbecovirus UVL /
-CWx 4@-CK 88sHYA1NZW
XL / -C [\ KL / -C] ^ L / -C9
; _L / -CT < # -CG` > HSBab;
? r mC` cOGZ#; < dPxeT

YZC) / aEH9E! G] ^` J
K9HU] ^ f] ^ g] ^ s] ex XO
GHKU5-CoV-2; r HI yC` ACE2 Qk
MN;] MN) { yr` v y GD7C`
ACE2 GL / -CabPmT%, J G =;
HKU5-CoV-2 HI hi ^ L C` ACE2 Qk
GYZd9C` Yaz9j z` kl T
mY Z v w x J K s : # 6 + G
HKU5-CoV-2; r XOGC` ACE2 Qk D7
{ 91hKhi H[; * wr whY? k PG
1hK>Q; < TYZ [\ nax EJ KL /
-CYsl < O; G, J B; umC / } Kp
tq69>i - 8z] Ox + G; r NAT
! " # \$ % &
https://doi.org/10.1016/j.cell.2025.01.042

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

! " # \$ % &' () * +, - . / O1
23456789tmFAP; < = > ? @ABC
D. / EFGHI J KLMNOPQRS
1278T2U20V; WXYZ [\] ^ _ ` a
bc; defgChijkl mnT
%&' opqr_sdp\$ tu\$; vw
qr_xy# \$; z, sdp\$ { { wj } ? T
vw- ! ; " # 2024 \$ % &' (\$) E * +,
dy- . # \$ / O1 2345678DmT
k' 89] ? } 9&4: ; < = > ? @A
BGCD; < EFGHI J # T = pY? PJ
? < KLM9NOTR%&' # PQ sdp\$
RcSTUVWXT



tmFAP ! " # \$ % &' > ? @ABC

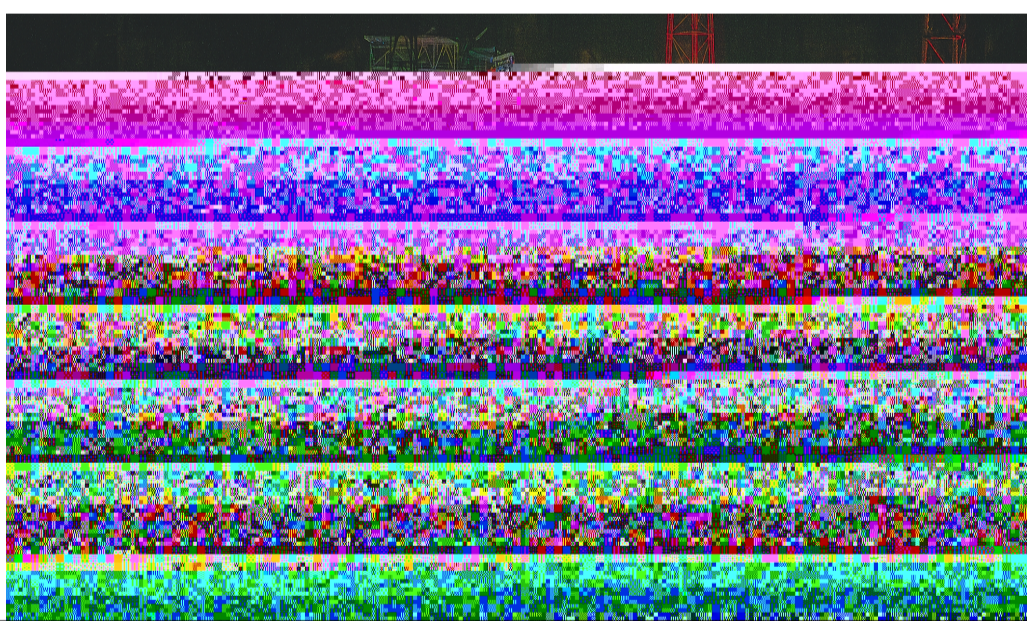
, - . / O1
k 278 = YZ2 [\] G78; ^ _ C
` abcG25% d] TefghGij k B?
l : = 278Tr%&' mnXT
#xy# \$ovpq; %&' z, | ? }
, r 278Mst h\$YZ; uvwxyz'
{ | } ~ PWXGJ! " R# \$%N
hG* @&Y' 2Ms; j (mz' { | } ~
G] ~) (* +x, J - . T
2015 \$ / O&4567~; %&' 123
784. / 5! 67_278. / T8W; &
4567#784. / 9Ms; ; < = J l
? > ; ? # 278. / @ABCDET2018 \$;
%&' * + [F & G. / xH+1278M
s; l Jx<?K8T
bL; M? Ms NOOPI ; %&' 12
QRCD278STGFHT2019 \$ Ud / O
! " # \$ - ; " VWxXW567; Y? Z [
4<? \ DT
k] ^ ^ YZ2_m = R` YZabcd
eG` ghi; j k 1278l] mgh] ? [
n&oG` gpiTr%&' qrstuX; v8
wdxyBz { h4YOYZ; O] B} ~
! " ? # QRSAB; z { 2abh4H\$N
%GOO; &' YZeb(deGH6; 2[
t) * + T
" H1278GFH: ; - _ yOPR
SGW. m7 / 5eTO] ; 1_232G2
45478; Aby2t 6AG7th 882
9: GRSMN; #4; 5<] tsr = (;
, L>? 2@NA; BC#D] - E (T
bL; - . / HI & FMNOPRSg1
278; = 784. / < = AGGH# @AT
l DGJ 5B = H@AG;] 2deG%
KB+278^L9M(GN\; d9QRS
MN78G, - . / l DT
%&' () O\ L] ; 75 \$Wq [4\
D; - . / OE () * @HI O] BMNO
PQRSg12345678T
defgCPMQL<? [\ ; Rjk <
= 784. / G? SI mrkj 784. / 9
Msth\$ = T / xUCVWGYXnY
?kH#67Z[nT
r 5] kl mn ~; YZ () <] \$G
^ _ E P` aT

23 456789: 1; < =

%&' () sbO? @cZdn / e
fg? Z; xy34a (HBC599 mj hi
j kRS; . / O? Kl mB345678
9WFAP; 7d6n. / G784Gaoso
9FHp>qZ; ErYst; 3vl ^Aw
xj yl ^A; + (j Y? j kMNH[Gz

mB1278T
b^ { x | ; ? } m - / P ! Tj x
3l mB78+ = j Y? FHG1278;
YZ () " # xHK@ \$T> % ; " 8U7>
\H\$&\$; # ' AB(=) a* 378^
Avl Bwj yl BTbL; 784^A = (-
+o. /, GQRSMN-. Gq/9(
\$MsOw=; 1r 2\$? 3MNj kTk < l
, 4# 78sq?? @#5; 6j #78^A
F | DI; NJ < 5iPH78; o9l J l N
\Tr%&' XT
j x (; < ; " 8 = C AlphaFold2 > C
D? H9Al : 784: ; @A3B; C] x. /
1278G@ \$; D7EMFGGH@.
/ ; 5ex#&l MN-. J PBGMW; K
(784G^ALA; [FMVxNN2de
6<G12yl OT
bL34a(HBC599 # l mPsO?
34; R? y78MN-; r srSTP; U
O] OVWG34NATk] \ _ F34; j
l = [FxT] \ Q? 34; XXYN6w
YTr%&' XT
AB? [ntuyK (; () Z _ [F.
/ Oyl mB345678wFAP [\ Ms
Wm;] Hy34a(HBC599 O] BMNG
123478tmFAPT r 34^A M56k B
1600_ ; yQRSGv9[LF` a' b-T
2023 \$ 9U; YZ () 3cdef abcT5
@U-; > / GU? gU&h j l n31fg
Cs; cCtkRw<SYZ; ? rs? C* O
? @l Y@ABGtu l D88J < YZ ()
nY123478mn [xo. / G' 2MsT
8W; YZ () mpxl mB34567
8G' 2Ms; 9. / qo? r; L] 1234
56789l mBsOY? WmG3456H
[; Xt) a* u? r; vA, wAnYx<?
l DT? 12345678MsmPN; ()
i xvAYsx# \$ " # ; Q? [FT
r 5; < 1fgCyZ < ? H\ ; " 3a
{ * OGI Dq jkR?] Uyz nT
PB; %&' 9 () [] Cb - Sk
! nT%&' U - ovpq; #Gz [?]
#G< ; r [_ @A > \ GMst h \$ l
DT8W; # | ? } 567; mpC! " R#
\$%Nh' 2Ms GCD\$ % Cx x 10 &
\$; uS[HCRj = PwHm' GI DT b
L; # " 8GP () l < ; < ? \ D > ZS [
4; WXYZ] ^ _ ` abc; Ox 2014 \$ s
d * # ptYX +, T
< ? + ; % &' - + ' P @AaFT
. _ + . / G1278kQ; M? 170@
) a* / O; P172345MsmP; i x
" # x # \$ k YZ? Q? [F; 78
S&R?] Uyz r6k = 9t; T
) QRR2Y

2: 22; 20 < 11 = > ? @ ABCD
EFGHI J 1 KLMNOPQRS > T U
VHE 10RDEF GWX > DEYO67Z
[\] FGA^ _ ` abcTU' de ^ _
fKLghPQRSij 560ekl'
HE 10RDEm1nopqNrs#
DEtu>vwxYH@zB{ } { ~z
n} { =@! " # \$ % DEa&' HE
10NDE(_ t) * + i, - . > DE / O
123HE 10NDE 456W> / 78#
c9' : 1; < = > ? @ABACD@! z
\$ 6EFGi DEHI JKL_'
CO12\34] ^



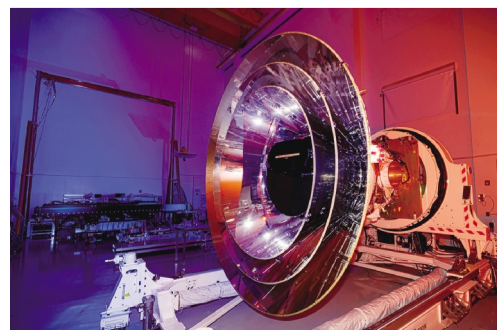
\$ ^ x, u % &' () * +, -



! | s` p \$ cRz; , ddqtKtu
O#NASA + ? f Kq2O5 SPHEREx 3_ ;
d8sWq 2U27V] v2K; CXj pc \$
Gw; xyT
SPHEREx = ? . z { # OG5b2O5;
r * 5 | y] ~W8; ? r 2e9] W8_
200@ UAUtM2O5L! 4.88" , # ; V
x [oPF NASA \$ % &' (Kq2O5G
1/20; g /) E 4.5" @ * [Ys; + ; , Ls
VH#G, - 3Ds' T<# . s? C_ v w *
[/ (B' 9O1 [G [\$ c [T
PB; SPHEREx > FC2hG73 = 45
, - k 67r(cGns; 8Q9] 67GZ#
b69] Tbj hx E_9 | , - 67Gb6;

p\$ q; X; < T
] \ SPHEREx [FYO: P = z; 3 > 6
@U, [? + 6u? @; + { * [s' ; SAV8
#5b4B! & CDrT < = ; P* [EFG-
, ; EFOG* [G4Ob, - 67LGT 5HT
kj 5eH@p\$hi ; F8# SPHEREX G
4\$. / @A = x { HI [TrSPHERExSh* F
p\$ q NASA J K > Y567G JamesBock XT
SPHERExU7. 3AL5c[G [\ ; j N
- B5bw = M4N5e * 2e < G4NAU
bT < KOOGM4NM! " OPB: 9] G4
AB;] wAB4GB; PM4N: M@m\$ %
= (Tb - ; SPHERExwQR 102KPrk CDn
G4TSbABM4NREG' 4RT4P9>
\4UV; ? < K. / wd1 SPHEREx# WX
%# 2e9] GmW? 3z { [oT
SPHEREx w; . j YZq; 3 [\] 7
G4S^' d^ 12052l # _ ` / L; G
& r 5b - ; GabMT

- b; c = 5b - ; Kd; SPHEREx NH
mpO1[efgh] G(\$ [R;] l i ?
j (k + qj (k9l m > s [t] qnGh
4TSPHEREx6uWXGw; H[31p\$ q
6Ao? < # h4GpM9R(WX; d9q
* 6 | ErwxGB' T } . /



SPHEREX' CO12NASA