

# 7ci fgY<sup>·</sup>Cj Yfj ]Yk

# GhJZZ 7 cbhJWh 8 YhJ] `g

### 7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`]m	@cWUh]cb	D\cbY
GYUb Dfmcf	g"dfmcf4 i bgk "YXi "Ui	6mUddc]bha Ybh	FcVYfh KYVghYf*&%	-',)+'%)

GW.cc`7cbhJWh′±bZcfa Uh]cb

# 5W\_bck `YX[ Ya YbhcZ7ci bhfm

I BGK '5fhgž'8Yg][b'UbX'5fW]hYWhifY'?Ybg]b[hcb'UbX'DUXX]b[hcb'WUadigYg'UfY'Vi]hhcb'5Vcf][]bU`

### 7ci fgY 8YHJ] g

 $I b hg c Z 7 f Y X h^*$ 

Gi a a UfmcZh\Y 7ci fgY

Gi VYWh5fYU. 7 X]ZdY

 $\label{eq:continuity} $$H\setminus ]g^*WcifgY^*WUb^*U^*gc^*VY^*ghiX]YX^*]b^*h^Y^*Zc^*ck ]b[^*gdYW]U^*]gUh]cbg. ^5c^VReZgV^*H^*cZeZ_X^*explain (a.g., a.g., a$ 

 $\begin{tabular}{ll} K \begin{tabular}{ll} K \begin{tabular}{ll}$ 

#### 7cifgY@YUfb]b[CihWcaYg

%" 8Ya cbglfUlY'U'\_bck `YX[Y'cZdcYlfmk f]ltYb']b'U'j Uf]YlmcZd`UWYg'Uh'U'j Uf]YlmcZlja Yg" &" @cWUlY'dcYa g']b'l\Y]f'\]ghcf]WJ`ž'gcWJU'ž'W `li fU`ž'UbX'YWcbca ]WWcblYl lg"

### 5ggYgga Ybh

FYZYfYbWJb["Ghi XYbhg'UfY'ZfYY'hc'WkccgY'k\]WkYj Yf'fYZYfYbWJb['gmghYa'hk\YmdfYZYf''< ck Yj Yfž']b a U\_]b['hk]g'Wkc]WY'ghi XYbhg'g\ci `X'VYUf']b'a ]bX'hk\Y'di fdcgY'cZfYZYfYbWJb[.'hc'[i]XY'hk\Y'fYUXYf'hc gci fWY']b'ei YghJcb"'5b'Ui hkcf!XUhY'gmghYa k]hkci hdU[Y'bi a VYfg'a Umhk\YfYZcfY'VY'Uddfcdf]UhY'Zcf'gWkc'Uf'mkf]hJb['XYU']b['k]hk'g\cfhik cf\_g XY']j Yf]b['g]b['Y']XYUgž'Vi hhkY'gUa Y'gmghYa'k]``VY']bUddfcdf]UhY'k\Yb'WJhJb['U'bcj Y'ž'U'dcYa ž'U gi VghUbhJU``ci fbU``UfhJWYž'U'gWkc'Uf'ma cbc[fUd\žcf'U'k cf\_cZUbm`Yb[h\'UbX'Wca d`Yl]mh'' \delta hkcgY WUgYqž'dU[Y'cf'']bY'bi a VYfg'UfY'YqqYbhJU``Zcf'hkY'fYZYfYbW'hc'Xc']hg']bhY``YWi U`k cf\_"

 $\textbf{K cfX'7ci bhg''5```ei chUh]cbg``UbX`fYZYfYbWYg``UfY`]bWi XYX`]b``k cfX``Wci bhgZ'k \]`Y``V]V`]c[fUd\]Yg``UfY`bch''5 a Uf[]b``cZ\%i \`UVcj Y``UbX`VY`ck \`h\Y`gh]di ``UhYX`k cfX``Wci bhk ]```VY`UWW'dhYX`k ]h\ci hdYbU`hm''$ 

5ggYgga Ybh'hUg_	K Y][ \h	8iY'8UHY	7 ci fgY @YUfb]b[ Ci HWca Yg 5ggYggYX
%"`A Uʻcfʻ9ggUm	) \$1	&&#%\$#&\$&\$`%%) - `DA</td><td>(</td></tr><tr><td>&"'HU_Y!<ca Y'91 Ua</td><td>) \$1</td><td>&' #%#&\$&\$`%%) - `DA</td><td>%ž<sup>*</sup>(</td></tr></tbody></table>	

#### 5ggYgga Ybh% A U'cf 9ggUm

8i Y'XUhY. '&&#%\$#&\$&\$'\%\) - 'DA

&ž\$\$\$ k cfXgž ZYYXVUW dfcj ]XYX j ]U Hi fb]h]b

 $\label{eq:hamiltonian} $$H\]g'Ugg][baYbh]g'giVa]hhYX'h\fci[\Thifb]h]b'UbX'ghXYbhg'Xc'bchgYY'Hifb]h]b'g]a]'Uf]hmfYdcfhg'' $$$ 

### 5ggYgga Ybh& HU\_Y!<ca Y 9l Ua

8i Y'XUhY. '&' #%#&\$&\$'%%) - 'DA

&\$\$\$ k cfXg": YYXVUW\_'dfcj ]XYX'j ]U'Hi fb]h]b"

H\]g^Ugg][ ba Ybh]g^gi Va ]hh/X^h\fci [\Hi fb]h]b^UbX^gh XYbhg^Xc^bchgYYHi fb]h]b^g]a ]`Uf]hmfYdcfhg"



### Gi Va ]gg]cb cZ5ggYgga YbhHUg\_g

#### Hi fb]h]b Gi Va ]gg]cb

Image: Ybwb: bh/f'u'dfcv'ya k \yb'uhh/a dhjb[ 'hc'gi va ]hmci f'ugg][ ba Ybhh\fci [ \ 'Hi fb]h]bz'd'YugY

Hy'Yd\cby'9| h/fbu''Gi ddcfhcb'-', ) " ' ' %cf'Ya u] h\ya 'cb'Yl h/fbu'h/hgi ddcfh4 i bgk "YXi "Ui "'Gi ddcfh\ci fg'ufy', .\$\$ua '-'%\$.\$\$da 'cb'k YY\_Xumg'ubX'-.\$\$ua '-').\$\$da 'cb'k YY\_YbXg'fl \*) 'Xumg'u'mYuft'' I'mci

ufy'i buv'y 'hc'gi va ]hmci f'ugg][ ba YbhXi Y'hc'u'Zui 'hk ]h\ 'Hi fb]h]b'mci 'a Um'udd'mZcf'ub'Yl h/bg]cbz'vi hmci

a i ghfYhu]b'mci f'h]w\_Yhbi a vYf'Zfca '9| h/fbu''Gi ddcfhfU'cb[ 'k ]h\ 'Ubmch\Yf'fy'Yj UbhXcW a Ybhgthc

]bWi XY'ug'Yj ]XYbW'hc'gi ddcfhmci f'Yl h/bg]cb'udd']\wuh]cb"'Imci 'Ya U]''9| h/fbu''Gi ddcfhmci 'k ]'`

Ui hca Uh]\wu'`mfYw']j Y'u'h]w\_Yhbi a vYfzvi h]Zmci 'hY'yd\cbY'mci 'k ]``bYYX'hc'gdYw]Z]\wu'`mug\_'Zcf'cbY''

Hi fb]h]b'u'gc'dfcj ]XYg'i dXUhyg'cb'h\Y]f'gmghYa 'ghUh' g'cb'Hk]hYf''

; YbYfU`mž'UggYgga YbhiHug\_g'a i ghVY'gi Va ]hhYX'Y`YVWfcb]\WJ``mij ]U'Y]h\Yf'Hi fb]h]b'cf'U'A ccX`Y Ugg][ ba Ybh''=b']bgHJb\W'g'k \YfY'h\]g']g'bchdcgg]V`Yž']hk ]```VY'gHJhYX'cb'mci f'\\circ i fgY'g'A ccX`Y'g]hY'k ]h\U`hYfbUh]j Y'gi Va ]gg]cb'XYHJ]`g"

cfi]bZcfa Uhjcbicbi\ckihcigi Va ]hUgg][ ba Ybhgicbi]bYij ]UiA ccXiY.i\hdg.#gh XYbhi bgk "YXi "Ui #\ck! gi Va ]hUgg][ ba Ybha ccXiY