

MDIA3007

 $A YX]U^*UbX^*5fhg^* = bhYfbg^]d$

HYfa 'Hk c''##'&\$&%

7ci fgY'Cj Yfj]Yk

GHJZZ7cbHJWh8YHJ]`g

7cbj Ybcfg

BUa Y	9a U]`	5j U]`UV]`] m	@cWUhjcb	D\cbY
9a a U [.] 5"'>UbY	Ya a U"^UbY4 i bgk "YXi "Ui	6m'Uddc]bha Ybh		

GWXcc~7cbhJWh~abZcfa Uhlcb

GWXcc`cZh\Y'5fhg'UbX'AYX]U

Fcca " %&ž@YjY`" žFcVYfhK YVghYf'6i]X]b['f) %(Ł

D\cbY. f\$&Ł'-',) '(,) *

9a U]`. 'gUa 4 i bgk "YXi "Ui

K YVg]hY. k k k "Ufhg"i bgk "YXi "Ui #gUa

 $\label{eq:hamiltonian} $$HY'GW.cc``cZh,Y'5ftg'UbX'AYX]U'k ci`X``]_Y'tc'FYgdYWM\cong \cong m5W_bck``YX[Y'th,Y'HfUX]tjcbU``7i gtcX]Ubg\cong hY'6YXY[U'``fPYbg]b[tcb'WJa di g\cong \cong \cong \cong mUbX'5fti/'8Yg][b'7Ua di gYg\cong \cong \con$

7ci fgY 8YHJ] g

7 fYX]hDc]bhg**

Gi a a UfmcZh\Y 7ci fgY

: cf`a cfY`]bZcfa Uf]cbžj]g]hi\thdg.#k k k "Uffg"i bgk "YXi "Ui #gUa #ghi Xmli g#bhYfbg\]dg": cf`UbmYbei]f]Ygž d`YUqY`Ya U]``f\Y`K =@T b]hUh: 5GG!K =@4 i bgk "YXi "Ui

Hc VY Y`][]V`Y`Zcf`f\]g Wci fgYžmci a i gh\Uj Y`Ua]b]a i a 'K 5A 'cZ*) "

7ci fgY @YUfb]b['Ci hWca Yg

% \Uj Y`[U]bYX`YI dYf]YbWY`cZ]bXi glfmdfc\WfggYg`UbX`dfU\WfJ\Wfg & UbX`Y dfc[fUa `hc`fYU`!k cfX`\bhYI hg \\ ' \Uj Y`Yb\Ub\WX`h\Y]f`\WdU\\\\mZcf`]bXYdYbXYbhYb[U[Ya Ybhk]h\\]bXi glfmdfcj]XYfq

HYUWX]b[GhfUhY[]Yg

H\]g'Wci fgY'\Ug'bc'Zcfa U`'hYUW\]b['Wca dcbYbh'''

5ggYgga Ybh

FYgci fWfg

DfYgWf]VYX F Ygci fWYg

D`YUgY`k cf_'h\fci [\`h\Y`cbVcUfX]b[`_]hmci fî`Z]bX`cb`A ccX`Y`VYZcfY`Wca a YbW]b[`mci f`]bhYfbg\]d"`C h\Yf\Y`dZ``fYgci fWYg`WUb`VY`Zci bX`cb`h\Y`Wci fgY`A ccX`Y`g]hY"`

FYWca a YbXYX FYgci fWfg

7ci fgY 9j U'i Uhjcb UbX 8Yj Y'cda Ybh

K Y fYgdcbX hc ZYXVUW_fYWY]j YX j]U X]fYWhYa U] hc h Y 7 ci fgY 7 cbj Ybcf UbX h Y K ⊕ I b]hž UbX]bZcfa Uh]cb dfcj]XYX]b h Y gh XYbh UbX \cgh ZYXVUW_Zcfa g"

KY'\cdY'mci 'Yb'cm'mci f']bhYfbg\]d°

Gi Va]gg]cb cZ5ggYgga YbhHUg_g Hi fb]h]b Gi Va]gg]cb

-Zmci 'YbWci bhYf'U'dfcV`Ya 'k \Yb'UhhYa dh]b['hc'gi Va]hmci f'Ugg][ba Ybhh\fci [\'Hi fb]h]bž'd`YUgY hY`Yd\cbY'9I hYfbU``Gi ddcfhcb'-',)'''' %cf'Ya U]`'h\Ya 'cb'YI hYfbU`hY`hgi ddcfh4 i bgk "YXi "Ui '"'Gi ddcfh

5 WUXYa]W<cbYghmUbX D`U[]Uf]ga

D`U[]Uf]ga `]g`i g]b['h\Y`k cfXg`cf`]XYUg`cZch\Yfg`UbX`dfYgYbh]b['h\Ya `Ug`mci f`ck b"`±hWJb`hU_Y`a Ubm Zcfa gžZfca `XY`]VYfUhY`W\YUh]b['hc`UWW]XYbhJ``mWcdm]b['Zfca `U`gci fWY`k]h\ci hUW_bck `YX[Ya Ybh'

IBGK [fcidg'd'U[]Uf]ga]bhc'h\Y'Zc``ck]b['WUhY[cf]Yg.

 $7 \text{ cdm}b[...i g]b[...h\Y.gUa Y.cf.j Yfmig]a] \Uf'k cfXg'hc'h\Y.cf][]bU''hYl h'cf']XYU'k]h\ci h'U\V_bck `YX[]b[...h\Y.cf][]bU''hYl h'cf']XYU'k]h'cf']$

- i bXYfgfUbX mci f'f][\hg'UbX'fYgdcbg]V]`]hJYg'Ug'U'gh XYbhUhl BGK
- VY`Uk UfY`cZd`U[]Uf]ga ž`Wcdmf][\hzil BGK `Gh XYbh7cXY`cZ7cbXi WhUbX`5VWWdhUV`Y`I gY`cZ I BGK `=\forall H`F Ygci f\W\g`Dc`]\wh
- VY 'Uk UfY 'cZh\Y 'ghUbXUfXg 'cZVY\Uj]ci f'Yl dYWYX 'cZYj YfmcbY ']b 'h\Y 'l BGK 'Wca a i b]hm
- `cWUHY 'gYfj]WYg'UbX `]bZcfa UH]cb'UVci hI BGK 'UbX'I BGK '@]VfUfm

Gca Y'cZh\YgY'UfYUg'k]``VY'ZJa]`]Uf'hc'mci ž'ch\Yfg'k]``VY'bYk"'; U]b]b['U'gc`]X'i bXYfgHJbX]b['cZU``h\YfY`UhYX'UgdYWng'cZ9@+69'k]``\Y`d'mci 'a U_Y'h\Y'a cghicZmci f'ghi X]Yg'UhI BGK "'\\hd.##qi VYWfi |XYg"`]VfUfm'i bqk "YXi "Ui #\`]qY#JVci hY`]qY