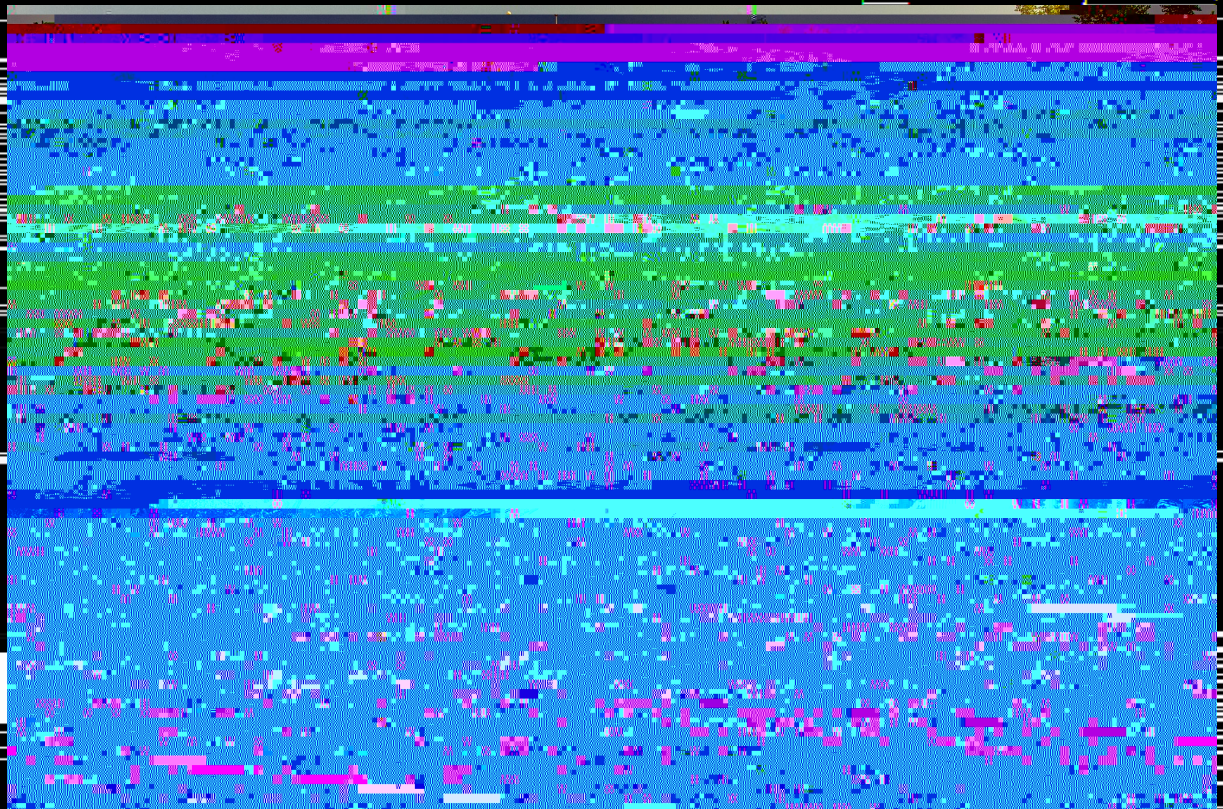


WAVELENGTH [nm] 1000 900 800 700 600 500 400 300 200 100



7ci fgY`Cj Yfj]Yk`

GHJZZ'7cbHJW`8YHU]`g`

7cbj Ybcfg`

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GWXcc``7cbHJW`hZcfa Uh]cb`

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[9b\[\]bYYf\]b\[`hXi gfh\]U`HfU\]b\]b\[`](#) -`hXi gfh]U`HfU]b]b[`ei Ygh]cbg`

[I_BGK `Gh Xm5VfcUX`](#) -`gh`XmiUVfcUX`gh`XYbhYbei]f]Yg`fZc`f`]bVci bX`gh`XYbhtg`

[I_BGK `9I WU\]b\[Y`](#) -`gh`XYbhYI WU]b[Y`Ybei]f]Yg`fZc`f`]bVci bX`gh`XYbhtg`

[I_BGK `: i h fY`Gh XYbhtg`](#) -`dchYbh]U`gh`XYbhYbei]f]Yg`Y["`"UXa`]gg]cbgz`ZYgž`dfc[fUa`gž`WfYX]hfU]bgZYf`

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fZ`*%&Ł`- ' ,) ``%+ -`-I_BGK `Gh Xm5VfcUX`UbX`I_BGK `9I WU]b[Y`fZc`f`]bVci bX`gh`XYbhtg`

7ci fgY'8YHJ]`g

I b]hg'cZ7 fYX]h*`

Gi a a UfmicZ\hY'7ci fgY

hfcXi W]cb'hc'hY' [Yca Yhf]WUbX'gdYWFU'dfcdYfh]Yg'cZfYa ch'`mgYbgYX'fgUH'`]hZ'UYf]U'cf'hYffYghf]U'Ł
]a U[Yg'cZ\hY'9Ufh'fg'gi fZUW'cf'cV'YWg''8YgW]dh]cb'cZUbU'c[i Y'UbX'X][]hU'`]a U[Yg'! d\c[fUd\mZ
Y'YWFc!cdh]WU'`UbX'a]Wck Uj Y'gmghYa g''H\Y'd\mg]Wg'cZj]g]V'Yz]bZUFYX'UbX'a]Wck Uj Y'fYa ch'`mgYbgYX
]a U[YfmZ]bW] X]b['Uha cgd\Yf]WYZZYWg''a U[Y' [Yca Yfm! W]bhfU'dfc'YW]cbZ'gWUb'UbX'a]Wck Uj Y
gmghYa g''H\Y'df]bW]d'Yg'cZghYfYcj]g]cb''bYf'cf]YbU]h]cb'cZWbhfU'dfc'YW]cbZ'V'`]bYUf]hmYei Uh]cbg'UbX
XYj]Uh]cbg'Zca 'V'`]bYUf]hm'9i hY]cf'cf]YbU]h]cb'cZgYbgcf'gmghYa g''C V'YWh[Yca YfmZca 'cj Yf'Udd]b[
]a U[YgZ'Zf'V'cW' d\c[fUd\mZcf'UYf]U'`UbX'WcgY'fUb[Y'Udd']W]h]cbg''8][]hU' d\c[fUa a Yhf]W
k cf_g]h]cbg'UbX'hY]f'Z bW]cbg''D\c[fUa a Yhf]Wdfc'YWh'd'Ubb]b[''a U[Y']bhfdfYU]h]cb''

7ci fgY'5]a g

Hc'Yi d'cfY'UbX'[U]b'Z fhYfi bXYfghUbX]b['cZfYa ch'`gYbg]b['Zcf'9Ufh'c'VgYfj Uh]cb'hfci [\ 'hY
]bj Ygh[Uh]cb'cZgUH'`]h'fYa ch'`gYbg]b['XUH'Z'Ug'k Y''Ug'X][]hU' d\c[fUd\]W]a U[]b['UbX'gW]bb]b[
hYXbc'c' []YgZ'k]h'U'X]fYWhYa d\Ug]g'cb'hY]f'Udd']W]h]cb'hc'a Udd]b['UbX'Ybj]fcb'a YbU'a cb]hc]b[''

Hc'dfYgYbhhY'df]bW]d'Yg'cZdfcW]gg]b['UYf]U'`UbX'gUH'`]h'Z'Ua Y'UbX'di g\!Vfcca 'VUgYX'X][]hU'`]a U[YgZ'
Ug'k Y''Ug'WcgY'fUb[Y'Z'Ua Y'`]a U[Yg'Zcf'XYh'fa]b]b['UWW'fUH'a Yhf]WXYfU]g'cZYi hfUWYX'cV'YWg'cf'9Ufh'
ZYU' h'Yg'Zcf']bdi h]bhc'X][]hU'`a Udd]b[ž; €'XUHUVUgYg'UbX'UbU'mgYgZ'UbX'Zcf'WcgY'fUb[Y'Udd']W]h]cbg''

Hc'dfYgYbhhY'VUg]Wdf]bW]d'Yg'cZUW'ei]g]h]cb'UbX'dfcW]gg]b['cZ@]XUf'XUH'Zcf'hY'XYh'fa]bUh]cb'cZ89A g
UbX'chYf]bZca Uh]cb'Yi hfUW]h]cb''

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

5Zhf'gi W]ggZ ''mWca d'Yh]b['h]g'W'ei fgYžmci 'g\ci 'X'VY'UV'Y'hc.

@YUfb]b['Ci hWca Y	95'GHJ[Y'%7ca dYHbW]Yg
%'`b] Ygh[UH'fYa ch'`gYbg]b['UbX'd\c[fUa a Yhf]Wcdh]cbg'Zcf]XYbh]Z'YX'Udd']W]h]cbg	D9%"%žD9%"&žD9%" žD9%"(ž D9' "(
&"5dd'mhYcfmhc'hY'`]a d'Ya YbU]h]cb'cZ\hY'W]cgYb'cdh]cb	D9%) žD9&"%žD9&" žD9' "" ž D9' ")
' ""5ddfYW]UH'hY'Wca d'Ya YbU]fmbU' h'fY'VYh'YYb'fYa ch' gYbg]b[žd\c[fUa a Yfm]UbX'gi f] Ym]b[D9%" žD9%"(žD9%)
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5j Uf]YmicZ\hUW]b['UW]h]h]Yg'k]''VY'WcbXi W]X'hc'a U]]a]gY'hUW]b['UbX''YUfb]b['ci hWca YgZ]bW] X]b[.

5ggYgga Ybh

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5 hYbXUbW'F Yei]fYa Ybhg

Gh XYbhg'UFY'ghfcb['mYbWci fU[YX'hc 'UhhYbX'U''WUggYg'UbX'fYj]Yk ''YWhi fY'fYWcfX]b[g"

7 ci fgY'GWXYXi `Y

[J \]Yk 'WUgg'ha YhUV`Y](#)

H]a YhUV`Y`

8UhY	HmdY	7cbhYbh
C!K YY_') 'GYdhYa VYf! - 'GYdhYa VYf		
K YY_ '%&'GYdhYa VYf !'%'GYdhYa VYf	@YWhi fY	bhfcXi W]cb'hc'7ci fgY/ bhfcXi W]cb'hc'fY'hc'chY'GYbg]b[/ 9`YWfcz bYh]WF UX b'-'8Yz]b]hcb / 'D g]Vg
K YY_ '&'%'GYdhYa VYf !'&'GYdhYa VYf	6`YbXYX	@YWhi fY!'GdYWFU'F .wUbwW'UbX'5ha c Yf]W 5hYbi Uhcb @UV!'cdh]WU'fYa chY'gYbg]b[
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K YY_ %\$. % ('Bcj Ya VYf ! '% 'Bcj Ya VYf	@YWhi fY	@UgYf'GWJbb]b[ž F Ya cHY 'GYbg]b[ž D\cłc [fUa a Yłfm' ; € /DWh[e[a` † UagđW eg_ _ Sđk
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H\Y`Wci fgY`k]`VY`a U]b`mVUgYX`cb`D8: `Z]Yg`cZDck Yfdc]bh`YWfi fY`g]XYg`Uj U]UV`Y`Uhih`Y`Wci fgY`A ccX`Y`g]h`"

H\Y`a UHf]U`k]`VY`i d`cUXYX`k YY`_`Vmik YY`_"

H\Y`Zc`ck]b[`UFY`fYWca a YbXYX`fYUX]b[`a UHf]U`g.

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% " 7 7 F G `k YVg]hY. `hd. ## k k "bfWJb"[WWU#bcXY# ' *'
& " "Df]bW]d`Yg`cZF Ya ch`G`Ybg]b["z`DUi `>`"7 i ffUb""@cbXcb/BYk `Mcf_`@cb[a Ubz`% ,) "
' " "D\mg]W]Df]bW]d`Yg`cZF Ya ch`G`Ybg]b["z`K]`Ua "; "F YYg"7 Ua Vf]X[YzI "? "/BYk `Mcf_`z`B M.
7 Ua Vf]X[Y`I b]j Yfg]miDfYggz`&\$`\$`% "
(" "b]fcXi W]cb`hc`a cXYfb`d`chc[fUa a Yhfm`z`A]_\U]`9`z`>"6Yh`Y`z`UbX`>"7 "A W `cbYz`K]Ymz`&\$`\$`% "
) " "9`Ya Yb]g`cZd`chc[fUa a Yhfm`z`DUi `F "K c`Z`A W fUk !<]`z`% , ' "
*" H\Y`I B G K `@]VfUfmi YVg]hY. `hd. ##]bZc"]VfUfmi b gk "YXi "Ui # YV#gYfj]Wg#gYfj]Wg`"h`a `

Gi Va]gg]cb'cZ5ggYgga YbhiHUg_g

D`YUgY`fYZf`h`h`Y`A`ccX`Y`dU[`Y`cZ`h`Y`W`i`fgY`Z`f`Z`f`h`Y`f`[`i`]XUbW`'cb`UggYgga Ybhgi Va]gg]cb"

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-)i `d`Y`f`X`U`m`z`Z`f`U`U`UggYgga Ybhg`k` \`Y`f`Y`U`d`Y`b`U`'h`m`U`d`'Y`g`z`W`U`d`d`Y`X`U`h`Z`j`Y`X`U`m`g`f`%`&`\$` \`c`i`f`g`l`z`U`Z`Y`f`k` \`j`W`'U`'g`h`X`Y`b`h`W`U`b`b`c`h`g`i` Va]h`U`b`U`g`g`Y`g`g`a`Y`b`h`z`U`b`X`'b`c`'d`Y`f`a`]h`Y`X`'j`U`f`]U`h`]c`b"

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

6Yk UFY`5b`Ugg][ba YbhH.Uh]bWĩ XYg`d`U[]Uf]gYX`a UHf]U`k]`fYW]j Y`U`\$i : U]žUbX`gh XYbtg`k \c

5 WUXYa]W**≠**Zcfa Uh]cb

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5ddYbX|l . '9b[]bYYfg'5i ghfU`U'f95Ł'DfcZYgg]cbU`'9b[]bYYf'7ca dYhYbWm
GHUbXUfX

Dfc[fUa ' bHYbXYX'@YUfb]b['Ci hWta Yg	
? bck `YX[Y'UbX'g_]`VUgY	
D9%"%7 ca dfY\Ybg]j YžhYcfmVUgYX'i bXYfghUbX]b['cZhY'i bXYfd]bb]b['bUh fU`UbX d\mg]WU`gWYbWg'UbX'hY'Yb[]bYYf]b['Z bXUa YbHU'g'Udd`]WUV'Y'hc'hY'Yb[]bYYf]b['X]gWd`]bY	
D9%"&'7 cbWdh U`i bXYfghUbX]b['cZhY'a UhYa Uh]Wgžbi a Yf]WU`UbU'mg]gžghUhgh]WgžUbX Wta di hYf'UbX']bZcfa Uh]cb'gWYbWg'k \]W' i bXYfd]b'hY'Yb[]bYYf]b['X]gWd`]bY	
D9%" " ' b!XYdh'i bXYfghUbX]b['cZgdYWU`]ghVcX]Yg'cZ_bck `YX[Y'k]h]b'hY'Yb[]bYYf]b[X]gWd`]bY	
D9%"('8]gWfba YbhcZ_bck `YX[Y'XYj Y`cda YbhUbX'fYgYUfW'X]fYW]cbg'k]h]b'hY Yb[]bYYf]b['X]gWd`]bY	
D9%") ? bck `YX[Y'cZYb[]bYYf]b['XYg][b'dfUW]W'UbX'WcbHYI h U`ZUWc'fg]a dUW]b['hY Yb[]bYYf]b['X]gWd`]bY	
D9%"* 'i bXYfghUbX]b['cZhY'gWc'dYždf]bWd`Ygžbcfa gžUW]c' bHUJ`]h]Yg'UbX'Vci bXg'cZ gi gh]bUV'Y'Yb[]bYYf]b['dfUW]W']b'hY'gdYW]ZWX]gWd`]bY	
9b[]bYYf]b['Udd`]WUh]cb'UV`]jm	
D9%"%5dd`]WUh]cb'cZYghUV`]g\YX'Yb[]bYYf]b['a YhlcXg'hc'Wta d'YI'Yb[]bYYf]b['dfcV'Ya gc`]b[
D9%"&'&: 'i YbhUdd`]WUh]cb'cZYb[]bYYf]b['hYW]b]ei Ygžhc'c'g'UbX'fYgci fW'g	
D9%" " '5dd`]WUh]cb'cZgmg]Ya Uh]WYb[]bYYf]b['gmbhYg]g'UbX'XYg][b'dfcW'ggYg	
D9%"('5dd`]WUh]cb'cZgmg]Ya Uh]WUddfcUW]Yg'hc'hY'WcbXi W]UbX'a UbU[Ya YbhcZYb[]bYYf]b[dfc'YW]g	
DfcZYgg]cbU`UbX'dYfgcbU`Uhf]Vi hYg	
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D9' ") 'C'fXYfma UbU[Ya YbhcZgY'Zi'UbX'dfcZYgg]cbU`WcbXi W]h	
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