

The colorwav package*

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The colorwav package defines a command to return the RGB values for a color corresponding to a given wavelength. The L^AT_EX code is based upon the FORTRAN code found at <http://www.efg2.com/Lab/ScienceAndEngineering/Spectra.htm> which is based upon Dan Bruton's FORTRAN code.

For more information on the mapping and the original FORTRAN code, see <http://www.midnightkite.com/color.html>

1 Basics

The physics of this is far too complicated to get into, but it may come about that you have a wavelength of light that you need to express as a color and this code will do that for you.

2 Descriptions

`\storeRGBofWavelength` `\storeRGBofWavelength{R value command}{G value command}{B value command}{wavelength}` stores the RGB values of *wavelength* in *R value command*, *G value command*, *B value command* respectively

3 Test Cases

3.1 Wavelengths in Nanometers (default)

`\storeRGBofWavelength`

*This document corresponds to colorwav v1.0, dated 2007/04/12.

<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{400}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{400}</code>	400
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{430}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{430}</code>	430
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{460}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{460}</code>	460
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{490}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{490}</code>	490
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{520}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{520}</code>	520
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{550}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{550}</code>	550
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{580}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{580}</code>	580
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{600}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{600}</code>	600
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{630}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{630}</code>	630
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{660}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{660}</code>	660
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{690}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{690}</code>	690

3.2 Wavelengths in Angstroms

`\storeRGBofWavelength`

Change the units to Angstroms `\setUnitsE{-10}`

<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{4000}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{4000}</code>	4000
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{4300}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{4300}</code>	4300
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{4600}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{4600}</code>	4600
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{4900}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{4900}</code>	4900
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{5200}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{5200}</code>	5200
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{5500}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{5500}</code>	5500
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{5800}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{5800}</code>	5800
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{6000}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{6000}</code>	6000
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{6300}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{6300}</code>	6300
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{6600}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{6600}</code>	6600
<code>\storeRGBofWavelength{\Rval}{\Gval}{\Bval}{6900}</code> <code>\textcolor[rgb]{\Rval,\Gval,\Bval}{6900}</code>	6900

4 Acknowledgments

Special Thanks to <http://www.efg2.com/Lab/ScienceAndEngineering/Spectra.htm> and Dan Bruton for placing their code online so that it may be translated to other languages.

5 Implementation

5.1 Constants and Parameters

```

\COLORWAV@gamma This is the gamma correction factor.
1 \newcommand{\COLORWAV@gamma}{0.8}%

\setGammaCorrection Allow the user to set the gamma correction
2 \newcommand{\setGammaCorrection}[1]{%
3 \renewcommand{\COLORWAV@gamma}{#1}%
4 }
```

`\COLORWAV@powerOfTen` The power of ten representing the units of the wavelength. λ is in 10 to the `\COLORWAV@powerOfTen` meters
5 `\newcommand{\COLORWAV@powerOfTen}{-9}`%

`\setUnitsE` Set the power of ten of the units
6 `\newcommand{\setUnitsE}[1]{%`
7 `\renewcommand{\COLORWAV@powerOfTen}{#1}`%
8 `}`%

`\COLORWAV@minWavelength` The minimum wavelength to accept
9 `\newcommand{\COLORWAV@minWavelength}{380}`%

`\setMinVisibleWavelength` Set the min wavelength
10 `\newcommand{\setMinVisibleWavelength}[1]{%`
11 `\renewcommand{\COLORWAV@minWavelength}{#1}`%
12 `}`%

`\COLORWAV@maxWavelength` Max visible wavelength
13 `\newcommand{\COLORWAV@maxWavelength}{780}`%

`\setMaxVisibleWavelength` Set the maximum visible wavelength
14 `\newcommand{\setMaxVisibleWavelength}[1]{%`
15 `\renewcommand{\COLORWAV@maxWavelength}{#1}`%
16 `}`%

5.2 Internal Functions

`\COLORWAV@colorAdjust` a function that adjust things.
17 `\newcommand{\COLORWAV@colorAdjust}[3]{%`
18 `\FPifzero{#2}`%
19 `\xdef#1{0}`%
20 `\else%`
21 `\FPmul{\COLORWAV@tempA}{#2}{#3}`%
22 `\FPpow{\COLORWAV@tempA}{\COLORWAV@tempA}{\COLORWAV@gamma}`%
23 `\xdef#1{\COLORWAV@tempA}`%
24 `\fi%`
25 `}`%

5.3 Internal Parameters

26 `\newboolean{COLORWAV@lessthansmallest}`%
27 `\newboolean{COLORWAV@greaterthanlargest}`%
28 `\newboolean{COLORWAV@isnearuv}`%
29 `\newboolean{COLORWAV@isviolet}`%
30 `\newboolean{COLORWAV@isindigo}`%
31 `\newboolean{COLORWAV@isblue}`%
32 `\newboolean{COLORWAV@isgreen}`%
33 `\newboolean{COLORWAV@isorange}`%
34 `\newboolean{COLORWAV@isnearir}`%

5.4 The Workhorse

```

\storeRGBofWavelength \storeRGBofWavelength{⟨R value command⟩}{⟨G value command⟩}{⟨B value
command⟩}{⟨wavelength⟩} stores the wavelength's R value number in ⟨R value
command⟩, etc
35 \newcommand{\storeRGBofWavelength}[4]{%
initialize booleans
36 \setboolean{COLORWAV@lessthansmallest}{false}%
37 \setboolean{COLORWAV@greaterthanlargest}{false}%
38 \setboolean{COLORWAV@isnearuv}{false}%
39 \setboolean{COLORWAV@isviolet}{false}%
40 \setboolean{COLORWAV@isindigo}{false}%
41 \setboolean{COLORWAV@isblue}{false}%
42 \setboolean{COLORWAV@isgreen}{false}%
43 \setboolean{COLORWAV@isorange}{false}%
44 \setboolean{COLORWAV@isnearir}{false}%

get the current units and convert to nanometers
45 \FPsub{\COLORWAV@tempA}{\COLORWAV@powerOfTen}{-9}%
46 \FPpow{\COLORWAV@tempA}{10}{\COLORWAV@tempA}%
47 \FPMul{\COLORWAV@thewavelen}{#4}{\COLORWAV@tempA}%

Now set the booleans based upon the wavelength. One can't just use the FP
conditionals since they aren't always expanded and this leads to "extra" \fi's
48 \FPiflt{\COLORWAV@thewavelen}{\COLORWAV@minWavelength}%
49 \setboolean{COLORWAV@lessthansmallest}{true}%
50 \fi%
51 %
52 \FPifgt{\COLORWAV@thewavelen}{\COLORWAV@maxWavelength}%
53 \setboolean{COLORWAV@greaterthanlargest}{true}%
54 \fi%
55 %
56 \FPiflt{\COLORWAV@thewavelen}{440}%
57 \setboolean{COLORWAV@isviolet}{true}%
58 \fi%
59 %
60 \FPiflt{\COLORWAV@thewavelen}{490}%
61 \setboolean{COLORWAV@isindigo}{true}%
62 \fi%
63 %
64 \FPiflt{\COLORWAV@thewavelen}{510}%
65 \setboolean{COLORWAV@isblue}{true}%
66 \fi%
67 %
68 \FPiflt{\COLORWAV@thewavelen}{580}%
69 \setboolean{COLORWAV@isgreen}{true}%
70 \fi%
71 %
72 \FPiflt{\COLORWAV@thewavelen}{645}%
73 \setboolean{COLORWAV@isorange}{true}%
74 \fi%

now determine what to do
75 \ifthenelse{ \boolean{COLORWAV@lessthansmallest} \OR \boolean{COLORWAV@greaterthanlargest} }%

```

```

76 {%
77 \gdef\COLORWAV@redValue{0}%
78 \gdef\COLORWAV@greenValue{0}%
79 \gdef\COLORWAV@blueValue{0}%
80 }%
81 {\ifthenelse{ \boolean{COLORWAV@isviolet} }%
82 {%
83 % R
84 \FPsub{\COLORWAV@tempA}{440}{\COLORWAV@minWavelength}%
85 \FPsub{\COLORWAV@tempB}{440}{\COLORWAV@thewavelen}%
86 \FPdiv{\COLORWAV@redValue}{\COLORWAV@tempB}{\COLORWAV@tempA}%
87 % G
88 \gdef\COLORWAV@greenValue{0.0}%
89 % B
90 \gdef\COLORWAV@blueValue{1.0}%
91 }%
92 {\ifthenelse{ \boolean{COLORWAV@isindigo} }%
93 {%
94 % R
95 \gdef\COLORWAV@redValue{0.0}%
96 % G
97 \FPsub{\COLORWAV@tempA}{490}{440}%
98 \FPsub{\COLORWAV@tempB}{\COLORWAV@thewavelen}{440}%
99 \FPdiv{\COLORWAV@greenValue}{\COLORWAV@tempB}{\COLORWAV@tempA}%
100 % B
101 \gdef\COLORWAV@blueValue{1.0}%
102 }%
103 {\ifthenelse{ \boolean{COLORWAV@isblue} }%
104 {%
105 %R
106 \gdef\COLORWAV@redValue{0.0}%
107 %G
108 \gdef\COLORWAV@greenValue{1.0}%
109 %B
110 \FPsub{\COLORWAV@tempA}{510}{490}%
111 \FPsub{\COLORWAV@tempB}{510}{\COLORWAV@thewavelen}%
112 \FPdiv{\COLORWAV@blueValue}{\COLORWAV@tempB}{\COLORWAV@tempA}%
113 }%
114 {\ifthenelse{ \boolean{COLORWAV@isgreen} }%
115 {%
116 %R
117 \FPsub{\COLORWAV@tempA}{580}{510}%
118 \FPsub{\COLORWAV@tempB}{\COLORWAV@thewavelen}{510}%
119 \FPdiv{\COLORWAV@redValue}{\COLORWAV@tempB}{\COLORWAV@tempA}%
120 %G
121 \gdef\COLORWAV@greenValue{1.0}%
122 %B
123 \gdef\COLORWAV@blueValue{0.0}%
124 }%
125 {\ifthenelse{ \boolean{COLORWAV@isorange} }%
126 {%
127 %R
128 \gdef\COLORWAV@redValue{1.0}%
129 %G

```

```

130 \FPsub{\COLORWAV@tempA}{645}{580}%
131 \FPsub{\COLORWAV@tempB}{645}{\COLORWAV@thewavelen}%
132 \FPdiv{\COLORWAV@greenValue}{\COLORWAV@tempB}{\COLORWAV@tempA}%
133 %B
134 \gdef\COLORWAV@blueValue{0.0}%
135 }%
136 % Else
137 {%
138 %R
139 \gdef\COLORWAV@redValue{1.0}%
140 %G
141 \gdef\COLORWAV@greenValue{0.0}%
142 %B
143 \gdef\COLORWAV@blueValue{0.0}%
144 }}}}

now adjust intensity to fall off near vision limits
145 \FPiflt{\COLORWAV@thewavelen}{420}%
146 \setboolean{COLORWAV@isnearuv}{true}%
147 \fi%
148 %
149 \FPifgt{\COLORWAV@thewavelen}{700}%
150 \setboolean{COLORWAV@isnearir}{true}%
151 \fi%
152 %
153 \ifthenelse{ \boolean{COLORWAV@lessthansmallest} \OR \boolean{COLORWAV@greaterthanlargest} }%
154 {%
155 \gdef\COLORWAV@multFactor{0}%
156 }%
157 {\ifthenelse{ \boolean{COLORWAV@isnearuv} }%
158 {%
159 \FPsub{\COLORWAV@tempA}{420}{\COLORWAV@minWavelength}%
160 \FPsub{\COLORWAV@tempB}{\COLORWAV@thewavelen}{\COLORWAV@minWavelength}%
161 \FPdiv{\COLORWAV@multFactor}{\COLORWAV@tempB}{\COLORWAV@tempA}%
162 \FPmul{\COLORWAV@multFactor}{0.7}{\COLORWAV@multFactor}%
163 \FPadd{\COLORWAV@multFactor}{0.3}{\COLORWAV@multFactor}%
164 }%
165 {\ifthenelse{ \boolean{COLORWAV@isnearir} }%
166 {%
167 \FPsub{\COLORWAV@tempA}{\COLORWAV@maxWavelength}{700}%
168 \FPsub{\COLORWAV@tempB}{\COLORWAV@maxWavelength}{\COLORWAV@thewavelen}%
169 \FPdiv{\COLORWAV@multFactor}{\COLORWAV@tempB}{\COLORWAV@tempA}%
170 \FPmul{\COLORWAV@multFactor}{0.7}{\COLORWAV@multFactor}%
171 \FPadd{\COLORWAV@multFactor}{0.3}{\COLORWAV@multFactor}%
172 }%
173 % Else
174 {%
175 \gdef\COLORWAV@multFactor{1.0}%
176 }}}}

finally, adjust and return the colors
177 \COLORWAV@colorAdjust{#1}{\COLORWAV@redValue}{\COLORWAV@multFactor}%
178 \COLORWAV@colorAdjust{#2}{\COLORWAV@greenValue}{\COLORWAV@multFactor}%
179 \COLORWAV@colorAdjust{#3}{\COLORWAV@blueValue}{\COLORWAV@multFactor}%
180 }%

```

Change History

v1.0

General: Initial Release 1

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