

SWIFT-UVOT-CALDB-16-R01

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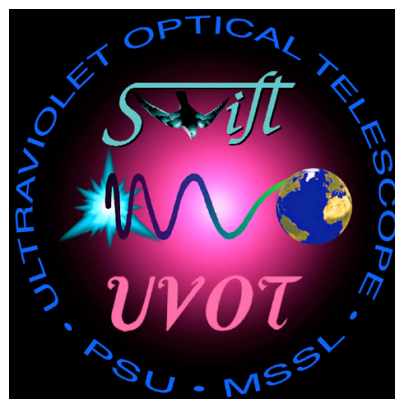
Revision #0

Revised by:

Pages Changed:

Comments:

First release of AB magnitude system for UVOT



SWIFT UVOT CALDB RELEASE NOTE

SWIFT-UVOT-CALDB-16-R01: AB magnitude system

1. Summary:

This product provides the in-orbit AB zeropoints and AB counts to flux conversion for the 7 lenticular filters of the UVOT.

2. Component Files:

FILE NAME	VALID DATE	RELEASE DATE	VERSION

3. Scope of Document:

This document contains a description of the product, expected future updates, warnings for the user, a list of data the product is based on and finally the analysis methods used to create the product.

4. Changes:

- This is the first release of the AB magnitude system for UVOT

5. Reason For Update:

6. Expected Updates:

Further updates may follow if the effective area curves are altered.

7. Caveat Emptor:

8. Data Used:

The effective areas as described in SWIFT-UVOT-CALDB-05-R03 ([uvot_caldb_effectiveareas_10wa.pdf](#)), and a simulated AB spectrum.

9. Description of Analysis:

The AB photometric system (Oke, 1974) can be defined by the response of our instrument to an input spectrum of 1 erg/s/cm²/hz. If we obtain a photon rate in each filter n_{phot} , then the corresponding Zeropoints are defined as:

$$Z = -48.6 - 2.5\text{LOG} (1/n_{phot}) \quad (1)$$

An AB spectrum of 1 erg/s/cm²/hz was convolved with the effective areas described in SWIFT-UVOT-CALDB-05-R03 for each of the optical (v , b and u) filters, UV ($uvw1$, $uvm2$, $uvw2$) filters and the *white* filter, to obtain n_{phot} . Equation (1) was then used to derive the zeropoints, given in Table 1. Using the Vega zeropoints defined in SWIFT-UVOT-CALDB-01-R04 (included in Table 1 for convenience) we can derive a correction from the Vega to AB photometric system, and this is also included in Table 1.

The errors on the Vega zeropoints reflect the scatter in the standard star measurements and the error on the standard star spectra, which were used to test and normalise the effective area curves (see SWIFT-UVOT-CALDB-01-R04). Thus our photometric system is only known to within these errors, and the AB magnitudes should have the same errors as the Vega magnitudes.

Filter	AB zeropoint (mag)	Error on AB zp (mag)	Vega zeropoint (mag)	Error on Vega zp (mag)	Correction to AB from Vega (mag)
<i>v</i>	17.88	0.01	17.89	0.01	-0.01
<i>b</i>	18.98	0.02	19.11	0.02	-0.13
<i>u</i>	19.36	0.02	18.34	0.02	1.02
<i>uvw1</i>	18.95	0.03	17.44	0.03	1.51
<i>uvm2</i>	18.54	0.03	16.85	0.03	1.69
<i>uvw2</i>	19.11	0.03	17.38	0.03	1.73
<i>white</i>	21.09	0.04	20.29	0.04	0.8

Table 1 AB zeropoints and comparison with Vega zeropoints

9.1. Counts to flux conversion factors:

Since n_{phot} is the number of photons produced by a spectrum with a constant flux of $1 \text{ erg/s/cm}^2/\text{hz}$, then the count rate to flux conversion factor (in frequency space) is $1/n_{phot}$. These factors are given in Table 2. The frequency at which the conversion factor is valid can be anywhere within the filter range since the flux is constant.

We can convert these factors to wavelength space by multiplying by (c/λ^2) , where c is the speed of light and λ is the effective wavelength of the filter when using the AB spectrum. These conversion factors are also included in Table 2. The second column gives the flux per photon in $\text{erg/s/cm}^2/\text{hz}$. The fourth column gives the flux per photon in $\text{erg/s/cm}^2/\text{\AA}$.

Filter	Counts to flux ratio (F_ν) *	Effective wavelength (λ) in \AA	Counts to flux ratio (F_λ) **	Error on ratio (F_λ)
<i>V</i>	2.547×10^{-27}	5410	2.611×10^{-16}	8.7×10^{-19}
<i>B</i>	9.211×10^{-28}	4321	1.480×10^{-16}	5.6×10^{-19}
<i>U</i>	6.567×10^{-28}	3442	1.663×10^{-16}	2.5×10^{-18}
<i>uvw1</i>	9.524×10^{-28}	2486	4.623×10^{-16}	1.4×10^{-17}
<i>uvm2</i>	1.396×10^{-27}	2221	8.489×10^{-16}	5.3×10^{-18}
<i>uvw2</i>	8.225×10^{-28}	1991	6.225×10^{-16}	1.3×10^{-17}
<i>White</i>	1.326×10^{-28}	2753	5.249×10^{-17}	7.0×10^{-18}

Table 2 Counts to flux conversion factors in frequency and wavelength space for the AB photometric system.

* Multiplying your count rate by this column gives you flux in $\text{erg/s/cm}^2/\text{hz}$.

** Multiplying your count rate by this column gives you flux in $\text{erg/s/cm}^2/\text{\AA}$.