The fits-astro package

v1.0.0

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The *fits-astro* package provides a simple interface to read Flexible Image Transport System (FITS) files and access their header to retrieve information. It relies on a custom Lua script and therefore requires the LuaLaTeX engine. Unlike more complex libraries, such as `astropy.io.fits` in Python, this package is designed solely for directly recovering key-value pairs from headers. It is *not* intended for modifying the header or fixing standardisation issues, let alone for reading the data part.

1 Loading the package

The package may be loaded in either of the following ways:

- `\usepackage{fits-astro}` if compiling with LuaLaTeX.
- `\input{fits-astro.tex}` if compiling with LuaTeX.

2 Package macros

`\loadheader` `\loadheader {⟨FITS identification⟩} {⟨FITS file path⟩}`

This macro reads the `FITS` file and allocates the header information to the specified FITS identification, which can either be a string or a control sequence (similarly to how `\newread` works for file streams). In the latter case, `\csstring` is used to convert the control sequence to a string for internal storage. Therefore, if a control sequence is specified, it does not actually contain the header in any way. As a result, the two inputs are interchangeable. The macro furthermore uses the `Kpathsea` library, so the file shouldn't necessarily be in the current directory.

```
\loadheader\flameHalpha{Halpha_raw.fits} % A frame of the Flame Nebula with H-alpha
  filter
\loadheader{flameHalpha}{Halpha_raw.fits} % Alternative way to load the file
```

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\showheader `\showheader {⟨FITS identification⟩}`

This macro displays the header information for the specified FITS identification in the log file.

```
\showheader\flameHalpha
\showheader{flameHalpha} % Would produce the same result
```

\headerkey `\headerkey {⟨FITS identification⟩} {⟨key⟩}`

This macro retrieves the value associated with the specified key from the header of the given FITS identification.

```
\headerkey\flameHalpha{OBJECT}\par
\headerkey\flameHalpha{FILTER}
```

NGC_2024
H-alpha

\setheaderkey \gsetheaderkey `\setheaderkey {⟨FITS identification⟩} {⟨key⟩} {⟨control sequence⟩}`

This macro retrieves the value associated with the specified key from the header of the given FITS identification and assigns it to the specified control sequence. The assignment is either local to the current group or global.

```
\tt
\begingroup
\setheaderkey\flameHalpha{EXPTIME}
   \exptime
\gsetheaderkey\flameHalpha{OBSERVER}
   \observer
\meaning\exptime\par
\endgroup
\meaning\exptime\par
\meaning\observer
```

```
macro:->3.00000000000E+002
undefined
macro:->Valentin Dao
```

Changelog

1.0.0 (06-04-2026) — Initial version.

3 Implementation

3.1 TEX package

```
⟨*package-tex⟩
\ifdefined\loadheader\expandafter\endinput\fi

\def\FITSerr#1{\errmessage{Package fits Error: #1}}
\def\FITSwar#1{\message{Package fits Warning: #1}}

\unless\ifdefined\directlua
  \FITSerr{LuaTeX required}
\fi

\directlua{dofile('fits-astro.lua')}

\def\loadheader#1#2{
  \directlua{
    local key = '\csstring#1'
    if FITS_data[key] then
      tex.print('\luaescapestring{\FITSerr{FITS file '#2' already loaded}}')
    else
      FITS_data[key] = load_fits('#2')
    end
  }
}

\def\showheader#1{
  \directlua{
    show_fits(FITS_data['\csstring#1'])
  }
}

\def\headerkey#1#2{
  \directlua{
    if FITS_data['\csstring#1']['#2'] then
      get_header_key(FITS_data['\csstring#1'], '#2')
    else
      tex.print('\luaescapestring{\FITSwar{Header key '#2' not found}}')
    end
  }
}

\def\setheaderkey#1#2#3{
  \directlua{
    if FITS_data['\csstring#1']['#2'] then
      token.set_macro('\csstring#3', FITS_data['\csstring#1']['#2'])
    end
```

```
  }
}

\def\gsetheaderkey#1#2#3{
  \directlua{
    if FITS_data['\csstring#1']['#2'] then
      token.set_macro('\csstring#3', FITS_data['\csstring#1']['#2'], 'global')
    end
  }
}
```
⟨/package-tex⟩

3.2 LaTeX package

⟨*package-latex⟩
```
\NeedsTeXFormat{LaTeX2e}
\ProvidesPackage{fits-astro}[2026-04-06 v1.0.0 Retrieving FITS file header information in Lu

\input{fits-astro.tex}
```
⟨/package-latex⟩