Fedora Astronomy
Integration of astronomical software into a Linux distribution

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Why should astronomical software be part of the distribution?

- Fair question
- We have distribution (or even OS-) independent approaches like conda and PyPI/pip (for Python)
- These approaches don't care about distribution specific stuff like SELinux at Fedora
- Requirement for creation of a Spin/Lab, a preconfigured, installable live distribution
- User should be able to work with just one software management application like APT or DNF

Advantages of packaging within a Linux distribution

- Clear packaging guidelines, e.g. well defined set of compiler flags
- Proper check of licensing ($\rightarrow$ talk from Ole Streicher)
- Complete builds from source, no convenience copies of libraries etc.
- Availability for many architectures (currently 7 in Fedora)
- Team maintainance
- Continuous Integration (CI), automatic rebuilds and test execution on dependency changes (e.g. updates)
- Ensure compatibility with the base operating system (common issue with ESO Scisoft)

History of Fedora Astronomy

2003	Fedora has been founded, some basic packages like cfitsio right from beginning
2008	Fedora SciTech Special Interest Group (SIG) has been founded **Fedora Astronomy SIG has been founded**
2008 -	Packaging of many important astronomical software
2016	**Fedora Astronomy Lab released with Fedora 24**

Fedora Science & Technology SIG

As many packages and tasks are not unique to a specific scientific domain:

- Fedora SciTech (Science & Technology) SIG has been founded
- Takes care of packaging of general packages, e.g. Python SciPy-Stack, TeXLive and Sage
- Package groups for scientific applications
- Handles questions like handling of BLAS/LAPACK implementations
- Contact for user questions
- https://fedoraproject.org/wiki/Category:SciTech_SIG

Fedora Astronomy SIG

The Astronomy SIG works on top of SciTech:

- Takes care of software and tasks specific for astronomy
- Creates ready to use live environment (installable): Astronomy Lab
- Coordinates collaboration with other distribution projects
- Fedora is "bazaar" style: everyone can follow and contribute, development is transparent, currently 4-5 active members
- Point of contact for users (Mailing list, IRC etc.)
- **Important: Be interesting for both amateurs and professionals**
- `https://fedoraproject.org/wiki/Category:Astronomy_SIG`

Fedora Astronomy packages: Data analysis

Most important and prominent packages

- Astropy and affiliated packages (e.g. ccdproc and photutils) in addition to the common SciPy-Stack, supports both Python 2 and Python 3
- AstrOmatic software (psfex, scamp, sextractor, swarp)
- astrometry.net plate solver
- cfitsio, ccfits
- CPL (ESO Common Pipeline Library)
- Ginga FITS viewer
- healpix (C, C++, Fortran, Java) and healpy
- PyVO (Python 2 and 3) for VO support
- wcstools
- wcslib

Important missing packages

Sadly some very important packages are missing in Fedora (or even all Linux distributions)

- IRAF
    - Contains non-free code from Numerical Recipes...
    - Quite unmaintained upstream (at least they pushed to Github this year)
    - From-source build complicated and unreliable on current systems (Thanks to Ole Streicher who is working on that!)
    - Some parts not usable anymore (X11IRAF) as they are 32 Bit only, but PyRAF solves that
    - Not distributable for any Linux distribution at the moment
- DS9
    - Mostly done, many bundled libraries
    - Good upstream support
    - Currently waiting for approval by Fedora Legal as it contains an MPEG encoder
- Non-official builds available

Fedora Astronomy for observatory control

- Provide a complete software solution for small observatories
- INDI: Instrument-Neutral-Distributed-Interface
- Supports several mounts, CCD (Apogee, QSI,...), filters, focusers etc.
- Client-Server structure
- Client: KStars with support for scheduling, astrometry etc.
- http://indilib.org/ and https://edu.kde.org/kstars/

How new software gets pushed to Fedora

- F Astronomy members check for new stuff at ASCL and astropy (new affiliated packages) regulary
- New packages are introduced in well-defined review process
  - Check for compliance with packaging guidelines
  - License check
  - Ensure proper packaging style in addition to guidelines, e.g. ensure that provided tests are executed
- Package gets added to the distribution
- Packages become part of astro-sig package group to ensure that all SIG members have access and loss of single contributors can be compensated

Currently WIP

General packages

- DS9 (packaged, some patent related stuff waiting. . .)
- IRAF (packaged, contains nonfree NR code. . .)
- PyRAF (packaged, but depends on IRAF)

VO packages

- Aladin (mostly done)
- DaCHS (in progress, latest release contains necessary changes)
- TOPCAT (packaging of dependencies started)

Fedora Astronomy Lab
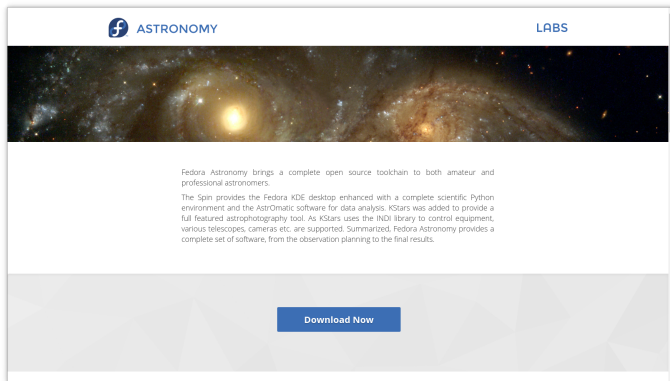
- Ready to use Fedora environment (based on Fedora KDE)
- Astropy + affiliated packages, IPython, AstrOmatic, INDI, much more
- https://labs.fedoraproject.org/astronomy/

Connection to other distributions
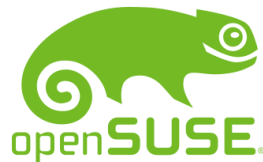
- Close collaboration with other distributions useful
  - Packaging guidelines quite similar
  - Many common tasks like library unbundling, license checks avoid duplicated work
  - Combined efforts have more power
  - More weight at discussions with upstream projects
- Close cooperation between Debian Astronomy and Fedora Astronomy since 2015
- Initially very close collaboration with Mageia

Other RPM based distributions

- Some work has been done for Mageia, but quite unmaintained
- Only few packages available for openSUSE and SUSE, e.g. astropy but no affiliated packages
- Idea: as these distributions use the same packaging format as Fedora, enhance the Fedora packaging to support them too
- Possible in a common build infrastructure, openSUSE Build Service (OBS)

Contributions back to science – Example: OpenNGC

A new variant of the New General Catalogue (NGC) and the Index Catalogue (IC) called OpenNGC has been released in summer 2017

- Initiated and compiled by Mattia Verga
- When packaging astrometry, we realized: The included NGC2000.0 catalog is not free (as in free speech)
- The second modern version of NGC/IC is also not free (Steinicke NGC/IC)
- Further investigation: Many free software applications, including KStars and Stellarium, contain a copy of these. . .
- Result: Mattia created OpenNGC using data from NASA/IPAC Extragalactic Database (NED), HyperLEDA etc., resulting in more precise positions than in Steinicke NGC/IC for example
- https://github.com/mattiaverga/OpenNGC

Conclusion and prospect

- Packaging of many important astronomical software packages for years
- Ready to use Fedora Astronomy Lab
- Well defined packaging and distribution process
- Proper collaboration with other projects like Debian Astronomy
- Sometimes nice results beside software: OpenNGC
- Future: Try to unify and enhance packaging for more distributions to get a unified experience over the most important distributions (Debian universe and RPM universe)

Thank you for your attention!

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