Christoph Gohlke

cgohlke@cgohlke.com • Irvine, California

Windows Binaries

These repositories provide rare, preview, or alternative binaries of open-source Python packages for the Windows operating system:

Wheels for Python for Windows on ARM64

Wheels for Python on Windows, linked to oneAPI MKL: numpy, scipy, numexpr, etc.

Geospatial library wheels for Python on Windows: GDAL, rasterio, Fiona, etc.

Pymol-open-source, **PyAlembic**, **PyLibTiff**, **Pygame**, **PyOpenGL**, **PyICU**, **TA-Lib**, **python-curses**, and **python-ldap**.

Open Source

These software packages for (mostly) the Python programming language are available from the **Python Package Index** and **GitHub.com**:

PhasorPy: an open-source Python library for the analysis of fluorescence lifetime and hyperspectral images using the phasor approach.

Liffile: read image and metadata from Leica image files (LIF, LOF, XLIF, XLCF, XLEF, and LIFEXT).

Ptufile: read and write PicoQuant PTU and related files (PHU, PCK, PCO, PFS, PUS, PQRES, PQDAT, PQUNI, SPQR, and BIN).

Fbdfile: read FLIMbox data and related files (FBD, FBF, and FBS.XML).

Tifffile: read and write TIFF files. Read image and metadata from many bio-scientific formats such as TIFF, BigTIFF, OME-TIFF, GeoTIFF, Adobe DNG, ZIF (Zoomable Image File Format), MetaMorph STK, Zeiss LSM, ImageJ hyperstack, Micro-Manager MMStack and NDTiff, SGI, NIHImage, Olympus FluoView and SIS, ScanImage, Molecular Dynamics GEL, Aperio SVS, Leica SCN, Roche BIF, PerkinElmer QPTIFF (QPI, PKI), Hamamatsu NDPI, Argos AVS, Philips DP, and ThermoFisher EER formatted files. Write image data to TIFF, BigTIFF, OME-TIFF, and ImageJ hyperstack compatible files in multi-page, volumetric, pyramidal, memory-mappable, tiled, predicted, or compressed form. Create kerchunk/fsspec ReferenceFileSystem files from TIFF.

Imagecodecs: in-memory buffer transformation, compression, and decompression codecs for Zlib (DEFLATE), GZIP, LZMA, ZStandard (ZSTD), Blosc, Brotli, Snappy, BZ2, LZ4, LZ4F, LZ4HC, LZ4H5, LZW, LZO, LZF, LZFSE, LZHAM, PGLZ (PostgreSQL LZ), RCOMP (Rice), ZFP, SZ3, Meshopt, Pcodec, SPERR, AEC, SZIP, LERC, EER, NPY, BCn, DDS, BMP, PNG, APNG, GIF, TIFF, WebP, JPEG (2 to 16-bit), Lossless JPEG (LJPEG, LJ92, JPEGLL), JPEG 2000 (JP2, J2K), High-throughput JPEG 2000 (HTJ2K, JPH), JPEG LS, JPEG XL, JPEG XS, JPEG XR (WDP, HD Photo), Ultra HDR (JPEG_R), MOZJPEG, AVIF, HEIF, QOI, RGBE (HDR), Jetraw, DICOMRLE, PackBits, Packed Integers, Delta, XOR Delta, Floating Point Predictor,

Bitorder reversal, Byteshuffle, Bitshuffle, Float24 (24-bit floating point), Bfloat16 (brain floating point), Quantize (Scale, BitGroom, BitRound, GranularBR), and CMS (color space transformations). Checksum functions are implemented for CRC-32, Adler-32, Fletcher-32, and Jenkins lookup3.

Lfdfiles: read, write, convert, and view many proprietary file formats used to store experimental data and metadata at the Laboratory for Fluorescence Dynamics: SimFCS VPL, VPP, JRN, BIN, INT, CYL, REF, BH, BHZ, B64, I64, Z64, and R64; GLOBALS LIF and ASCII; CCP4 MAP; Vaa3D RAW; Bio-Rad PIC; ISS Vista IFLI and IFI; FlimFast FLIF.

Roifile: read and write ImageJ ROI format.

Psdtags: read and write layered TIFF ImageSourceData and ImageResources tags.

Sdtfile: read time-correlated single photon counting (TCSPC) data from Becker & Hickl SDT files.

Czifile: read image and metadata from Carl Zeiss ZISRAW (CZI) microscopy files.

Oiffile: read image and metadata from Olympus Image Format (OIB and OIF) files.

Fcsfiles: read fluorescence correlation spectroscopy (FCS) data from Carl Zeiss ConfoCor raw and ASCII files.

Cmapfile: create Chimera MAP files from various file formats containing volume data.

Netpbmfile: read and write Netpbm image and related files (PBM, PGM, PPM, PNM, PAM, PGX, PF, Pf, PF4, and XV thumbnail).

Vidsrc: read frames from video files as NumPy arrays using Microsoft's DirectShow IMediaDet interface.

Qdafile: read and write KaleidaGraph version 3.x QDA data files.

Molmass: calculate the molecular mass (average, nominal, and isotopic pure), the elemental composition, and the mass distribution spectrum of a molecule given by its chemical formula, relative element weights, or sequence. Includes a database of physicochemical properties of the chemical elements.

Dnacurve: calculate the global structure of a DNA molecule from its nucleotide sequence according to the dinucleotide wedge model.

Transformations: calculate 4x4 matrices for translating, rotating, reflecting, scaling, shearing, projecting, orthogonalizing, and superimposing arrays of 3D homogeneous coordinates. Convert between rotation matrices, Euler angles, and quaternions. Includes an Arcball control object and functions to decompose transformation matrices.

Chebyfit: fit multi-exponential and harmonic functions to time- and frequency-domain fluorescence data/images using Chebyshev polynomials.

Psf: calculate point spread functions for fluorescence microscopy according to the complex integration representation for the diffraction by Richards and Wolf.

Icsdll: a ctypes interface to the Image Correlation Spectroscopy Dynamic Link Library (ICSx64.dll) for the Globals for Images SimFCS software. Implements ipCF, apCF, iMSD, lSTICS and other functions for the analysis of fluorescence time series data.

Lucam: a ctypes and NumPy based interface to the Lumenera USB cameras.

Imreg: implements an FFT-based technique for translation, rotation and scale-invariant image registration.

Akima: interpolate data points in a plane using a continuously differentiable spline built from piecewise cubic polynomials (Akima, JACM, 17(4), 589).

Fmkr: access FileMaker Server 8 Advanced databases via the XML publishing interface.

Uciwebauth: access identity management and authentication services at the University of California, Irvine (UCI): WebAuth, LDAP, and Active Directory user objects.

Czi2b64: a console application to convert Carl Zeiss Image CZI files containing Airyscan FCS data to SimFCS binary B64 files.

Tutorials

Advanced tutorials in Jupyter notebook format:

Ipcf.ipynb: pair correlation function analysis of fluorescence fluctuations in big image time series using Python. Presented at the Big Data Image Processing and Analysis (BigDIPA) workshop 2016-2018.

Simulate_diffusion.ipynb: simulate diffusion on a grid using Python.

Earthbigdata.ipynb: create a fsspec ReferenceFileSystem for a large set of remote GeoTIFF files.

Online Calculators

The online calculators are currently unavailable:

DNA Curvature Analysis: calculate the global 3D structure of a double-stranded DNA molecule from its nucleotide sequence according to the dinucleotide wedge model.

Molecular Mass Calculator: calculate the molecular mass, the elementary analysis, and the molecular mass distribution spectrum of a molecule based on the isotopic composition of the chemical elements.

Older Software

Research software written in Turbo Pascal, C, C++, LabVIEW, and Python:

vLFD Lifetime Demo (2007): an interactive Python script to display time and frequency domain fluorescence curves, fluorescence lifetime phasors and apparent single lifetimes as a function of excitation frequency, donor and acceptor lifetime, FRET efficiency, the percentage of donors undergoing FRET, the percentage of donor emission in the acceptor channel, the percentage of directly excited acceptors, the background intensity, and the excitation pulse width.

MolMass (2005): a Python desktop application to calculate the molecular mass, the elementary analysis, and the molecular mass distribution spectrum of a molecule based on the isotopic composition of the chemical elements.

FlimFast (2002): fluorescence lifetime imaging at video-rate. FlimFast enables continuous mode fluorescence lifetime image acquisition from fast frequency-domain, full-field fluorescence imaging hardware with concurrent analysis and visualization of multi-parameter image information.

FLImage (2000): a LabVIEW module for the acquisition of fluorescence lifetime images from frequency-domain, full-field fluorescence imaging hardware and subsequent image analysis and display.

FLOP97 (1998), the Fluorescence Lifetime Operating Program, measures fluorescence phase and modulation as a function of excitation light frequency and polarization for multiple samples relative to a reference. Licensed to the Max-Planck Institute for Biophysical Chemistry.

Absorption (1996): acquire absorption spectra from the Zeiss Specord M500 spectrometer on Windows and Macintosh computers.

FRET D&A Fit (1994): analyze Förster resonance energy transfer induced enhanced acceptor fluorescence from fluorescence emission spectra according to the $(\text{ratio})_A$ method.

CGMol (1992): interactive and scriptable visualization and analysis of biological macromolecules on Intel 486 based PCs with Tseng ET4000 graphics card and DOS operating system.

MolGraph (1990): visualization and analysis of molecules on Intel 386SX based PCs with VGA and DOS.

Publications

ORCID **0000-0001-8108-7707**

An open, integrated platform for multiplexed bioluminescence microscopy. Lorenzo Scipioni, Belen Torrado, Giulia Tedeschi, Lila Halbers, Zachary R Torrey, Erin B Fuller, Francesco Fersini, Christoph Gohlke, Andrej Luptak, Jennifer A Prescher, Michelle A Digman. *Preprint*. 2025. doi: 10.1101/2025.08.17.670750

Array programming with NumPy. Charles R Harris, K Jarrod Millman, Stéfan J van der Walt, Ralf Gommers, Pauli Virtanen, David Cournapeau, Eric Wieser, Julian Taylor, Sebastian Berg, Nathaniel J Smith, Robert Kern, Matti Picus, Stephan Hoyer, Marten H van Kerkwijk, Matthew Brett, Allan Haldane, Jaime Fernández Del Río, Mark Wiebe, Pearu Peterson, Pierre Gérard-Marchant, Kevin Sheppard, Tyler Reddy, Warren Weckesser, Hameer Abbasi, Christoph Gohlke, Travis E Oliphant. *Nature*. 2020; 585(7825): 357-362. doi: 10.1038/s41586-020-2649-2

Self-assembly of nanostructured polymetallaynes polymer. Ilaria Fratoddi, Christoph Gohlke, Cesare Cametti, Marco Diociaiuti, and Maria Vittoria Russo. *Polymer*. 2008; 49(15): 3211-3216. doi: 10.1016/j.polymer.2008.05.022. Source code: dimeropt.py

Fluorescence lifetime imaging microscopy of *Chlamydomonas reinhardtii*: non-photochemical quenching mutants and the effect of photosynthetic inhibitors on the slow chlorophyll fluorescence transient. Oliver Holub, Manfredo J Seufferheld, Christoph Gohlke, Govindjee, Gregor J Heiss, and Robert M Clegg. *J Microsc*. 2007; 226(2): 90-120. doi: 10.1111/j.1365-2818.2007.01763.x

Fluorescence lifetime-resolved imaging: measuring lifetimes in an image. Robert M Clegg, Oliver Holub, and Christoph Gohlke. In Biophotonics, Part A (*Methods in Enzymology*, Vol. 360). By G Marriott and I Parker (Editors). Academic Press, pp. 509-42, 2003. ISBN 012182263X. doi: 10.1016/S0076-6879(03)60126-6

Fluorescence lifetime imaging (FLI) in real-time - a new technique in photosynthesis research. Oliver Holub, Manfredo J Seufferheld, Christoph Gohlke, Govindjee, and Robert M Clegg. *Photosynthetica*. 2000; 8(4): 581-599. doi: 10.1023/A:1012465508465

Fluorescence characteristics of 5-carboxytetramethylrhodamine linked covalently to the 5' end of oligonucleotides: multiple conformers of single-stranded and double-stranded dye-DNA complexes. Gyorgy Vámosi, Christoph Gohlke, and Robert M Clegg. *Biophys J*. 1996; 71(2): 972-94.

doi: 10.1016/S0006-3495(96)79300-1

Kinking of DNA and RNA helices by bulged nucleotides observed by fluorescence resonance energy transfer. Christoph Gohlke, Alastair I H Murchie, David M J Lilley, and Robert M Clegg. *Proc Natl Acad Sci USA*. 1994; 91(24): 11660-4. doi: 10.1073/pnas.91.24.11660

A three-dimensional model for the hammerhead ribozyme based on fluorescence measurements. Thomas Tuschl, Christoph Gohlke, Thomas M Jovin, Erick Westhof, and Fritz Eckstein. *Science*. 1994; 266(5186): 785-9. doi: 10.1126/science.7973630. pdb: 1RMN

Posters and Abstracts

PhasorPy: an open-source Python library for the analysis of fluorescence lifetime and hyperspectral images using the phasor approach. Bruno Pannunzio, Bruno Schuty Teske, Michelle A Digman, Christoph Gohlke, Leonel S Malacrida. 69th Annual Meeting of the Biophysical Society, Los Angeles, California, 2025. *Biophys J*. 2025; 124 (3 Suppl. 1): 328a, 1562-Pos/B569.

Versatile rapid lifetime imaging. Glen I Redford, Christoph Gohlke, and Robert M Clegg. 47th Annual Meeting of the Biophysical Society, San Antonio, Texas, 2003. *Biophys J*. 2003; 84 (2 Suppl. S): 584, 2860-Pos/B459.

Imaging in skin and plants: using photons and fluorescence lifetimes to find the molecules and quantify the information. Kerry Hanson, Oliver Holub, Christoph Gohlke, Nicholas P Barry, Martin J Behne, Enrico Gratton, and Robert M Clegg. The 8th Biophysical Society Annual Meeting and Frontier Biophysics Symposium, Taiwan, ROC, 2002.

Fast macroscopic chlorophyll fluorescence lifetime imaging of apple fruit skin. Martin vandeVen, Oliver Holub, Christoph Gohlke, Govindjee, Roland Valcke, Marcel Ameloot, and Robert M Clegg. 46th Annual Meeting of the Biophysical Society, San Francisco, California, 2002. *Biophys J*. 2002; 82(1): 502a.

FliFast: Software for fast fluorescence lifetime-resolved image acquisition with concurrent analysis and visual feedback. Christoph Gohlke, Oliver Holub, and Robert M Clegg. 45th Annual Meeting of the Biophysical Society, Boston, Massachusetts, 2001. *Biophys J*. 2001; 80(1 Pt 2): 169a, 656.54-Pos.

Application of real-time fluorescence lifetime-resolved imaging in photosynthesis: studies of maize leaves (*Zea Mays*), small mustard leaves (*Arabidopsis Thaliana*), and of individual wild-type and mutant cells of the green alga *Chlamydomonas Reinhardtii*. Oliver Holub, Manfredo Seufferheld, Christoph Gohlke, Govindjee, and Robert M Clegg. 45th Annual Meeting of the Biophysical Society, Boston, Massachusetts, February 17-21, 2001. *Biophys J*. 2001; 80(1 Pt 2): 428a, 1819-Pos.

Real-time fluorescence lifetime-resolved images of individual cells of wild type and NPQ mutants of *Chlamydomonas reinhardtii*. Oliver Holub, Manfredo Seufferheld, Christoph Gohlke, Robert M Clegg, and Govindjee. 9th International Conference on the Cell and Molecular Biology of Chlamydamonas, Amsterdam, The Netherlands, 2000.

Want to know something about your fluorescent samples that optics cannot resolve? Long working-distance stage-scanning instrument for Real-Time Fluorescence Lifetime-Resolved Imaging. Oliver Holub, Christoph Gohlke, Manfredo Seufferheld, Govindjee, and Robert M Clegg. 44th Annual Meeting of the Biophysical Society, New Orleans, Louisiana, 2000. *Biophys J*. 2000; 78(1 Pt 2), 1464-Pos.

Photophysics of 5-carboxytetramethylrhodamine linked to the 5'-end of ss & ds DNA molecules. Gyorgy Vámosi, Christoph Gohlke, and Robert M Clegg. XIIth International Biophysics Congress, Amsterdam, The Netherlands. *Prog Biophys Mol Biol*. 1996; 65(Suppl 1): 76, P-B1-31.

doi: 10.1016/S0079-6107(97)80255-6

A 3-dimensional model for the hammerhead ribozyme from fluorescence resonance energy-transfer measurements. Thomas Tuschl, Christoph Gohlke, Thomas M Jovin, Eric Westhof, and Fritz Eckstein. Keystone Symposia on Molecular & Cellular Biology, Santa Fe, New Mexico, 1995. *J Cell Biochem*. 1995; 59(S19A): 218. doi: 10.1002/jcb.240591007

Structure of the hammerhead ribozyme from fluorescence resonance energy-transfer measurements. Thomas Tuschl, Christoph Gohlke, Thomas M Jovin, Eric Westhof, and Fritz Eckstein. *FASEB J*. 1994; 8(7): A1324-A1324.

Probing the conformation of DNA structures - 4-way junctions and bulges - with fluorescence. Gyorgy Vámosi, Christoph Gohlke, Alastair I H Murchie, David M J Lilley, and Robert M Clegg. 11th International Biophysics Congress, Budapest, Hungary, July 25-30, 1993.

Positions and Education

2006-2025: Specialist at the Department of Biomedical Engineering, University of California, Irvine.

1998-2006: Researcher at the Department of Physics, University of Illinois at Urbana-Champaign.

1993-1996: Scientific Employee at the Institute for Molecular Biology, Jena, Germany.

1992-1993: Diploma thesis at the Max Planck Institute for Biophysical Chemistry, Göttingen, Germany.

1988-1993: Student at the Georg-August-Universität Göttingen, Germany.

Other Achievements

Laboratory for Fluorescence Dynamics website (2006-2022)

Unofficial Windows Binaries for Python Extension Packages (2009-2022)

Python Software Foundation Fellow Membership - 2019 Q1 (2019)

Python Software Foundation Community Service Award – 2014 3rd Quarter (2014)

EKD Internet Award 1997 – WebFish Bronze – RU - Wissen und Meinung (1997)

Max Planck Institute for Biophysical Chemistry – 25th Anniversary Brochure (1996)