Summary

The evolution of drug resistance across kingdoms, including in cancer and infectious disease, is governed by the same fundamental laws. Modeling evolution with genotype-specific dose response curves, collectively forming a 'fitness seascape' enables simulations that include realistic pharmacokinetic constraints, more closely resembling the environmental conditions within a patient. FEArS (Fast Evolution on Arbitrary Seascapes) is a python package that enables simulating evolution with fitness seascapes. FEArS can simulate a wide variety of experimental conditions with many arbitrary biological parameters. FEArS remains computationally efficient despite being an agent-based model, even for very large population sizes. FEArS also contains powerful and flexible utilities for data analysis, plotting, and experimental fitness seascape estimation.

Statement of need

`Gala` is an Astropy-affiliated Python package for galactic dynamics. Python enables wrapping low-level languages (e.g., C) for speed without losing flexibility or ease-of-use in the user-interface. The API for `Gala` was designed to provide a class-based and user-friendly interface to fast (C or Cython-optimized) implementations of common operations such as gravitational potential and force evaluation, orbit integration, dynamical transformations, and chaos indicators for nonlinear dynamics. `Gala` also relies heavily on and interfaces well with the implementations of physical units and astronomical coordinate systems in the `Astropy` package [@astropy] (`astropy.units` and `astropy.coordinates`).

`Gala` was designed to be used by both astronomical researchers and by students in courses on gravitational dynamics or astronomy. It has already been used in a number of scientific publications [@Pearson:2017] and has also been used in graduate courses on Galactic dynamics to, e.g., provide interactive visualizations of textbook material [@Binney:2008]. The combination of speed, design, and support for Astropy functionality in `Gala` will enable exciting scientific explorations of forthcoming data releases from the *Gaia* mission [@gaia] by students and experts alike.

Mathematics

Single dollars ($) are required for inline mathematics e.g. $f(x) = e^{\pi/x}$

Double dollars make self-standing equations:

$$\Theta(x) = \left{\begin{array}{l} 0\textrm{ if } x < 0\cr 1\textrm{ else} \end{array}\right.$$

You can also use plain \LaTeX for equations \begin{equation}\label{eq:fourier} \hat f(\omega) = \int_{-\infty}^{\infty} f(x) e^{i\omega x} dx \end{equation} and refer to \autoref{eq:fourier} from text.

Citations

Citations to entries in paper.bib should be in rMarkdown format.

If you want to cite a software repository URL (e.g. something on GitHub without a preferred citation) then you can do it with the example BibTeX entry below for @fidgit.

For a quick reference, the following citation commands can be used:

- `@author:2001` -> "Author et al. (2001)"
- `[@author:2001]` -> "(Author et al., 2001)"
- `[@author1:2001; @author2:2001]` -> "(Author1 et al., 2001; Author2 et al., 2002)"

Figures

Figures can be included like this: Caption for example figure.\label{fig:example} and referenced from text using \autoref{fig:example}.

Figure sizes can be customized by adding an optional second parameter: Caption for example figure.{ width=20% }

Acknowledgements

We acknowledge contributions from Brigitta Sipocz, Syrtis Major, and Semyeong Oh, and support from Kathryn Johnston during the genesis of this project.

References