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# **fsph Documentation**

*Release 0.2.0*

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## Contents:

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<b>1</b>	<b>Installation</b>	<b>3</b>
<b>2</b>	<b>API Reference</b>	<b>5</b>
2.1	Tensorflow Operations . . . . .	5
<b>3</b>	<b>Indices and tables</b>	<b>7</b>
	<b>Python Module Index</b>	<b>9</b>
	<b>Index</b>	<b>11</b>



fsph is a library to compute series of complex spherical harmonics.

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**Note:** The Condon-Shortley phase is not included, although it is often used by many other libraries; to incorporate it, multiply the positive- $m$  spherical harmonics by  $(-1)^m$ .

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# CHAPTER 1

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## Installation

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Install from PyPI:

```
pip install --no-build-isolation fsph
```

Or from source:

```
git clone https://github.com/glotzerlab/fsph.git
cd fsph
python setup.py install
```





`fsph.pointwise_sph` (*phi*, *theta*, *lmax*, *negative\_m=True*)

Evaluate a series of spherical harmonics on an array of spherical coordinates.

The array objects *phi* and *theta* should have the same length and can hold single- or double-precision floating point numbers. The resulting array will be of length (N\_coordinates, N\_sphs) where N\_coordinates is the length of the given coordinate arrays.

To map the columns of the result array to particular (l, m) values, see `get_LMs()`.

#### Parameters

- **phi** – Array-like object of polar angles in [-pi, pi]
- **theta** – Array-like object of azimuthal angles in [0, 2\*pi]
- **lmax** – Integer maximum spherical harmonic degree to compute (inclusive)
- **negative\_m** – Set to False to disable the negative-m spherical harmonics

`fsph.get_LMs` (*lmax*, *negative\_m=True*)

Returns the (l, m) indices in the order that they are exposed by `fsph`.

Creates a (N\_sphs, 2) array where the first column corresponds to the l values and the second column corresponds to the m values for any index in the series.

## 2.1 Tensorflow Operations

As of version 0.2, `fsph` can also compute spherical harmonic series of points on the CPU and GPU using tensorflow. This module is automatically built when tensorflow is found while installing `fsph`. GPU support is enabled when CUDA (specifically, the `nvcc` binary) is found while installing `fsph`.

`fsph.tf_ops.spherical_harmonic_series` (*inputs*, *lmax*, *negative\_m*)

Compute a spherical harmonic series for a set of input points.

#### Parameters

- **inputs** – ( $\dots, 2$ ) array of (phi, theta) values
- **lmax** – Maximum spherical harmonic l to compute
- **negative\_m** – If True, compute for negative as well as positive m values

## CHAPTER 3

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### Indices and tables

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- genindex
- modindex
- search



**f**

fsph, 5



## F

`fsph` (*module*), 5

`fsph.tf_ops.spherical_harmonic_series()`  
(*in module fsph*), 5

## G

`get_LMs()` (*in module fsph*), 5

## P

`pointwise_sph()` (*in module fsph*), 5