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# **abelian Documentation**

***Release 0.2.0***

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A Python library for locally compact Abelian (LCA) groups.

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**Note:** This software is being built, and is not ready to be used yet.

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# CHAPTER 1

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## Project Goals

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- Classical groups  $\mathbb{R}$ ,  $\mathbb{T}$ ,  $\mathbb{Z}$  and  $\mathbb{Z}_n$  and computations on these.
- Relationship between continuous and discrete should be ‘pretty’.
- FFT computations on discrete, compact groups (and their products), e.g.  $\mathbb{Z}_{n_1} \oplus \mathbb{Z}_{n_2} \oplus \cdots \oplus \mathbb{Z}_{n_r}$ .
- The software should build on the mathematical theory.





## CHAPTER 2

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Todo

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- Create skeleton for project
- Factorizations of homomorphisms between FGAs (tests, docs, implementation)



## Software specification

### All public classes

<i>Function</i> (representation, domain)	A function on a LCA.
<i>Group</i> ()	

### All public functions

<i>hermite_normal_form</i> (A)	<b>param A</b>
<i>smith_normal_form</i> (A)	<b>param A</b>

### All public classes with methods

#### Methods for **Function**

<i>__init__</i> (representation, domain)	Create a function.
<i>call</i> (list_arg, *args, **kwargs)	Evaluate the function.
<i>compose</i> (func)	Compose with C -> C function.
<i>convolve</i> (other)	Convolution (if domain is discrete + compact).
<i>dft</i> ()	Discrete fourier transform (if domain is discrete + compact).

Continued on next page

Table 3.3 – continued from previous page

<i>pointwise</i> (func, operator)	Pointwise mult/add/...
<i>pullback</i> (morphism)	Pullback.
<i>pushfoward</i> (morphism)	Pushfoward.

## Methods for Group

<code>__init__()</code>
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## Developers

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## abelian

### abelian package

#### Subpackages

#### abelian.linalg package

#### Submodules

#### abelian.linalg.factorizations module

`hermite_normal_form(A)`

Parameters **A** –

`smith_normal_form(A)`

Parameters **A** –

#### abelian.linalg.utils module

`matrix_times_diag(A, diag_as_list)`

Parameters

- **A** –
- **diag\_as\_list** –

#### Module contents

#### Submodules



## abelian.function module

**class** **Function** (*representation, domain*)

Bases: `object`

A function on a LCA.

**call** (*list\_arg, \*args, \*\*kwargs*)

Evaluate the function.

**Parameters** *arg* –

**compose** (*func*)

Compose with C -> C function.

**Parameters** *other* –

**convolve** (*other*)

Convolution (if domain is discrete + compact).

**Parameters** *other* –

**dft** ()

Discrete fourier transform (if domain is discrete + compact).

**pointwise** (*func, operator*)

Pointwise mult/add/... .

**Parameters**

- **func** –
- **operator** –

**pullback** (*morphism*)

Pullback.

**Parameters** *morphism* –

**pushfoward** (*morphism*)

Pushfoward.

**Parameters** *morphism* –

## abelian.group module

**class** **Group**

Bases: `object`

## abelian.utils module

**identity** (*x*)

The identity mapping.

## Module contents

**class** **Function** (*representation, domain*)

Bases: `object`

A function on a LCA.

**call** (*list\_arg*, \**args*, \*\**kwargs*)

Evaluate the function.

**Parameters** *arg* –

**compose** (*func*)

Compose with C -> C function.

**Parameters** *other* –

**convolve** (*other*)

Convolution (if domain is discrete + compact).

**Parameters** *other* –

**dft** ()

Discrete fourier transform (if domain is discrete + compact).

**pointwise** (*func*, *operator*)

Pointwise mult/add/... .

**Parameters**

- **func** –
- **operator** –

**pullback** (*morphism*)

Pullback.

**Parameters** *morphism* –

**pushfoward** (*morphism*)

Pushfoward.

**Parameters** *morphism* –

**class Group**

Bases: `object`

## CHAPTER 5

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