The DimPy physical quantity package for Python

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Terminology

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- **A Dimension** stores the exponent of each SI unit in a Quantity or Unit.
- **A Unit** contains a Dimension, a unit name (“meter”) and a unit symbol (“m”). Meter, mile, second are units.
- **A Quantity** contains a Unit and a scalar multiple. Variables such as my_height and mass_of_moon would be Quantity instances.
Creating quantities and new units

In general, users do not need to explicitly construct a Dimension, Unit or Quantity. Instead, new Units and Quantities can be constructed from existing ones:

```python
>>> my_height = 1.8*meter
>>> mass_of_moon = 7.36e22*kilogram
```

DimPy will also check that standard operations are valid:

```python
>>> my_height + mass_of_moon
DimensionMismatchError: Addition, dimensions were (m) (kg)
```

It is also possible to define new units from existing ones:

```python
>>> Nm = newton*meter; Nm
```

```m N```
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Quantity methods

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```python
>>> my_height = 1.8*meter
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```python
>>> my_height.in_unit(foot)
'5.90551181102 ft'
```

```python
>>> my_height % inch
'70.8661417323 inch'
```

Quantity functions such as `is_scalar`, `type`, `have_same_dimensions` and `is_dimensionless` are also available to compare `Quantity` instances.
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Non-standard units

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To create a unit from a string the Flydim class is used:

```python
>>> house = Flydim('house')
>>> flat = Flydim('flat')
>>> house*flat
house flat
>>> house/flat
house flat^-1
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A Flyquant contains a Quantity and a Flydim, and are usually constructed from already existing Flydims and Quantities:

```python
>>> house = Flydim('house')
>>> street = 200*house
>>> length_of_house = 10*meter
>>> length_of_street = street*(length_of_house/house)
>>> length_of_street
2000.0 m
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One should view a `QuantMatrix` as follows:

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\begin{array}{cc}
\text{kg} & \text{mol} \\
m & 1.0 & 2.0 \\
s & 3.0 & 4.0 \\
\end{array}
\]

which represents the matrix:

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To create a QuantMatrix, the base matrix must be a child of numpy.ndarray and the two dimension vectors must be lists containing Dimension, Unit or Quantity types.

```python
>>> base_matrix = numpy.array([[1,2],[3,4]])
```

```python
>>> vertical = [meter, second]
>>> horizontal = [mile, mole]
```

```python
>>> A = QuantMatrix(base_matrix, [vertical, horizontal])
```

```
<table>
<thead>
<tr>
<th></th>
<th>m</th>
<th>mol</th>
</tr>
</thead>
<tbody>
<tr>
<td>m</td>
<td>1609.344</td>
<td>2.0</td>
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The base matrix or quantities can be changed after creation using attributes, but DimPy will check that the new values are compatible (i.e. that the size of the new matrix matches that of the old one).
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```python
>>> A[0,0]
1609.344 m^2
```
The shuffle function

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>>> shuffle(A, meter/second); A
   m^2 s^-1  m s^-1 mol
     s   1  2
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shuffle_vector may be a Dimension, Unit or Quantity.
Requesting Conversions

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Given an expression, DimPy will try to calculate its value and return an answer in SI units. A line is printed showing how the request was interpreted and the result:

```plaintext
---> 3 meters/(2 hours)*4 seconds
3*meter/(2*hour)*4*second = 0.00166666666667 m
```
The parser accepts two forms of multiplication and each will give a different interpretation.

---

1.0/ten million
1.0/(ten * million) = 1e-07

1.0/ten * million
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1.0/ten*million = 100000.0
Prefixes and Suffixes

A word is any string of non-whitespace characters, separated by whitespace. The parser will look for several sections in a word:

- A scalar multiple at the start of a word
- It will then look for an SI prefix (e.g. 'milli')
- Next some quantity ('mile')
- Then for an 's', to see if the word is plural.
- A number may then follow to represent an exponent. This exponent will act on the quantity and prefix, but not the scalar multiple.

Therefore, the most general word is of the form: 

\[ 1e3\text{millimeters}^2 \]

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----> new_variable = 3 meters
new_variable = 3*meter
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To recall the value, use the variable name as for a regular variable:

```
----> new_variable*4
new_variable*4 = 12.0 m
```
Live demo