# The MGv5 model structure

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## 1 particles.py

Each particle is defined as a dictionary, *e.g.* for the electron,

```
particles[0] = {
   'name':'e-',
   'antiname':'e+',
   'spin':2,
   'color':1,
   'mass':'ME',
   'width':'WE',
   'texname':'e^-',
   'antitexname':'e^+',
   'line':'S',
   'charge':-1
   }
```

All attributes are strings, except for `spin`, `color`, and `charge`. The number for the spin corresponds to $(2s+1)$, for color it is the representation. All particles can have a additional optional attribute that tags the particle as non propagating,

```
'propagating':False
```

The default value is `True`, in which case the attribute can be omitted.

## 2 parameters.py

Each parameter is defined as a dictionary, *e.g.* for the strong coupling,

```
parameters[0] = {
   'name':'gs',
   'nature':'external' / 'internal',
   'type':'real' / 'complex',
   'value': ...
   'texname':'g_s'
```

```
   }
```

For external parameters, `value` is a number, whereas for internal parameters it is an algebraic expression. For external parameters there are two more attributes linking the parameter to the corresponding entry in the `param_card.dat`,

```
   'lhablock':'SMINPUTS',
   'lhacode':[1,2,3,...],
```

# 3 vertices.py

Each vertex is represented as a dictionary, *e.g.* for the $u$, $\bar{u}$, $g$ vertex,

```
vertices[0] = {
   'particles':[u, u, g],
   'color':[ 'T(a3,i2,i1)', ...],
   'lorentz':[ L1, L2, ...],
   'couplings':[ (0,0):'g1', (0,1):'g2', ...],
   'orders':['QCD', ...]
   }
```

`color` is a list of all color structures appearing in the vertex. Similarly, `lorentz` is a list containing all Lorentz structures appearing in the vertex. Note that `'L1'`, `'L2'`, ... denote the classes of HELAS routines (See below). Finally, couplings is a list linking the couplings to the color and Lorentz structures, *i.e.*, `(0,0):'g1'` represents `g1 * T(a3, i2, i1) * L1`, *etc.*

# 4 couplings.py

```
couplings[0] = {
   'name':'g1',
   'expression': ...
   }
```

# 5 lorentz.py

```
buildingblocks[0] = {
   'name':'B1',
   'expression': ...
   }


lorentz[0] = {
   'name':'L1',
```

```
'particles':[2, 2, 1],
        # spin structure
'onshell':[{'L10': ...}]
        # there are two entries for fermions
'offshell':[ [ {'L11': ... }], [{'L12': ... }], ....]
        # L11 is the Lorentz structure L1 with particle 1 off shell, etc.
}
```