THE DYNKIN DIAGRAMS PACKAGE

BEN MCKAY

Contents

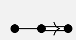
1. Quick introduction

Load the Dynkin diagram package (see options below)

```
\usepackage{dynkin-diagrams}
```

Invoke it

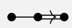
```
The Dynkin diagram of \(B_3\) is \dynkin{B}{3}.
```

The Dynkin diagram of B_3 is .

Date: January 12, 2018.

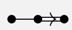
Use the long form inside a `tikz` statement . . .

```
\tikz \dynkin{B}{3};
```



. . . or a TikZ environment

```
\begin{tikzpicture}
\dynkin{B}{3}
\end{tikzpicture}
```



Indefinite rank Dynkin diagrams

```
\dynkin{B}{}
```

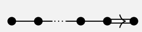
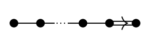
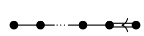
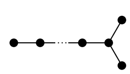
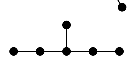
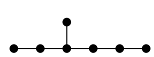
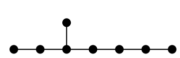
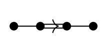


Table 1: The Dynkin diagrams of the reduced simple root systems [2] pp. 265–290, plates I–IX

A_n	
B_n	
C_n	
D_n	
E_6	
E_7	
E_8	
F_4	
G_2	

2. Set options globally

Most options set globally . . .

```
\pgfkeys{/Dynkin diagram,edgeLength=.5cm,foldradius=.5cm}
```

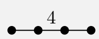
... or pass to the package

```
\usepackage[
     ordering=Kac,
     edge/.style=blue,
     mark=o,
     radius=.06cm]
     {dynkin-diagrams}
```

3. Coxeter diagrams

Coxeter diagram option

```
\dynkin[Coxeter]{F}{4}
```



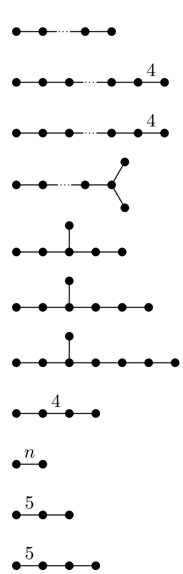
gonality option for G_2 and I_n Coxeter diagrams

```
\(G_2=\dynkin[Coxeter,gonality=n]{G}{2}\), \
\(I_n=\dynkin[Coxeter,gonality=n]{I}{}\)
```

$G_2 =$ , $I_n =$ 

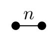
Table 2: The Coxeter diagrams of the simple reflection groups

A_n, B_n, C_n, D_n, E_6, E_7, E_8, F_4, G_2, H_3, H_4



continued below ...

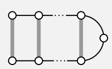
Table 2: (continued)

I_n 

4. Satake diagrams

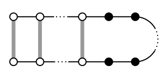
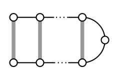
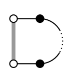
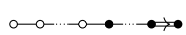
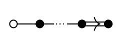
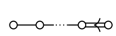
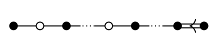
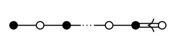
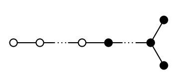
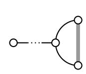
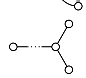
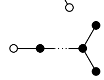
Satake diagrams use the standard name instead of a rank

```
\(A_{IIIb}=\dynkin{A}{IIIb}\)
```

$A_{IIIb} =$ 

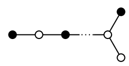
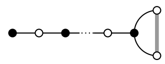
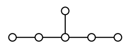
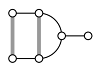
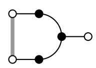
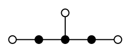
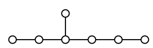
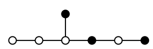
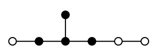
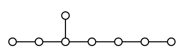
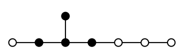
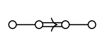
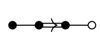
We use a solid gray bar to denote the folding of a Dynkin diagram, rather than the usual double arrow, since the diagrams turn out simpler and easier to read.

Table 3: The Satake diagrams of the real simple Lie algebras [9] p. 532–534

A_I	
A_{II}	
A_{IIIa}	
A_{IIIb}	
A_{IV}	
B_I	
B_{II}	
C_I	
C_{IIa}	
C_{IIb}	
D_{Ia}	
D_{Ib}	
D_{Ic}	
D_{II}	

continued below ...

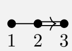
Table 3: (continued)

D_{IIIa}	
D_{IIIb}	
E_{I}	
E_{II}	
E_{III}	
E_{IV}	
E_{V}	
E_{VI}	
E_{VII}	
E_{VIII}	
E_{IX}	
F_{I}	
F_{II}	
G_{I}	

5. Labels for the roots

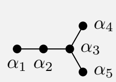
Label the roots by root number

```
\dynkin[label]{B}{3}
```



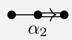
Make a macro to assign labels to roots

```
\dynkin[label,labelMacro/.code={\alpha_{#1}}]{D}{5}
```



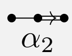
Make a label for a single root

```
\begin{tikzpicture}
\dynkin{B}{3}
\dynkinLabelRoot{2}{\alpha_2}
\end{tikzpicture}
```



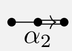
Use a text style

```
\begin{tikzpicture}
\dynkin[text/.style={scale=1.2}]{B}{3};
\dynkinLabelRoot{2}{\alpha_2}
\end{tikzpicture}
```



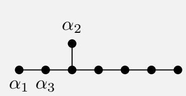
Access root labels via TikZ

```
\begin{tikzpicture}
\dynkin{B}{3};
\node[below] at (root 2) {\(\alpha_2\)};
\end{tikzpicture}
```



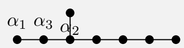
The labels have default locations

```
\begin{tikzpicture}
\dynkin{E}{8};
\dynkinLabelRoot{1}{\alpha_1}
\dynkinLabelRoot{2}{\alpha_2}
\dynkinLabelRoot{3}{\alpha_3}
\end{tikzpicture}
```



The starred form flips labels to alternate locations

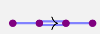
```
\begin{tikzpicture}
\dynkin{E}{8};
\dynkinLabelRoot*{1}{\alpha_1}
\dynkinLabelRoot*{2}{\alpha_2}
\dynkinLabelRoot*{3}{\alpha_3}
\end{tikzpicture}
```



6. Style

Colours

```
\dynkin[edge/.style={blue!50,thick},*/.style=blue!50!red]{F}{4}
```

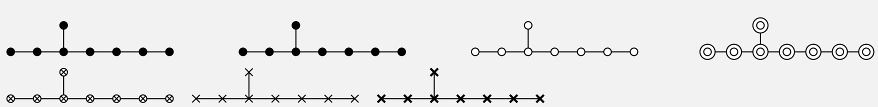


Edge lengths

```
\dynkin[edgeLength=1.2,parabolic=3]{A}{3}
```


Root marks

```
\dynkin{E}{8}
\dynkin[mark=*]{E}{8}
\dynkin[mark=o]{E}{8}
\dynkin[mark=O]{E}{8}
\dynkin[mark=t]{E}{8}
\dynkin[mark=x]{E}{8}
\dynkin[mark=X]{E}{8}
```



At the moment, you can only use:

`*` solid dot

`o` hollow circle

`O` double hollow circle

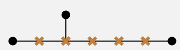
`t` tensor root

`x` crossed root

`X` thickly crossed root

Mark styles

```
\dynkin[parabolic=124,x/.style={brown,very thick}]{E}{8}
```



Sizes of root marks

```
\dynkin[radius=.08cm,parabolic=3]{A}{3}
```

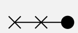


Table 4: Classical Lie superalgebras [7]. We need a slightly larger radius parameter to distinguish the tensor product symbols from the solid dots.

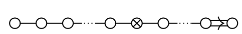
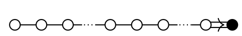
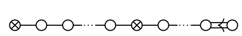
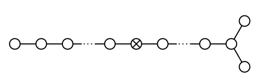
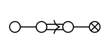
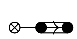
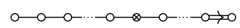
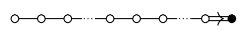
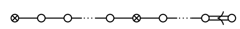
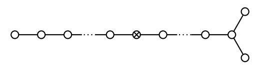
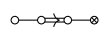
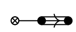
A_{mn}	
B_{mn}	
B_{0n}	
C_n	
D_{mn}	
$D_{21\alpha}$	
F_4	
G_3	

Table 5: Classical Lie superalgebras [7]. Here we see the problem with using the default radius parameter, which is too small for tensor product symbols.

A_{mn}	

continued below ...

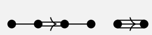
Table 5: (continued)

B_{mn}	
B_{0n}	
C_n	
D_{mn}	
$D_{21\alpha}$	
F_4	
G_3	

7. Suppress or reverse arrows

Some diagrams have double or triple edges

```
\dynkin{F}{4}
\dynkin{G}{2}
```

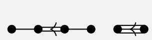


Suppress arrows

```
\dynkin[arrows=false]{F}{4}
\dynkin[arrows=false]{G}{2}
```


Reverse arrows

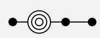
```
\dynkin[reverseArrows]{F}{4}
\dynkin[reverseArrows]{G}{2}
```



8. Drawing on top of a Dynkin diagram

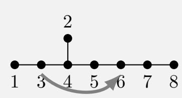
TikZ can access the roots themselves

```
\begin{tikzpicture}
\dynkin{A}{4};
\fill[white,draw=black] (root 2) circle (.15cm);
\fill[white,draw=black] (root 2) circle (.1cm);
\draw[black] (root 2) circle (.05cm);
\end{tikzpicture}
```



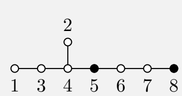
Draw curves between the roots

```
\begin{tikzpicture}
\dynkin[label]{E}{8}
\draw[very thick, black!50,-latex]
        (root 3.south) to [out=-45, in=-135] (root 6.south);
\end{tikzpicture}
```



Change marks

```
\begin{tikzpicture}
\dynkin[mark=o,label]{E}{8};
\dynkinRootMark{*}{5}
\dynkinRootMark{*}{8}
\end{tikzpicture}
```

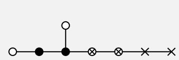


9. Mark lists

The package allows a list of root marks instead of a rank:

A mark list

```
\dynkin{E}{oo**ttxx}
```



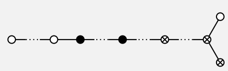
The mark list `oo**ttxx` has one mark for each root: `o`, `o`, . . . , `x`. Roots are listed in the current default ordering. (Careful: in an affine root system, a mark list will *not* contain a mark for root zero.)

10. Indefinite edges

An *indefinite edge* is a dashed edge between two roots, indicating that an indefinite number of roots have been omitted from the Dynkin diagram. In between any two entries in a mark list, place a period to indicate an indefinite edge:

Indefinite edges

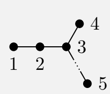
```
\dynkin{D}{o.o*.*.t.to.t}
```



In certain diagrams, roots may have an edge between them even though they are not subsequent in the ordering. For such rare situations, there is an option:

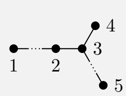
Indefinite edge option

```
\dynkin[makeIndefiniteEdge={3-5},label]{D}{5}
```



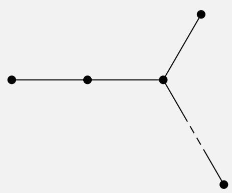
Give a list of edges to become indefinite

```
\dynkin[makeIndefiniteEdge/.list={1-2,3-5},label]{D}{5}
```



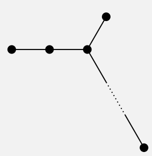
Indefinite edge style

```
\dynkin[indefiniteEdge/.style={draw=black,fill=white,thin,densely
    dashed},%
        edgeLength=1cm,%
        makeIndefiniteEdge={3-5}]
        {D}{5}
```



The ratio of the lengths of indefinite edges to those of other edges

```
\dynkin[edgeLength = .5cm,%
        indefiniteEdgeRatio=3,%
        makeIndefiniteEdge={3-5}]
        {D}{5}
```



11. Parabolic subgroups

Each set of roots is assigned a number, with each binary digit zero or one to say whether the corresponding root is crossed or not:

```
The flag variety of pointed lines in
projective 3-space is associated to
the Dynkin diagram \dynkin[parabolic=3]{A}{3}.
```

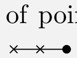
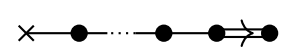
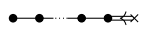
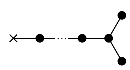
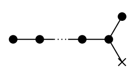
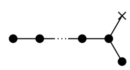
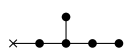
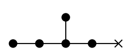
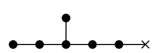
The flag variety of pointed lines in projective 3-space is associated to the Dynkin diagram .

Table 6: The Hermitian symmetric spaces

A_n		Grassmannian of k-planes in $\mathbb{C}^{n+1}$

continued below . . .

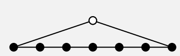
Table 6: (continued)

B_n		$(2n-1)$-dimensional hyperquadric, i.e. the variety of null lines in $\mathbb{C}^{2n+1}$
C_n		space of Lagrangian n-planes in $\mathbb{C}^{2n}$
D_n		$(2n-2)$-dimensional hyperquadric, i.e. the variety of null lines in $\mathbb{C}^{2n}$
D_n		one component of the variety of maximal dimension null subspaces of $\mathbb{C}^{2n}$
D_n		the other component
E_6		complexified octave projective plane
E_6		its dual plane
E_7		the space of null octave 3-planes in octave 6-space

12. Extended Dynkin diagrams

Extended Dynkin diagrams

```
\dynkin[extended]{A}{7}
```



The extended Dynkin diagrams are also described in the notation of Kac [11] p. 55 as affine untwisted Dynkin diagrams: we extend `\dynkin{A}{7}` to become `\dynkin{A}[1]{7}`:

Extended Dynkin diagrams

```
\dynkin{A}[1]{7}
```

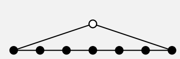
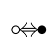
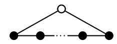


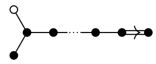
Table 7: The Dynkin diagrams of the extended simple root systems

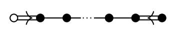
$\tilde{A}_1$ 

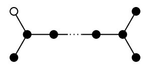
continued below ...

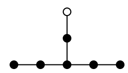
Table 7: (continued)

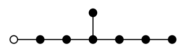
$\tilde{A}_n$ 

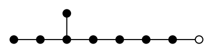
$\tilde{B}_n$ 

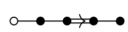
$\tilde{C}_n$ 

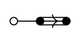
$\tilde{D}_n$ 

$\tilde{E}_6$ 

$\tilde{E}_7$ 

$\tilde{E}_8$ 

$\tilde{F}_4$ 

$\tilde{G}_2$ 

13. Affine twisted and untwisted Dynkin diagrams

The affine Dynkin diagrams are described in the notation of Kac [11] p. 55:

Affine Dynkin diagrams

```
\(A^{(1)}_7=\dynkin{A}[1]{7}, \
E^{(2)}_6=\dynkin{E}[2]{6}, \
D^{(3)}_4=\dynkin{D}[3]{4}\)
```

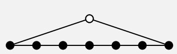
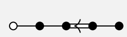
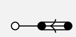
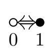
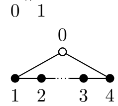
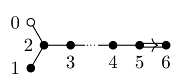
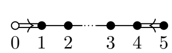
$A^{(1)}_7 =$ , $E^{(2)}_6 =$ , $D^{(3)}_4 =$ 

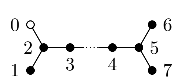
Table 8: The affine Dynkin diagrams

A^1_1 

A^1_ℓ 

B^1_ℓ 

C^1_ℓ 

D^1_ℓ 

continued below ...

Table 8: (continued)

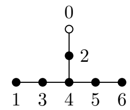
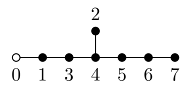
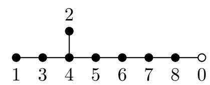
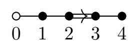
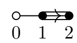
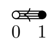
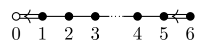
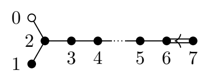
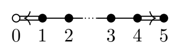
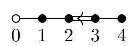
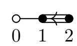
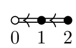
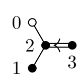
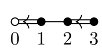
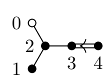
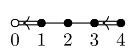
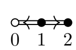
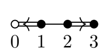
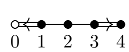
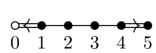
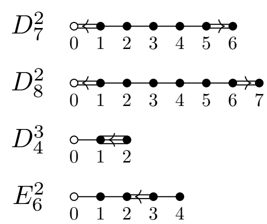
E_6^1	
E_7^1	
E_8^1	
F_4^1	
G_2^1	
A_2^2	
$A_{2\ell}^2$	
$A_{2\ell-1}^2$	
D_ℓ^2	
E_6^2	
D_4^3	

Table 9: Some more affine Dynkin diagrams

A_4^2	
A_5^2	
A_6^2	
A_7^2	
A_8^2	
D_3^2	
D_4^2	
D_5^2	
D_6^2	

continued below . . .

Table 9: (continued)



14. Extended Coxeter diagrams

Extended and Coxeter options together

```
\dynkin[extended,Coxeter]{F}{4}
```

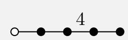
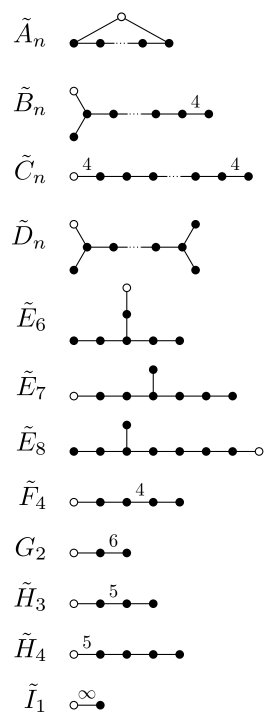


Table 10: The extended (affine) Coxeter diagrams



15. Kac style

We include a style called `Kac` which tries to imitate the style of [11].

Kac style

```
\dynkin[Kac]{F}{4}
```

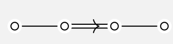
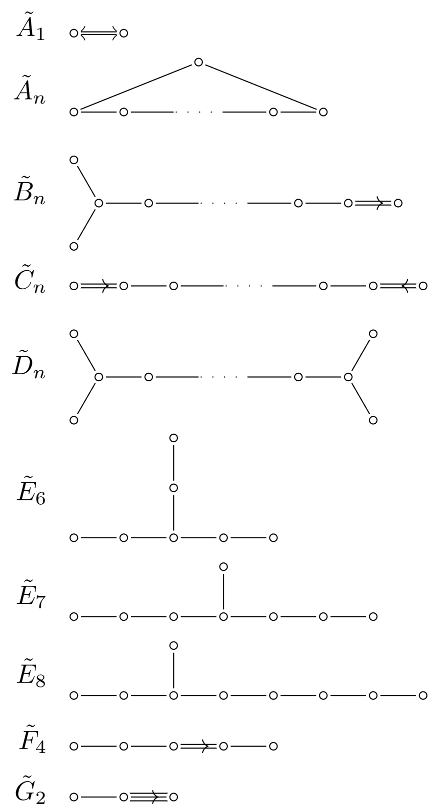


Table 11: The Dynkin diagrams of the extended simple root systems in Kac style

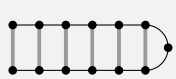


16. Folded Dynkin diagrams

The Dynkin diagrams package has limited support for folding Dynkin diagrams.

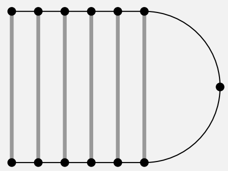
Folding

```
\dynkin[fold]{A}{13}
```



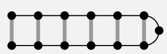
Big fold radius

```
\dynkin[fold,foldradius=1cm]{A}{13}
```



Small fold radius

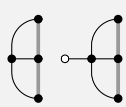
```
\dynkin[fold,foldradius=.2cm]{A}{13}
```



Some Dynkin diagrams have multiple foldings, which we attempt to distinguish (not entirely successfully) by their *ply*: the maximum number of roots folded together. Most diagrams can only allow a 2-ply folding, so `fold` is a synonym form `ply=2`.

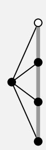
3-ply

```
\dynkin[ply=3]{D}{4}
\dynkin[ply=3]{D}[1]{4}
```



4-ply

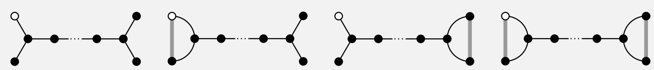
```
\dynkin[ply=4]{D}[1]{4}
```



The $D_\ell^{(1)}$ diagrams can be folded on their left end and separately on their right end:

Left, right and both

```
\dynkin{D}[1]{} \
\dynkin[foldleft]{D}[1]{} \
\dynkin[foldright]{D}[1]{} \
\dynkin[fold]{D}[1]{}
```



We have to be careful about the 4-ply foldings of $D^{(1)}_{2\ell}$, for which we can have two different patterns, so by default, the package only draws as much as it can without distinguishing the two:

Default $D^{(1)}_{2\ell}$ and the two ways to finish it

```
\begin{tikzpicture}
\dynkin[ply=4]{D}[1]{****.*****.*****}%
\end{tikzpicture} \
\begin{tikzpicture}
\dynkin[ply=4]{D}[1]{****.*****.*****}%
\dynkinFold[bend right=65]{1}{13}%
\dynkinFold[bend right=65]{0}{14}%
\end{tikzpicture} \
\begin{tikzpicture}
\dynkin[ply=4]{D}[1]{****.*****.*****}%
\dynkinFold{0}{1}%
\dynkinFold{1}{13}%
\dynkinFold{13}{14}%
\end{tikzpicture}
```

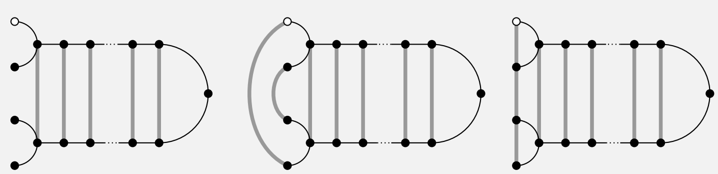
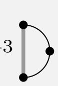
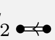


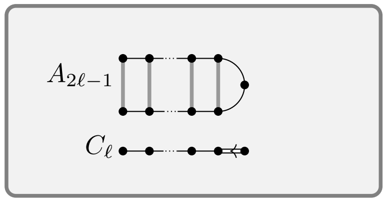
Table 12: Some foldings of Dynkin diagrams

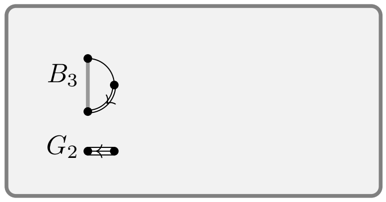
A_3 

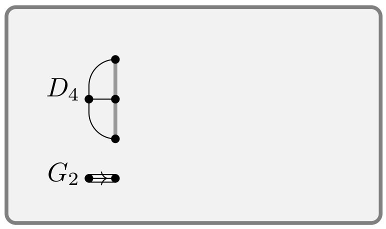
C_2 

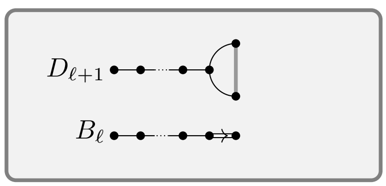
continued below . . .

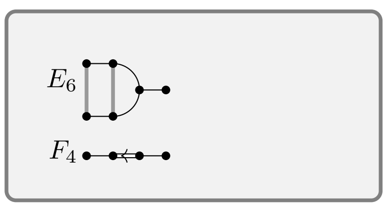
Table 12: (continued)

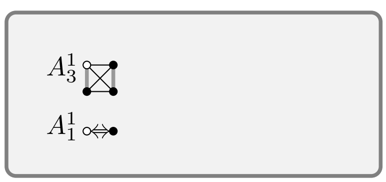






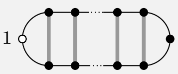


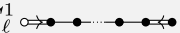


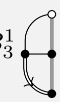


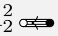
continued below . . .

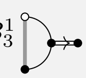
Table 12: (continued)

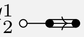
$A^1_{2\ell-1}$ 

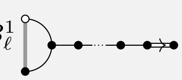
C^1_ℓ 

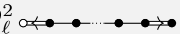
B^1_3 

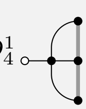
A^2_2 

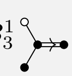
B^1_3 

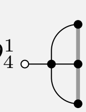
G^1_2 

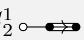
B^1_ℓ 

D^2_ℓ 

D^1_4 

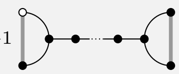
B^1_3 

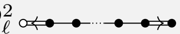
D^1_4 

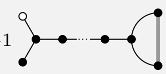
G^1_2 

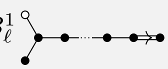
continued below . . .

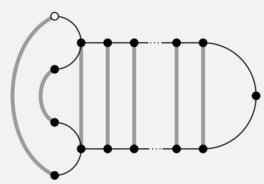
Table 12: (continued)

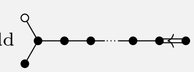
$D^1_{\ell+1}$


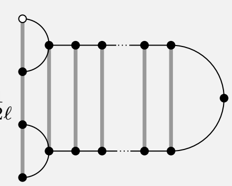
D^2_ℓ


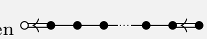
$D^1_{\ell+1}$


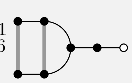
B^1_ℓ


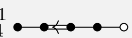
$D^1_{2\ell}$


A^2_{odd}


$D^1_{2\ell}$


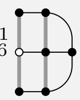
A^2_{even}


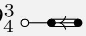
E^1_6


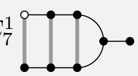
F^1_4


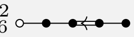
continued below . . .

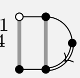
Table 12: (continued)

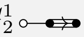
E_6^1 

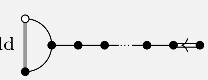
D_4^3 

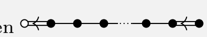
E_7^1 

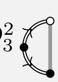
E_6^2 

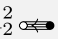
F_4^1 

G_2^1 

A^2_{odd} 

A^2_{even} 

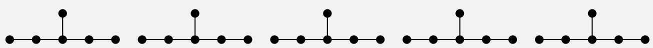
D_3^2 

A_2^2 

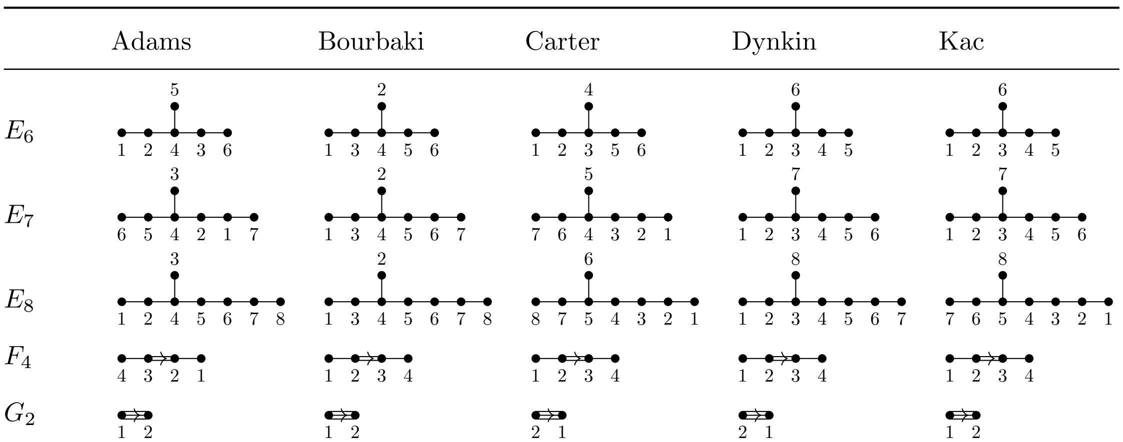
17. Root ordering

Root ordering

```
\dynkin[ordering=Adams]{E}{6}
\dynkin[ordering=Bourbaki]{E}{6}
\dynkin[ordering=Carter]{E}{6}
\dynkin[ordering=Dynkin]{E}{6}
\dynkin[ordering=Kac]{E}{6}
```



Default is Bourbaki.

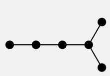


18. Naming Dynkin diagrams and connecting different ones

We can make some sophisticated folded diagrams by drawing multiple diagrams, each with a name:

Name a diagram

```
\dynkin[name=Bob]{D}{6}
```

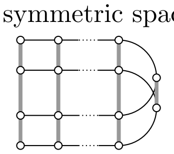


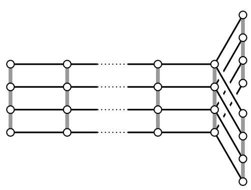
We can then connect the two with folding edges:

Connect diagrams

```
\begin{tikzpicture}
\dynkin[name=upper]{A}{3}
\dynkin[name=lower]{A}{3}
\foreach \i in {1,...,3}%
{%
        \draw[/Dynkin diagram/foldStyle] ($(upper root \i)$) --
    ($(lower root \i)$);%
}%
\end{tikzpicture}
```


The following diagrams arise in the Satake diagrams of the pseudo-Riemannian symmetric spaces [1].

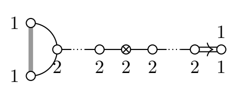


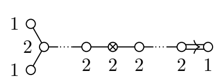


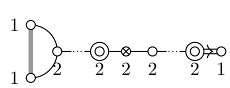
19. Other examples

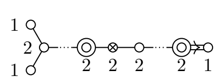
Table 14: The Vogan diagrams of some affine Lie superalgebras [16, 15]

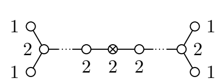
$\mathfrak{sl}\,(2m|2n)^{(2)}$





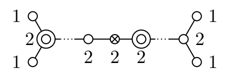
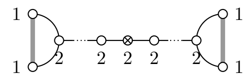
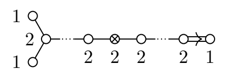
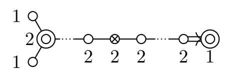
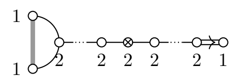
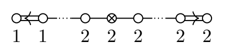
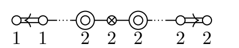
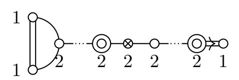
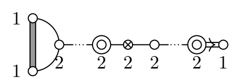
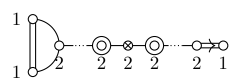
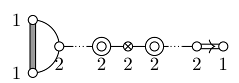
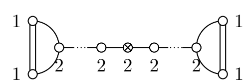
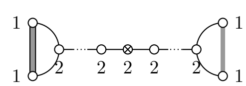
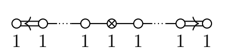
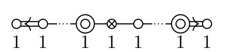
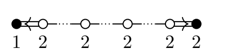
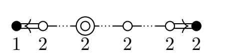
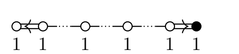






continued below ...

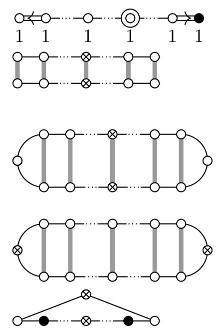
Table 14: (continued)

	
	
$\mathfrak{sl}\,(2m+1\|2n)^2$	
	
	
$\mathfrak{sl}\,(2m+1\|2n+1)^2$	
	
$\mathfrak{sl}\,(2\|2n+1)^{(2)}$	
	
	
	
$\mathfrak{sl}\,(2\|2n)^{(2)}$	
	
$\mathfrak{osp}\,(2m\|2n)^{(2)}$	
	
$\mathfrak{osp}\,(2\|2n)^{(2)}$	
	
$\mathfrak{sl}\,(1\|2n+1)^4$	

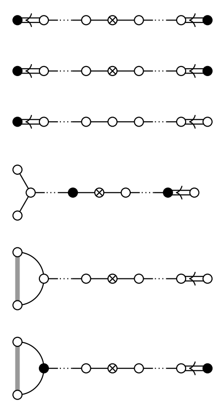
continued below ...

Table 14: (continued)

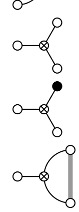
A^1



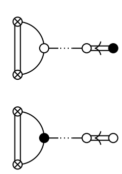
B^1



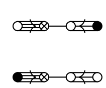
D^1



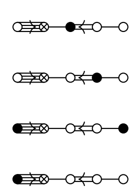
C^1



F^1



G^1



20. Syntax

The syntax is `\dynkin[<options>]{<letter>}[<twisted rank>]{<rank>}` where `<letter>` is A, B, C, D, E, F or G, the family of root system for the Dynkin diagram, `<twisted rank>` is $0, 1, 2, 3$ (default is 0) representing:

0	finite root system
1	affine extended root system, i.e. of type $^{(1)}$
2	affine twisted root system of type $^{(2)}$
3	affine twisted root system of type $^{(3)}$

and `<rank>` is

(1) an integer representing the rank or
(2) blank to represent an indefinite rank or
(3) the name of a Satake diagram as in section 4.

21. Options

`text/.style` = ⟨`TikZ style data`⟩,

default : `scale=.7`

Style for any labels on the roots.

`name` = ⟨`string`⟩,

default : `anonymous`

A name for the Dynkin diagram, with `anonymous` treated as a blank; see section 18.

`parabolic` = ⟨`integer`⟩,

default : `0`

A parabolic subgroup with specified integer, where the integer is computed as $n = \sum 2^{i-1} a_i$, $a_i = 0$ or 1, to say that root i is crossed, i.e. a noncompact root.

`radius` = ⟨`number`⟩`cm`,

default : `.05cm`

size of the dots and of the crosses in the Dynkin diagram

`edgeLength` = ⟨`number`⟩`cm`,

default : `.35cm`

distance between nodes in the Dynkin diagram `edge/.style` = `TikZ style data`,

default : `thin`

style of edges in the Dynkin diagram

`mark` = ⟨`o,O,t,x,X,*`⟩,

default : `*`

default root mark

`affineMark` = `o,O,t,x,X,*`,

default : `*`

default root mark for root zero in an affine Dynkin diagram

`label` = `true or false`,

default : `false`

whether to label the roots according to the current labelling scheme.

`labelMacro` = ⟨`1-parameter TeX macro`⟩,

default : `#1`

the current labelling scheme.

`makeIndefiniteEdge` = ⟨`edge pair` i-j `or list of such`⟩,

default : {}

edge pair or list of edge pairs to treat as having indefinitely many roots on them.

`indefiniteEdgeRatio` = ⟨`float`⟩,

default : `1.6`

ratio of indefinite edge lengths to other edge lengths.

`indefiniteEdge/.style` = ⟨`TikZ style data`⟩,

default : `draw=black,fill=white,thin,densely dotted`

style of the dotted or dashed middle third of each indefinite edge.

`arrows` = ⟨`true or false`⟩,

default : `true`

whether to draw the arrows that arise along the edges.

`reverseArrows` = ⟨`true or false`⟩,

default : `true`

whether to reverse the direction of the arrows that arise along the edges.

`fold` = ⟨`true or false`⟩,

default : `true`

whether, when drawing Dynkin diagrams, to draw them 2-ply.

`ply` = ⟨`0,1,2,3,4`⟩,

default : `0`

how many roots get folded together, at most.

`foldleft` = ⟨`true or false`⟩,

default : `true`

whether to fold the roots on the left side of a Dynkin diagram.

`foldright` = ⟨`true or false`⟩,

default : `true`

whether to fold the roots on the right side of a Dynkin diagram.

`foldradius` = ⟨`length`⟩,

default : `.3cm`

the radius of circular arcs used in curved edges of folded Dynkin diagrams.

`foldStyle` = ⟨`TikZ style data`⟩,

default : `draw=black!40,fill=none,line width=radius`

when drawing folded diagrams, style for the fold indicators.

`*/.style` = ⟨`TikZ style data`⟩,

default : `draw=black,fill=black`

style for roots like •

`o/.style` = ⟨`TikZ style data`⟩,

default : `draw=black,fill=black`

style for roots like ∘

`O/.style` = ⟨`TikZ style data`⟩,

default : `draw=black,fill=black`

style for roots like ◎

`t/.style` = ⟨`TikZ style data`⟩,

default : `draw=black,fill=black`

style for roots like ⊗

`x/.style` = ⟨`TikZ style data`⟩,

default : `draw=black`

style for roots like ×

`X/.style` = ⟨`TikZ style data`⟩,

default : `draw=black,thick`

style for roots like **×**

`leftFold/.style` = ⟨`TikZ style data`⟩,

default :

style to override the `fold` style when folding roots together on the left half of a Dynkin diagram

`rightFold/.style` = ⟨`TikZ style data`⟩,

default :

style to override the `fold` style when folding roots together on the right half of a Dynkin diagram

`doubleEdges` = ⟨⟩,

default : `not set`

set to override the `fold` style when folding roots together in a Dynkin diagram, so that the foldings are indicated with double edges (like those of an F_4 Dynkin diagram without arrows).

`doubleFold` = ⟨⟩,

default : `not set`

set to override the `fold` style when folding roots together in a Dynkin diagram, so that the foldings are indicated with double edges (like those of an F_4 Dynkin diagram without arrows), but filled in solidly.

`doubleLeft` = ⟨⟩,

default : `not set`

set to override the `fold` style when folding roots together at the left side of a Dynkin diagram, so that the foldings are indicated with double edges (like those of an F_4 Dynkin diagram without arrows).

`doubleFoldLeft` = ⟨⟩,

default : `not set`

set to override the `fold` style when folding roots together at the left side of a Dynkin diagram, so that the foldings are indicated with double edges (like those of an F_4 Dynkin diagram without arrows), but filled in solidly.

`doubleRight` $= \langle\rangle$,

default : `not set`

set to override the `fold` style when folding roots together at the right side of a Dynkin diagram, so that the foldings are indicated with double edges (like those of an F_4 Dynkin diagram without arrows).

`doubleFoldRight` $= \langle\rangle$,

default : `not set`

set to override the `fold` style when folding roots together at the right side of a Dynkin diagram, so that the foldings are indicated with double edges (like those of an F_4 Dynkin diagram without arrows), but filled in solidly.

`Coxeter` $= \langle$`true or false`$\rangle$,

default : `false`

whether to draw a Coxeter diagram, rather than a Dynkin diagram.

`ordering` $= \langle$`Adams, Bourbaki, Carter, Dynkin, Kac`$\rangle$,

default : `Bourbaki`

which ordering of the roots to use in exceptional root systems as in section 17.

All other options are passed to TikZ.

References

1. Kurando Baba, *Satake diagrams and restricted root systems of semisimple pseudo-Riemannian symmetric spaces*, Tokyo J. Math. **32** (2009), no. 1, 127–158. MR 2541161
2. Nicolas Bourbaki, *Lie groups and Lie algebras. Chapters 4–6*, Elements of Mathematics (Berlin), Springer-Verlag, Berlin, 2002, Translated from the 1968 French original by Andrew Pressley. MR 1890629
3. R. W. Carter, *Lie algebras of finite and affine type*, Cambridge Studies in Advanced Mathematics, vol. 96, Cambridge University Press, Cambridge, 2005. MR 2188930
4. Meng-Kiat Chuah, *Cartan automorphisms and Vogan superdiagrams*, Math. Z. **273** (2013), no. 3-4, 793–800. MR 3030677
5. E. B. Dynkin, *Semisimple subalgebras of semisimple Lie algebras*, Mat. Sbornik N.S. **30(72)** (1952), 349–462 (3 plates), Reprinted in English translation in [6]. MR 0047629
6. ———, *Selected papers of E. B. Dynkin with commentary*, American Mathematical Society, Providence, RI; International Press, Cambridge, MA, 2000, Edited by A. A. Yushkevich, G. M. Seitz and A. L. Onishchik. MR 1757976
7. L. Frappat, A. Sciarrino, and P. Sorba, *Structure of basic Lie superalgebras and of their affine extensions*, Comm. Math. Phys. **121** (1989), no. 3, 457–500. MR 990776
8. L. C. Grove and C. T. Benson, *Finite reflection groups*, second ed., Graduate Texts in Mathematics, vol. 99, Springer-Verlag, New York, 1985. MR 777684
9. Sigurdur Helgason, *Differential geometry, Lie groups, and symmetric spaces*, Graduate Studies in Mathematics, vol. 34, American Mathematical Society, Providence, RI, 2001, Corrected reprint of the 1978 original. MR 1834454

10. James E. Humphreys, *Reflection groups and Coxeter groups*, Cambridge Studies in Advanced Mathematics, vol. 29, Cambridge University Press, Cambridge, 1990. MR 1066460
11. Victor G. Kac, *Infinite-dimensional Lie algebras*, third ed., Cambridge University Press, Cambridge, 1990. MR 1104219
12. S. Pratik Khastgir and Ryu Sasaki, *Non-canonical folding of Dynkin diagrams and reduction of affine Toda theories*, Progr. Theoret. Phys. **95** (1996), no. 3, 503–518. MR 1388245
13. A. L. Onishchik and È. B. Vinberg, *Lie groups and algebraic groups*, Springer Series in Soviet Mathematics, Springer-Verlag, Berlin, 1990, Translated from the Russian and with a preface by D. A. Leites. MR 91g:22001
14. A. L. Onishchik and È. B. Vinberg, *Lie groups and algebraic groups*, Springer Series in Soviet Mathematics, Springer-Verlag, Berlin, 1990, Translated from the Russian and with a preface by D. A. Leites. MR 1064110
15. B. Ransingh, *Vogan diagrams of affine twisted Lie superalgebras*, ArXiv e-prints (2013).
16. Biswajit Ransingh, *Vogan diagrams of untwisted affine Kac-Moody superalgebras*, Asian-Eur. J. Math. **6** (2013), no. 4, 1350062, 10. MR 3149279
17. V. Regelskis and B. Vlaar, *Reflection matrices, coideal subalgebras and generalized Satake diagrams of affine type*, ArXiv e-prints (2016).
18. Ichirô Satake, *Algebraic structures of symmetric domains*, Kanô Memorial Lectures, vol. 4, Iwanami Shoten, Tokyo; Princeton University Press, Princeton, N.J., 1980. MR 591460
19. È. B. Vinberg (ed.), *Lie groups and Lie algebras, III*, Encyclopaedia of Mathematical Sciences, vol. 41, Springer-Verlag, Berlin, 1994, Structure of Lie groups and Lie algebras, A translation of ıt Current problems in mathematics. Fundamental directions. Vol. 41 (Russian), Akad. Nauk SSSR, Vsesoyuz. Inst. Nauchn. i Tekhn. Inform., Moscow, 1990 [MR1056485 (91b:22001)], Translation by V. Minachin [V. V. Minakhin], Translation edited by A. L. Onishchik and È. B. Vinberg. MR 1349140
20. Jean-Bernard Zuber, *Generalized Dynkin diagrams and root systems and their folding*, Topological field theory, primitive forms and related topics (Kyoto, 1996), Progr. Math., vol. 160, Birkhäuser Boston, Boston, MA, 1998, pp. 453–493. MR 1653035