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## Casimir operator

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Let  $\mathfrak{g}$  be a semisimple Lie algebra, and let  $(\cdot, \cdot)$  denote the Killing form. If  $\{g_i\}$  is a basis of  $\mathfrak{g}$ , then there is a dual basis  $\{g^i\}$  with respect to the Killing form, i.e.,  $(g_i, g^j) = \delta_{ij}$ . Consider the element  $\Omega = \sum g_i g^i$  of the universal enveloping algebra of  $\mathfrak{g}$ . This element, called the *Casimir operator* is central in the enveloping algebra, and thus commutes with the  $\mathfrak{g}$  action on any representation.