

The reference for Sec 1 is Soergel. Ginzburg's result quoted there is in [G]. A standard reference for the content of Sec 2 over a characteristic 0 field is in [H, Section 1]. The deformed version (over more general rings) was introduced by Jantzen in his monograph [J], Sec. 4. It is needed to prove an important result about category $\mathcal{O}$ known as the Jantzen sum formula.

REFERENCES

- [G] V. Ginzburg, *Perverse sheaves and $\mathbb{C}^*$ -actions*. J. Amer. Math. Soc. 4 (1991), no. 3, 483–490.
- [J] J.C. Jantzen, *Moduln mit einem höchsten Gewicht*. Lecture Notes in Math., 750 Springer, Berlin, 1979. ii+195 pp.
- [H] J. Humphreys, *Representations of semisimple Lie algebras in the BGG category $\mathcal{O}$* . Grad. Stud. Math., 94. AMS, Providence, RI, 2008. xvi+289 pp.
- [S2] W. Soergel, *Kategorie $\mathcal{O}$, perverse Garben und Moduln über den Koinvarianten zur Weylgruppe*. J. Amer. Math. Soc. 3 (1990), no. 2, 421–445.