

PROBING THE PHYSICS OF THE INTERSTELLAR MEDIUM IN SPIRAL GALAXIES FROM DIFFERENT ACTIVITY TYPES

Hülya ESER SULU

Yüzüncü Yıl University, Faculty of Science, Department of Physics

ORCID: 0000-0002-3187-4208

Assist. Prof. Dr. Selçuk TOPAL

Yüzüncü Yıl University, Faculty of Science, Department of Physics

ORCID: 0000-0003-2132-5632

ABSTRACT

One of the ways of probing the physics of the interstellar medium (ISM) in galaxies is to study molecular emission lines. In this study, we targeted two galaxies. NGC 5055 is a normal spiral galaxy, while NGC 3627 is also a spiral galaxy but hosting an active galactic nucleus (AGN). AGNs are the key to understand the role of the supermassive black hole in the physics of the central molecular zone and the evolution of galaxies. Using the literature data of four CO lines available for both galaxies, i.e. $^{12}\text{CO}(1-0, 2-1, 3-2)$ and $^{13}\text{CO}(1-0)$, along with $24\mu\text{m}$ and FUV emission properties, we investigated the line ratios across the disk of the galaxies. Our main results are summarized as follows. $^{12}\text{CO}(1-0)$ is the most extensive and the brightest gas over the disc of both galaxies compared to the other three CO lines. Integrated CO line intensity, molecular gas mass (M_{H_2}) and CO line ratios [i.e. $^{12}\text{CO}(1-0)/^{13}\text{CO}(1-0)$, $^{12}\text{CO}(2-1)/^{12}\text{CO}(1-0)$ and $^{12}\text{CO}(3-2)/^{12}\text{CO}(1-0)$] decrease as a function of distance from the center in both galaxies, although NGC 3627 shows more fluctuations. Although the line ratios show a negative correlation with the distance from the center in NGC 5055, there is no such negative present in NGC 3627. M_{H_2} shows a positive correlation with $24\mu\text{m}$ and FUV flux (F_{FUV}), i.e. both increase with respect to each other, in both galaxies, but the correlation is much weaker with a higher scatter in NGC 3627. The line ratios and the ratio of $24\mu\text{m}/F_{\text{FUV}}$ (i.e. the extinction) also have a positive correlation over the disc of both galaxies but the correlation is much stronger in NGC 5055 (except the ratio of $^{12}\text{CO}(3-2)/^{12}\text{CO}(1-0)$) compared to NGC 3627. Our results indicate that each galaxy shows some differences in the physical properties across its disk, possibly because of having different morphology and star formation histories.

Keywords: Spiral Galaxies, Active Galactic Nuclei, Molecular Gas, Dust, Ultra-violet Radiation