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PHYSICAL CONDITIONS IN A SAMPLE OF SEYFERT AND STARBURST GALAXIES

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RESUMEN

En el presente trabajo hemos estudiado la relación entre las líneas de emisión de alta y baja ionización del [O IV] 25,89 μm (54,93 eV), [Ne III] 15,56 μm (40,96 eV), y [Ne II] 12,81 μm (21,6 eV) con el propósito de restringir la contribución del núcleo activo de galaxias (Active Galactic Nuclei, AGN) y la formación estelar en una muestra de 79 galaxias Seyfert del Universo local ($z < 0,08$) Weaver et al. (2010). Este estudio se llevó a cabo mediante la utilización del código de fotoionización CLOUDY de Gary Ferland (1996), el cual utilizamos para generar un conjunto de modelos de fotoionización con los cuales fue posible identificar parámetros físicos tales como la densidad de hidrógeno $n_{\rm H}$ y parámetro de ionización U asociados al AGN y la formación estelar. A partir de estos diagnósticos encontramos que los cocientes de línea de emisión observados en la región de línea estrecha (Narrow Line Region, NLR) de las galaxias Seyfert pueden ser reproducidos eficientemente por un modelo de dos zonas, el cual está formado por una zona de baja ionización y alta densidad y una de alta ionización y baja densidad. Un modelo similar fue utilizado para modelar las líneas de emisión observadas en las galaxias starburst, para las cuales se encontró que los cocientes observados eran mejor reproducidos mediante la combinación de una zona de baja ionización con una de alta ionización y densidades similares.

ABSTRACT

Active galactic nuclei (AGN) are thought to harbor massive black holes ($M_{\rm BH} \approx 10^6 - 10^8\ M_\odot$) surrounded by an accretion disk responsible for the enormous energy rates observed in their unresolved nuclei. Seyfert galaxies represent the most common type of AGN. Seyfert 1 galaxies have broad permitted (FWHM $\approx 1-5\times10^3$ km s^{-1}) and narrow (FWHM $\approx 5\times10^2$ km s^{-1}) permitted and forbidden lines and Seyfert 2 galaxies have only narrow permitted and forbidden line emission. According to the unified model of active galaxies, Seyfert 1 and Seyfert 2 galaxies are intrinsically the same, with their differences attributed to viewing angle. In Seyfert 2 galaxies, our line of sight to the broad line region (BLR) and the central engine is obstructed by an optically thick dusty torus-like structure, while in Seyfert 1 galaxies, our line of sight is not obstructed by the torus, allowing a direct view of the central regions of the active galaxy. In this work, we use photoionization models to fit the observed ratios between high and low ionization mid-infrared emission lines to separate the relative contributions of the AGN and star formation in the host galaxy. Overall, we found that the observed mid-infrared spectra can be reproduce by a two zone model defined by a radiation- and matter-bounded component.

Key Words: galaxies: active

1. INTRODUCTION

We have studied the relationship between the high-and low-ionization [O IV]λ25.89 μm, [Ne III]λ15.56 μm, and [Ne II]λ 12.81μm emission lines to constrain the active galactic nuclei (AGNs) and star formation contribution of a sample of 79 ($z <$ 0.08) Seyfert galaxies (Weaver et al. 2010).

We used the [O IV] as a truly isotropic property of the AGN because given its high ionization potential (54.9 eV) is less affected by star formation and, also, [O IV] is significantly less affected by extinction than [O III]λ 5007 Å (Melendez et al. 2008). On the other hand, [Ne II] and [Ne III] can be readily produced by star formation. Moreover, [O IV], [Ne II] and [Ne III] are present in AGN, starburst, H II galaxies and have a wide range of ionization potentials and critical densities which allow us to study the connection between the active nucleus and star formation.

2. SEYFERT AND STARBURST GALAXIES: MODEL AND OBSERVATION

As we mentioned before, the ratios of high-ionization lines to low-ionization lines can reveal the relative contributions of the AGN and star formation. It is also known,that the most likely contributor to the [O IV] emission in starburst galaxies are

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