The Neutral ISM in Starburst Galaxies
ASP Conference Series, Vol. 320, 2004
S. Aalto, S. Hüttemeister, A. Pedlar

Gas Dynamics in the Non-Barred Seyfert Galaxy NGC 4501

Sachiko Onodera, Jin Koda, Yoshiaki Sofue & Kotaro Kohno

Institute of Astronomy, the University of Tokyo, Mitaka, Tokyo, 181-0015, Japan

Abstract. We report high resolution interferometer observations of the central 5 kpc region of NGC 4501. The observations were carried out with the CO line using the Nobeyama Millimeter Array (NMA). It is known that NGC 4501 has high degree of central gas concentration for a non-barred galaxy. The CO major features (1) a nuclear concentration which is resolved into double peaks, (2) spiral arms. The feature (1) has a low star-forming efficiency, which might be due to low $M_{\rm gas}/M_{\rm dyn}$ ratio. Double peaks are located on the root of optical spiral arms in a *HST* image. To understand gas motions in NGC 4501, we did model calculations of gas cloud orbits governed by a stellar spiral potential, which is a modification of the model with a bar potential. The observed CO spirals and non-circular motions were explained with this spiral model. We estimated the loss of angular momentum due to galactic spiral shocks in orbit-crowding regions and gravitational torques exerted by the stellar spirals. We found that the galactic shock is dominant. These mechanisms lead to gas inflow and possibly explain the central-condensed double peaks in NGC 4501.

1. Observational Data and Results

Observational data of ^{12}CO(J=1-0) emission in NGC 4501 were obtained with the NMA in the course of a CO-line survey of Virgo spirals (Sofue et al. 2003). They were mapped using CLEAN procedure with two weightings ($\sim 5''$ and $\sim 2''$). Low-resolution map and velocity field are shown in Figure 1 (upper left). We found 2.5 kpc spiral arms and strong central condensation ($r \sim 5''$) which resolves into double peaks with $2''$ beam. Molecular spiral arms seem to be associated with dust lanes. The velocity field along these arms shows non-circular motion about $\sim 50\,{\rm km\,s^{-1}}$ on the galactic minor axis. With an *HST* image (Figure 1: right), it is shown that the double peaks inhabit the root of spiral dust lanes penetrating into the nucleus. $M_{\rm gas}/M_{\rm dyn}$ ratio within $r = 5''$ is only 1.7% , and it shows very low star-forming efficiency. That is, the peak surface brightness in $\sim 2''$ beam corresponds to $\Sigma_{\rm H_2} = 440 M_\odot {\rm pc}^{-2}$ and star formation rate $1.3 \times 10^3 M_\odot {\rm Gyr}^{-1}{\rm pc}^{-2}$ derived with Schmidt law by Kennicutt (1998). This is one order of magnitude higher than that derived from extinction-corrected Hα surface brightness, $\Sigma_{\rm SFR} = 1.9 \times 10^2 M_\odot {\rm Gyr}^{-1}{\rm pc}^{-2}$. It seems that some lack of star-forming triggers, probably ineffectiveness of self gravity, results in this low star-forming efficiency in this region.