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THE MULTI-WAVELENGTH STUDY OF OH MEGAMASER GALAXY IRAS16399-0937

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We present a multi-wavelength study of the morphology and spectral energy distribution (SED) of the OH Megamaser galaxy (OHMG) IRAS16399-0937, based on new HST ACS broad band (F814W) and emission line (Hα+[NII]) images and archive data from HST, 2MASS, Spitzer, Herschel and the VLA. This system has a double nucleus, whose northern and southern components have a projected separation of $\sim 6''$ (3.4 kpc) and have previously been optically identified as a Low Ionization Nuclear Emission Line Region (LINER) and starburst nucleus, respectively. The nuclei are embedded in what appears to be a tidally distorted common envelope, the main morphological features of which are a large ($\sim$ 3 kpc) diffuse region of star formation extending North and East of the northern nucleus and an arc-like structure, also including star formation regions (as traced by Hα+[NII] line emission and B-band continuum) which connects the southern nucleus to the NE diffuse region. An extensive dust lane complex running E-W separates the nuclei while the N nucleus itself is crossed by a dust lane oriented SE-NE. Star formation activity is widespread throughout the system but is mostly heavily obscured. The infrared spectrum is dominated by strong polycyclic aromatic hydrocarbon (PAH) features, but deep silicate absorption and absorption features due to water ice and hydrogenated amorphous carbon grains are also present, and are strongest in the northern nucleus. The radio emission, including the compact component associated with the northern nucleus, is consistent with star formation. The global star formation rate (SFR) is $\sim 20 M_{\odot}/yr$, with the two nuclei accounting for $\approx 40\%$ of the total. The 0.435 - 500μm SED was fitted with a model including stellar, dusty ISM and AGN torus components using a new Markov Chain Monte Carlo code, CLUMPY-DREAM. The results indicate that the northern nucleus contains an AGN of bolometric luminosity ($L_{bol} \sim 1.24 \times 10^{44}$ ergs/s), which is deeply embedded in a quasi-spherical distribution of optically thick clumps with a covering fraction ≈ 1. The high torus covering fraction precludes AGN photoionization as the origin of the LINER spectrum, however, the spectrum is consistent with shocks of velocity $\sim 100 - 200\,\mathrm{km\,s^{-1}}$, which be associated with gas inflows. The SED fits also indicate SFR of $\sim$ 2.9 and 2.4 $M\odot/yr$ for the N and S nucleus, respectively, roughly consistent with the rates derived from the observed 8μm PAH and 1.4 GHz radio luminosities. We infer that the $\sim 10^8\,M_{\odot}$ black hole in the northern nucleus is accreting at a small fraction ($\sim 1\%$) of its Eddington rate. The low accretion rate and modest nuclear star formation rates suggest that while the gas-rich major merger forming the IRAS 16399-0937 system has triggered widespread star formation, the massive gas inflows expected from merger simulations have not yet fully developed.

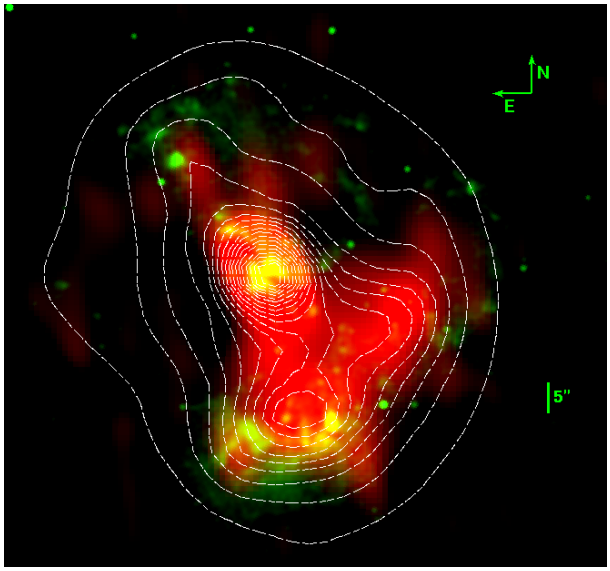

Fig. 1. Composed color image of IRAS16399-0937. The green, and red channels are filled with the Hα, and 1.4GHz VLA images while dotted line shows the Spitzer ISM-dust 8μm contours.

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