OBSERVATIONS AND MODELING OF NUCLEAR STARBURSTS

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We present new J, H, and K-band imaging and H and K-band spectroscopy at a resolution of ~ 3000 of a sample of 20 starburst galaxies. We use these data and data from the literature to derive the integrated properties of the stellar populations in the starburst regions of these galaxies. We compare these observational constraints to the output of a suite of starburst models which compute the integrated properties of a stellar population as a function of time. We vary the star formation rate, initial mass function, and strength of the starburst to match the observations. We determine the ages and strengths of the starbursts and attempt to place them on an evolutionary sequence. We show that the ionizing flux and the strength of the CO bands at 2.3 μm can together provide a strong constraint on the age of the starburst. The presence of both strong emission and absorption features in our spectra allow us to explore the kinematics of both the stellar and gaseous components in the starburst region. We determine a dynamical mass limit for some of these systems which allows us to place a limit on the number of low-mass stars present. In many of these galaxies, we find evidence for an IMF which is biased towards the formation of high-mass stars relative to the IMF in the solar neighborhood. We find a strong correlation between the equivalents widths of Brγ and [Fe II] 1.644 μm (which arises largely from supernova remnants) and a moderate correlation between Brγ and H_2(1,0)S(1), suggesting that the supernova rate is tightly coupled to the massive star formation rate and that the H_2(1,0)S(1) emission is dominated by some process other than fluorescence or shock excitation associated with supernova remnants.

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CIRCUMNUCLEAR STARBURSTS IN BARRED GALAXIES: Hα IMAGES

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Circumnuclear starburst activity has been detected, via Hα emission, in ten barred galaxies. The original sample, 52 galaxies, was selected from the Shapley Ames Catalog with *IRAS* fluxes characteristic of recent star formation (García-Barreto et al. 1996, RevMexAA, 32, 89). The circumnuclear Hα rings are located at distances between 300 pc up to 1.5 kpc from the compact nucleus. The most likely explanation for their origin is the inner Lindblad resonance (ILR), which is due to a non-axisymmetric gravitational potential. The NGC numbers of the galaxies with nuclear rings are; 1326, 1415, (possibly) 3318, 3351, 4314, 5135, 5347, 5430, 5728, and 6951. Three are classified as SBa, 6 as SBb, and 1 as SBbc. This result indicates that no nuclear rings were detected in any galaxy classified as late Hubble type. All galaxies with circumnuclear Hα emission have an average dust temperatures of, $T_d \geq 34$ K, which is sligthly higher than the average of the rest of the galaxies in the sample. Only NGC 6951 shows clear Hα emission from the compact nucleus (NGC 5728 also has nuclear emission, but higher angular resolution images indicate that Hα is minimum at the kinematical center; Arribas & Mediavilla 1993, ApJ, 410, 552). Nuclear emission could also exist from NGC 3318, NGC 5135 and NGC 5347, but higher angular resolution is needed. Note that NGC 5135, NGC 5347 and NGC 5728 are also classified as Seyfert 2 galaxies with X ray emission. On average, the relative orientations of the nuclear rings are different from the P.A. of the stellar bar, suggesting that gas and stars settle in inscribed x_2 orbits.

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POWERING OPTICAL FILAMENTS IN COOLING FLOWS WITH ALFVÉN WAVES

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We investigate the plausibility of Alfvén heating (AH) as a heating/excitation mechanism —like the ones used by Gonçalves et al. (1993, ApJ, 414, 57 and 1996, ApJ, 463, 489)— of optical filaments in cooling flows. We use a time-dependent hydrodynamical code to follow the evolution of cooling condensations arising from a 10^7 K cooling flow (Friaça 1993, A&A, 269, 145; Jafelice & Friaça 1996, MNRAS, 280, 438). The filaments contain magnetic fields and AH working at different degrees of efficiency (including no AH at all). We consider two damping mechanisms of Alfvén waves: nonlinear and turbulent. We calculate the optical line emission associated with the filaments and compare our results to the observations. From the energetic viewpoint, our models could account for typical filament systems, but not for the extreme ones (e.g., Perseus). Our models are better in reproducing the luminosities of the weaker class I filaments than the more luminous class II systems.