

least squares method, we minimize residuals between the calculated and observed IR brightness distribution of the zodiacal emission with respect to the 3 parameters  $\alpha$ ,  $p_1$ , and  $p_2$  of trial  $\zeta(r)$  function. Thereby we determine the volumetric absorption cross-section as a function of the heliocentric distance. Implication of the result for the properties of the zodiacal dust cloud will be discussed briefly.

## **MM Wave Observations of Late Type Carbon Star, IRC+10216**

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The NRO (Nobeyama Radio Observatory) 45 m radio telescope has been used for a high resolution mapping observation of the late type carbon star, IRC+10216. The four molecular spectra (HCN  $J=1-0$ ,  $H^{13}CN$   $J=1-0$ ,  $C_4H$   $N=9-8$ ,  $C_3N$   $N=9-8$ ) were simultaneously obtained with the Acousto-Optical Spectrometer (AOS). The HCN and  $H^{13}CN$  profiles show evident hyperfine components and their atmospheric structure is considered not simple. The spatial distribution of HCN emission reveals more central concentration than that of CO emission. Expanding envelope model is applicable to interpret these features.

## **Velocity Structure in Bipolar Molecular Outflows**

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The velocity structure in bipolar molecular outflows (BMO) has been studied and the physical attributions have been discussed. The relation between physical parameters, especially  $D$  (extended distance of the observed lobes) and  $V$  (observed expansion radial velocity of the BMO) has been analyzed using cross-plot with the observational data (Lada 1985). The obtained relation,  $V \propto D^{-0.6}$  is reasonable for the interpretation of the velocity structure in the BMO. It would be interpreted with the ram pressure deceleration effect and the buoyancy effect by density difference.

## **Stellar Populations in External Galaxies. I.**

### **Unconstrained Synthesis Models and Metallicity Problem.**

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Unconstrained population models for several elliptical and spiral galaxies are obtained from their integrated spectra. Spectral energy distributions (SED's) of 49 stellar groups published by O'Connell (1973) are used as input basis and "Linear Programming" algorithm is applied to the galaxy population synthesis problem. The reliability of the newly composed computer program is well-qualified.

The intrinsic strength anomaly (ISA) problem suggested by Taylor and Kellman (1978) is examined with our models, and it is concluded that the stellar SED library seems to be incomplete.

To solve the galaxy population synthesis problem with keeping out of ISAs, at least rough metallicities of galaxies should be calibrated with observable quantities. Several possibilities of determining extragalactic metallicities, although not confirmed, are discussed.

## **A Surface Photometry of Barred Galaxies: Analysis of Decomposition Parameters of Disk and Bulge**

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A detailed V-band surface photometry of barred galaxies has been made to derive luminosity profiles of 39 barred galaxies, of which morphological types range from T=3 to 7. From this we derived decomposition parameters which represent global structure of the galaxies by applying the decomposition scheme in which bulges, disks, and bars are assumed to be the main distinct components of barred galaxies. The luminosities in minor components such as lenses, rings, and arms can be accounted for from a comparison of the observed two-dimensional luminosity distributions and the decomposition models.

The constancy of disk central brightness and the relationships between disk central brightness and disk scale length are reexamined from the present photometry and previous investigations. An investigation of the distributions of bulge size and bulge-to-disk ratios along the Hubble sequence shows that distribution of bulge-to-disk ratios of barred galaxies is similar to that of normal disk galaxies. This may imply that the origin of the SB0 galaxies is not much different from that of S0 galaxies.

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〈 研 究 論 文 〉

## **Surface Photometry of Barred Galaxies: Luminosity Distribution of Bars**

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Using the Kiso V-band plates, a detailed two-dimensional surface photometry was made for 38