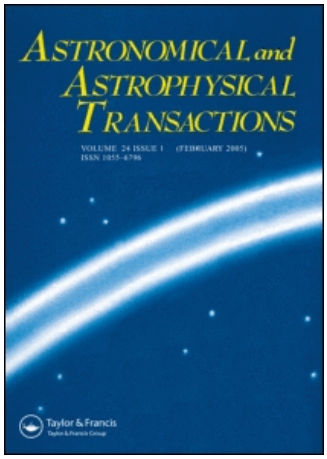

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INVESTIGATION OF IRAS GALAXIES FROM A NEW SAMPLE

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A new sample of 1178 faint IRAS galaxies (BIG) has been constructed by means of optical identification of IRAS point sources from PSC in the region $+61° < \delta < +90°$ at high galactic latitudes over an area of some 1500 deg^2. Compact galaxies, interacting pairs and groups, 'mergers', radio and X-ray sources are among the identified objects. Spectral observations have revealed new AGNs and luminous infrared galaxies. Study of the sample gives better understanding of star-formation, nuclear activity, interactions and connections between these phenomena.

1 THE BYURAKAN–IRAS GALAXY SAMPLE

A program of systematic optical identification of all IRAS PSC sources (IRAS, 1988) over a large area and the construction of a new IRAS galaxy sample have been conducted in the Byurakan Observatory. Identifications have been made over the area $+61° < \delta < +90°$ at galactic latitudes $|b| > 15°$ with a total area of 1487 deg^2 (Mickaelian, 2000; and references therein). In all, 1577 sources have been identified using many parameters, including the IR colors, optical images, the First Byurakan Survey (FBS) low-dispersion spectra (Markarian *et al.*, 1989), optical magnitudes and colors. Optical coordinates have been measured, V magnitudes, B–V colors have been estimated, and a rough classification has been made for all objects. There appeared to be late-type stars, planetary nebulae, candidate QSOs, single and multiple galaxies and small groups among the identified optical counterparts. There is no optical counterpart near the positions of some 50 sources even in the DSS, and taking into account their IR colors typical of galaxies, they must be very faint galaxies at optical wavelengths.

The identified galaxies can be considered as the most interesting objects among the different counterparts of IR sources. The identifications resulted in the construction of a new sample of IRAS galaxies: the Byurakan–IRAS Galaxy (BIG) sample, containing 1178 objects. For each, the angular size and position angles have been determined, and a morphological classification has been made in addition to the

above mentioned main parameters. The galaxies have various appearances and structures. Interaction features (tails, bridges) are present as well.

2 SPECTRAL STUDY OF THE *BIG* OBJECTS

Medium-dispersion spectral observations have been carried out for the BIG objects during 1997–2000 using three telescopes (Mickaelian *et al.*, 1998; Balayan *et al.*, 2000; Mickaelian *et al.*, 2001): the Special Astrophysical Observatory (SAO, Russia) 6m (UAGS and MPFS spectrographs), Observatoire de Haute-Provence (OHP, France) 1.93m (CARELEC), and the Byurakan Astrophysical Observatory (BAO, Armenia) 2.6m (ByuFOSC reducer). The investigated spectral range was 4000-8000Å; dispersions of 1.8–5.8 Å pix^{-1} were used and a spectral resolution of 5–14Å was obtained. Study of the objects with different telescopes and observational methods (e.g. MPFS is a multi-pupil spectrograph) is more efficient both for quick fulfillment of the program and better quality of classification. The redshift survey was the first task. In all, 329 spectra for 213 BIG objects corresponding to 172 IRAS sources were obtained. The spectra were reduced by MIDAS and/or a package of programs worked out at SAO (Vlasyuk, 1993). Redshifts for all observed galaxies were measured in the range 0.012–0.173 (brighter galaxies of the sample were observed having V magnitudes 12^m–18^m) and the calculated infrared luminosity is in the range $10^{10} < L_{ir}/L_{\odot} < 10^{12.5}$, including several LIGs already revealed.

The objects mostly have emission-line spectra with strong Balmer (H_β and H_α are in the observed range), [OIII] 4959Å/5007Å, [NII] 6548Å/6584Å, [SII] 6717Å/6731Ålines. [OI] 6300Å/6363Å, [OII] 7320Å/7330Å, [FeVII] 6087Å, HeI 5876Å emission lines and NaI 5890Å absorption lines are often present. Classification of the spectra was done and the activity types of the galaxies were estimated on the basis of the emission line ratios, using well-known diagnostic diagrams (ex. Veilleux and Osterbrock, 1987). Within the scheme constructed of HII, LINER, composite AGNs and Sy2 type classes, most of the objects classified already are of HII nature, 21 are Sy2 galaxies, 7 are LINERs, 4 are of composite AGN nature (Veron *et al.*, 1997). Objects having a composite spectrum (two distinct emission nebulae, for instance an HII region and a Seyfert, being superimposed on the slit) should be observed with higher resolution (< 3Å) to study the profile of the various emission lines and to identify the nature of the emission nebulosities present in the spectra.

3 WHAT IS INTERESTING IN THE *BIG* SAMPLE?

Different subsamples of objects were separated from the BIG sample. They are important for understanding certain processes taking place in galaxies, and evidence of activity, starburst and/or interactions at the same object allows one to study

connections between these phenomena. IRAS galaxies contain a large fraction of AGNs, and this grows with the IR luminosity. Are all high-luminosity IR galaxies AGNs at higher redshifts? Many BIG AGNs are radio and X-ray sources as well. Fainter galaxies in our BIG sample should appear to be high-luminosity IR galaxies: LIGs, ULIGs and HLIGs (Sanders and Mirabel, 1996). 18 IRAS sources seeming to be real extragalactic objects have no optical counterparts at the IR coordinate positions. They must be beyond the DSS limit. Revealed by the DSS images, interacting galaxies and mergers are a subject for further detailed study by 2D spectroscopy, which gives the velocity field of such objects and understanding of their relative motions. Is the high IR radiation due to a merging process?

Large number of interesting objects (active galaxies, interacting systems, QSOs, planetary nebulae, variable stars, etc.) among the IRAS sources makes investigations in this field important, as their study brings an understanding of evolutionary phenomena and processes taking place both in stars and galaxies.

References

Balayan, S. K., Hakopian, S. A., Mickaelian, A. M., and Burenkov, A. N. (2000) *Pisma A. Zh.* **26**, in press.

IRAS (1988) Joint IRAS Science Working Group. Infrared Astronomical Satellite Catalogs, The Point Source Catalog, Version 2.0, NASA RP-1190.

Markarian, B. E., Lipovetski, V. A., Stepanian, J. A., Erastova, L. K., and Shapovalova, A. I. (1989) *Commun. Special Astrophys. Obs.* **62**, 5.

Mickaelian A. M. (2000) *Astrofiz. Zh.* **43**, 425.

Mickaelian, A. M., Hakopian, S. A., Balayan, S. K., and Burenkov, A. N. (1998) *Pisma A. Zh.* **24**, 736.

Mickaelian, A. M., Balayan, S. K., Hakopian, S. A., Goncalves, A. C., Veron-Cetty, M. P., Veron, P., and Dodonov, S. N. (2001) *Astron. Astrophys.* (submitted).

Sanders, D. B. and Mirabel, I. F. (1996) *ARA&Ap* **34**, 749.

Veilleux, S. and Osterbrock, D. E. (1987) *Astrophys. J. Suppl. Ser.* **63**, 295.

Veron, P., Goncalves, A. C., and Veron-Cetty, M.-P. (1997) *Astron. Astrophys.* **319**, 52.

Vlasyuk, V. V. (1993) *Bull. Spec. Astrophys. Obs.* **36**, 107.