

**Volume 3**  
**Astronomy and Astrophysics**

**Subvolume C**  
**Interstellar Matter, Galaxy, Universe**

	Introductory material	
7	Interstellar matter	1
7.1	Phenomena of the generally distributed medium	1
7.2	Cool interstellar clouds	15
7.3	HII regions	22
7.4	Physics of interstellar dust	29
7.5	Physics of the interstellar gas	34
7.6	Cosmic rays	37
7.6.1	Introduction	37
7.6.2	The main experiments	37
7.6.3	Direct experiments	41
7.6.4	Ground-based experiments	46
7.6.5	The main elements in the TeV range	51
7.6.6	The isotope ratios	63
7.6.7	Electrons, positrons, photons and antiprotons	65
7.6.8	The allparticle spectrum	70
7.6.9	The highest energy events	75
7.6.10	Theoretical attempts	77
7.7	Interstellar magnetic field	91
8	Our Galaxy	95
8.1	Positions, motions, parallaxes of stars	95
8.1.1	Star positions	95
8.1.2	Proper motions	113
8.1.3	Radial velocities	118
8.1.4	Parallaxes	124
8.2	The nearest stars	128
8.3	Structure of the Galaxy	137
8.3.0	Introduction, Proceedings for 8.3	137
8.3.1	Apparent distribution of galactic objects on the celestial sphere	139
8.3.2	The local star field	142
8.3.3	Large-scale distribution of the stars	146
8.3.4	Large-scale distribution of interstellar matter	150
8.3.5	The galactic center	159
8.3.6	Properties of the Galaxy as a whole	170
8.4	Kinematics and dynamics	171
8.4.1	Kinematics	171
8.4.2	Dynamics	174

9	Galaxies and the universe	179
9.1	General information and integral properties of galaxies	179
9.1.1	Catalogues, atlases, positions	179
9.1.2	Apparent integral properties of galaxies	198
9.1.3	Qualitative classification of galaxies	210
9.1.4	Properties of galaxies	231
9.2	Internal structure and dynamics of galaxies	236
9.2.1	Stellar and gaseous content of normal galaxies	236
9.2.2	The ellipticity of galaxies	236
9.2.3	Luminosity distribution	237
9.2.4	Spiral structure	237
9.2.5	Radio radiation of normal galaxies	237
9.2.6	Rotation, kinematics, dynamics	243
9.3	Galaxies with special peculiarities; pairs, groups and clusters of galaxies	260
9.3.1	Galaxies with special peculiarities	261
9.3.2	Pairs of galaxies	261
9.3.3	Groups of galaxies	263
9.3.4	Clusters of galaxies	264
9.3.5	Superclusters and large-scale structure	265
9.4	Evolution of galaxies	266
9.4.1	Formation of galaxies	266
9.4.2	Evolution of galaxies	267
9.4.3	Starbursts	267
9.4.4	Star formation activity in normal galaxies	268
9.4.5	1997 Update to 9.4	269
9.5	Quasars and active galactic nuclei	296
9.5.1	Definition	296
9.5.2	Classification	296
9.5.3	Discovery and surveys	300
9.5.4	AGN evolution	301
9.5.5	The host galaxy of AGN	302
9.5.6	AGN continuum	302
9.5.7	AGN emission lines	306
9.5.8	Line and continuum correlations	312
9.5.9	AGN absorption lines	312
9.5.10	AGN models	313
9.6	Extragalactic radio sources	320
9.6.1	Observational methods	321
9.6.2	Surveys	323
9.6.3	Basic relations	327
9.6.4	Extended sources	330
9.6.5	Compact sources	335
9.6.6	Physics of extended and compact radio sources	340
9.7	Cosmology	366
9.7.1	List of symbols (See Vol. 2C)	
9.7.2	Friedmann cosmologies (See Vol. 2C)	
9.7.3	Observations supporting basic assumptions	367

9.7.4	Redshift	371
9.7.5	The determination of the Hubble constant $H_0$	372
9.7.6	The determination of $q_0$	374
9.7.7	Constituents of the universe (See Vol. 2C)	
9.7.8	The time scale of the universe	376
9.7.9	Other comologies (See Vol. 2C)	
9.7.10	Formation of cosmic large scale structure	377
9.7.11	Particle physics and cosmology	383