



## INDICE

<b>L. GRATTON - Preface . . . . .</b>	<b>pag. xi</b>
Gruppo fotografico dei partecipanti al Corso	fuori testo
<b>L. GRATTON - High-energy astrophysics.</b>	
1. Introduction . . . . .	pag. 1
2. Supernovae, neutron stars and gravitational collapse . . . . .	» 4
3. Radiogalaxies, quasi-stellar radio sources and related objects	» 6
<b>A. SANDAGE - Observational properties of radio galaxies and quasi-stellar sources.</b>	
1. Introduction . . . . .	» 10
2. Discrete radio sources . . . . .	» 11
2'1. Discovery and early surveys . . . . .	» 11
2'2. Recent surveys . . . . .	» 12
2'3. Early radio positions and optical I.D. . . . .	» 14
2'4. Modern radio positions and optical identifications . . . . .	» 18
2'5. Radio angular diameters and radio doubling . . . . .	» 19
3. Optical evidence for explosions: M82 . . . . .	» 21
4. Quasi stellar radio sources . . . . .	» 25
4'1. Discovery . . . . .	» 25
4'2. Optical colors of quasars . . . . .	» 26
4'3. Optical variations . . . . .	» 27
4'4. Radio variations . . . . .	» 27
4'5. Discussion of the optical and radio variations . . . . .	» 30
4'6. Red-shifts . . . . .	» 30
5. Absolute power levels of radio galaxies and quasars . . . . .	» 30
6. The existence of quasi-stellar galaxies . . . . .	» 34
6'1. Discovery . . . . .	» 34
7. Observational cosmology using radio sources . . . . .	» 35

**E. M. BURBIDGE - Radio galaxies and quasi-stellar radio sources.**

1. Introduction . . . . .	pag. 43
2. Power levels of radio emission . . . . .	» 43
3. General description of optical spectra of radio galaxies and information they yield . . . . .	» 44
4. General description of optical spectra of QSRS . . . . .	» 48
5. Kinematic information from spectra . . . . .	» 49
6. Seyfert galaxies. . . . .	» 50
7. NGC 1068 (3C 71) . . . . .	» 52
8. M 82 and NGC 1275 . . . . .	» 55
9. NGC 5128, NGC 1316 and 3C 33: relation between optical and radio structure and axis of rotation . . . . .	» 59
10. M 87 . . . . .	» 60
11. Multiple elliptical or <i>D</i> -type galaxies NGC 4782-3, NGC 6166, NGC 7236-7 and <i>Her. A</i> . . . . .	» 61
12. General discussion of radio galaxies; relation to theoretical work . . . . .	» 64
13. Quasi-stellar radio sources . . . . .	» 66

**R. GIACCONI, H. GURSEY, J. R. WATERS, B. ROSSI, G. CLARK, G. GARMIRE, M. ODA and M. WADA - Some observational aspects of X-ray astronomy.**

1. Introduction . . . . .	» 73
2. Instrumentation . . . . .	» 76
2'1. X-ray detectors . . . . .	» 76
2'2. Collimators . . . . .	» 81
2'3. Image-forming telescopes . . . . .	» 84
2'4. Optical sensors . . . . .	» 86
3. Analysis problems relative to rocket observations . . . . .	» 87
3'1. Frames of reference. . . . .	» 88
3'2. Freely spinning rockets . . . . .	» 89
4. Observational results . . . . .	» 96
4'1. The Crab Nebula . . . . .	» 96
4'2. The sources near the galactic center . . . . .	» 98
4'3. Other sources . . . . .	» 107
4'4. Spectral information and flux estimates. . . . .	» 107

**G. BURBIDGE - X-ray and  $\gamma$ -ray sources.**

1. Introduction . . . . .	» 115
2. Production in the interstellar gas, the galactic halo, and the intergalactic medium . . . . .	» 117
2'1. Meson production in cosmic-ray nuclear collisions . . .	» 119
2'2. The electron production spectrum . . . . .	» 122

2·3. Electron energy losses in the galaxy . . . . .	pag. 122
2·4. Electron production and energy losses in the intergalactic medium . . . . .	» 126
2·5. The electron energy spectrum in the halo and intergalactic medium . . . . .	» 128
2·6. High-energy photon flux from various processes . . . . .	» 129
2·7. Comparison with observations . . . . .	» 134
2·8. Test of cosmological theories . . . . .	» 140
3. Discrete sources of high-energy photons. . . . .	» 142
3·1. General summary of the observations . . . . .	» 142
3·2. Possible galactic sources. . . . .	» 144
3·3. Mechanisms for X-ray production in discrete sources	» 150
3·4. The Crab Nebula. . . . .	» 155
3·5. The galactic center . . . . .	» 160
3·6. Extragalactic discrete sources . . . . .	» 161

K. S. THORNE – The general-relativistic theory of stellar structure and dynamics.

1. Introduction . . . . .	» 166
2. Thermodynamic and gravitational preliminaries . . . . .	» 169
2·1. Separation of short-range and long-range forces . . . . .	» 169
2·2. Thermodynamics, the science of short-range forces. . . . .	» 170
2·3. General relativity, the science of long-range forces. . . . .	» 176
2·4. Summary . . . . .	» 181
3. Equilibrium stellar configurations. . . . .	» 182
3·1. Parameters describing the structure of nonrotating stellar models. . . . .	» 182
3·2. Equations of stellar structure . . . . .	» 185
3·3. Boundary conditions for stellar structure . . . . .	» 197
3·4. Construction of stellar models . . . . .	» 198
3·5. Properties of nonrotating stars. . . . .	» 200
3·6. Rotating equilibrium configurations. . . . .	» 208
3·7. Summary . . . . .	» 210
4. Stability of equilibrium configurations . . . . .	» 211
4·1. Nonradial perturbations of nonrotating configurations	» 211
4·2. Radial perturbations of nonrotating configurations . . . . .	» 212
4·3. Stability properties of nonrotating configurations . . . . .	» 223
4·4. Stability of rotating stellar models . . . . .	» 224
4·5. Summary . . . . .	» 224
5. White dwarfs, neutron stars, and hyperon stars . . . . .	» 225
5·1. Matter near the endpoint of thermonuclear evolution	» 225
5·2. Equations of stellar structure . . . . .	» 232
5·3. How to construct stellar models . . . . .	» 235
5·4. Structure and properties of configurations of catalyzed matter. . . . .	» 235
5·5. Stability and pulsations of configurations of catalyzed matter. . . . .	» 240
5·6. Summary . . . . .	» 248

6.	Nondegenerate stellar models . . . . .	pag. 249
6'1.	Method for decoupling thermal and hydrostatic equations »	249
6'2.	Relativistic polytropes . . . . .	» 251
6'3.	Stellar models considered in the literature . . . . .	» 252
6'4.	Summary and commentary . . . . .	» 253
7.	Gravitational collapse to infinite density . . . . .	» 254
7'1.	Inevitability of collapse for massive stars. . . . .	» 254
7'2.	Hydrodynamic equations for a collapsing star. . . . .	» 254
7'3.	Free-fall collapse . . . . .	» 255
7'4.	Spherical collapse with internal pressure forces . . . . .	» 269
7'5.	Collapse in totally realistic situations. . . . .	» 269
7'6.	Gravitational collapse to a singularity in other contexts »	272
7'7.	The issue of the final state . . . . .	» 273
 G. SZAMOSI – Properties of cold dense matter.		
	Introduction. . . . .	» 281
1.	Properties of very dense matter . . . . .	» 282
2.	Equation of state at very high densities . . . . .	» 289
 A. FINZI – Present status of the neutron-star hypothesis.		
1.	The creation of neutron stars in supernova explosions . . .	» 302
2.	The thermal radiation of neutron stars . . . . .	» 303
3.	The light curves of type I supernovae and the vibrational energy of the neutron stars . . . . .	» 307
 W. A. FOWLER – Supermassive stars, quasars and extragalactic radio sources.		
1.	Introduction . . . . .	» 313
2.	The optical identification of radio sources. . . . .	» 314
3.	The energy requirements of the radio sources . . . . .	» 315
4.	Supermassive stars . . . . .	» 316
5.	Quasars . . . . .	» 320
6.	Relaxation oscillations in nonrotating supermassive stars .	» 322
7.	Summary to this point . . . . .	» 334
8.	Rotation and stability of supermassive stars . . . . .	» 335
9.	Binding energy of a supermassive star in hydrostatic equilibrium . . . . .	» 337
10.	Equation of dynamic equilibrium . . . . .	» 340
11.	Adiabatic radial pulsation . . . . .	» 342
12.	Applications to polytropic models . . . . .	» 343
13.	Rotational stability <i>vs.</i> general relativistic instability .	» 345
14.	The limit of rotational stability . . . . .	» 349
15.	Dynamic and rotational periods . . . . .	» 355
16.	Conclusion . . . . .	» 357

**W. A. FOWLER - Neutrino astrophysics.**

1. Introduction . . . . .	pag. 367
2. Significance of neutrino detection . . . . .	» 368
3. Neutrino emission by the sun . . . . .	» 368
4. Detection of solar neutrinos . . . . .	» 375
5. Additional observational techniques. . . . .	» 378
6. Theoretical problems concerning neutrino astrophysics . . . . .	» 382
6'1. Introduction . . . . .	» 382
6'2. Neutrino emission during the equilibrium process . . . . .	» 383
6'3. Implications . . . . .	» 391

**N. DALLAPORTA - Symmetries of strong interactions . . . . .****D. W. SCIAMA - Cosmological aspects of high-energy astrophysics.**

1. Mach's principle and the physical foundations of general relativity. . . . .	» 418
1'1. A field theory of inertial forces . . . . .	» 419
1'2. Estimation of the coupling constant and relation to gravitation . . . . .	» 425
2. Physical conditions in intergalactic space . . . . .	» 428
2'1. The lower limit on the temperature of the intergalactic gas . . . . .	» 430
2'2. The upper limit on the temperature of the intergalactic gas . . . . .	» 432
2'3. The absorption of Lyman-alpha radiation by intergalactic neutral hydrogen . . . . .	» 434
2'4. Further effects of an ionized intergalactic gas . . . . .	» 435
3. Radio variables and their cosmological significance. . . . .	» 438
3'1. The angular diameters of QSS's . . . . .	» 439
3'2. Composite models for radio variables. . . . .	» 441
3'3. Conclusions . . . . .	» 450
4. The interpretation of the radio source counts . . . . .	» 451
4'1. The red-shift corrections . . . . .	» 452
4'2. Ryle's interpretation . . . . .	» 454
4'3. Sciama's interpretation . . . . .	» 456