

CONTENTS

1. INTRODUCTION.....	1
Reference	2
2. THE GENERATION OF GAMMA RAYS.....	3
2.1. Introduction	3
2.2. Nuclear gamma rays	4
2.3. The decay of neutral pions	13
2.4. Synchrotron radiation	18
2.5. Compton scattering	22
2.6. Bremsstrahlung	27
2.7. Optical depth	30
References	32
3. THE PROBLEM OF BACKGROUND RADIATION IN GAMMA RAY ASTRONOMY.....	33
3.1. Introduction	33
3.2. Atmospheric attenuation of gamma rays	33
3.3. Background effects produced by the cosmic radiation	36
3.4. The limiting sensitivity of a gamma ray telescope	47
References	51
4. LOW ENERGY GAMMA RAY TELESCOPES.....	52
4.1. Introduction	52
4.2. Scintillation counters	53
4.3. Solid state detectors	54
4.4. Passive shielding.....	56
4.5. Active shielding.....	58
4.6. Unshielded detectors	59
4.7. Collimators	62
References	66
5. COMPTON TELESCOPES.....	67
5.1. Introduction	67
5.2. Compton scattering	67
5.3. Multiple scattering of electrons	68
5.4. The design of a Compton telescope using detection of the scattered photon	71
5.5. The design of a Compton telescope using detection of the secondary electron ..	73
5.6. An example of a Compton telescope designed for use at balloon altitudes ..	77
References	80
6. SPARK CHAMBER TELESCOPES FOR HIGH ENERGY GAMMA RAYS	81
6.1. Introduction	81
6.2. Pair production.....	81
6.3. The basic design of a spark chamber telescope	83
6.4. The angular resolution of a spark chamber telescope.....	84
6.5. Background events in a spark chamber telescope	86
6.6. The triggering system of a spark chamber	87
6.7. The recording of spark positions in the chamber	89
6.8. An example of a spark chamber telescope designed for a satellite experiment	90
References	91

7. THE DETECTION OF EXTENSIVE AIR SHOWERS FROM VERY HIGH ENERGY GAMMA RAYS.....	92
7.1. Introduction	92
7.2. The longitudinal development of an air shower.....	92
7.3. The lateral development of an air shower.....	94
7.4. The detection of air showers using arrays of charged particle detectors at ground level.....	96
7.5. The detection of the Cerenkov light from air showers	96
7.6. An example of a ground-based system for detecting atmospheric Cerenkov light from extensive air showers	97
References	98
8. SOLAR GAMMA RAYS.....	99
8.1. The quiet sun	99
8.2. Solar activity	99
8.3. General characteristics of solar flares	101
8.4. Evidence for particle acceleration in solar flares	102
8.5. Observations of gamma rays from solar flares.....	105
8.6. Interpretation of the gamma ray observations from solar flares	110
8.7. The mechanism responsible for particle acceleration in solar flares	119
References	119
9. GAMMA RAYS FROM THE GALACTIC DISC	121
9.1. Introduction	121
9.2. Cosmic ray particles in the Galaxy	121
9.3. The interstellar gas.....	126
9.4. Measurements of gamma rays from the Galactic disc	127
9.5. Interpretation of the gamma ray measurements from the Galactic disc	135
References	140
10. DISCRETE GAMMA RAY SOURCES IN THE GALAXY	141
10.1. Introduction	141
10.2. Pulsars and supernova remnants	141
10.3. Molecular clouds in the Galaxy	156
10.4. Unidentified discrete sources of high energy gamma rays in the Galaxy	156
10.5. Gamma ray spectral lines from the central region of the Galaxy	159
10.6. Sources of gamma ray bursts	163
References	175
11. EXTRAGALACTIC GAMMA RAY SOURCES AND THE DIFFUSE BACKGROUND RADIATION.....	177
11.1. Introduction	177
11.2. Radiation processes in compact sources	177
11.3. Seyfert galaxies	179
11.4. Radio galaxies.....	184
11.5. Quasars	188
11.6. Cosmological background radiation	190
References	199
INDEX	201

