Table of Contents

About the Digital STARLAB System 5
About the Starry Night™ Small Dome Software 6
Using This Guide 7
Lesson 1 — Night and Day 8
NSES Connections & Background 8
Pre-Visit Activities 8
Daytime/Nighttime Images 8
Ring Around The Students 9
The Digital Lesson: Night and Day 10
1. Introduction 10
2. Daytime 10
3. Horizon 11
4. Reason for Day and Night 12
5. Earth and Sun 13
Starry Night High School Link 13
Extending the Lesson 13
Day/Night Model 13
Shadow Sticks and Sundials 13
Sunspotter Solar Telescope 14
Lesson 2 — Moon Phases 15
NSES Connections & Background 15
Pre-Visit Activities 16
Moon Phase Flip Book 16
Moon Phases and Cultural Events 16
The Digital Lesson: Going Through a Phase 17
1. Introduction 17
2. Moon Appearance 17
3. New Moon 18
4. Waxing Moon 19
5. First Quarter Moon 19
6. Waxing Gibbous Moon 20
7. Full Moon 20
8. Waning Moon 21
9. Phase Cycles 21
10. Phase Cycles from Space 22
11. Predictions 22
Starry Night High School Link 23
Extending the Lesson 23
Moon Phase Model 23
Moon Calendar 24
Lesson 3 — Finding Your Way Around the Sky 25
NSES Connections & Background 25
Pre-Visit Activities 26
Dot Puzzles 26
Longitude and Latitude 26
Angular Measurement 26
Using an Astrolabe 26
The Digital Lesson: Finding Your Way Around the Sky 27
1. Introduction 27
2. Forming Star Patterns 28
3. Asterisms 28
4. Unchanging Star Patterns 29
5. Circumpolar Stars 29
6. Polaris 30
7. Stars from the North Pole 31
8. Changing Latitude — Northern Hemisphere 31
9. The Equator 32
10. Changing Latitude — Southern Hemisphere 32
11. The South Pole 33
12. Star Hopping 34
13. Reasons for Navigating with Stars 35
Starry Night High School Link 35
Extending the Lesson 35
Making a Dipper Finder 35
Using Star Maps 37
Lesson 4 — Constellations and Star Lore 38
NSES Connections & Background 38
Pre-Visit Activity 39
Constellation Creations 39
The Digital Lesson: Constellations and Star Lore 40
1. Introduction 40
2. Sky Pictures 40
3. Connecting the Dots 41
4. The Greek Sky 41
5. Aries the Ram 42
6. Orion the Hunter 42
7. The Myth of Orion 43
8. Scorpius the Scorpion 43
9. Sagittarius the Centaur 44
10. Draco the Dragon 44

11. Northern Circumpolar Constellations 45
Starry Night High School Link 45
Extending the Lesson 45
Constellations Around the World 45
Myths and Morality 45
Modern Day Myths 46
Lesson 5 — Seasonal Change 47
NSES Connections & Background 47
Pre-Visit Activities 47
My Favorite Season 47
Sun Angle and Radiation 48
Tracking Hours of Daylight 48
The Digital Lesson: A Change of Season 49
1. Introduction 49
2. Earth's Orbit 49
3. Predicting Sunrise and Sunset in Winter 50
4. Understanding Horizon, Zenith and Meridian 50
5. Predicting Sunrise and Sunset in Summer 51
6. Sun's Path Comparisons 52
7. Earth's Axis 53
8. Axis and Sunlight 53
9. Sun Position in Autumn 53
10. The Sun at Noon 54
11. Analemma 55
Starry Night High School Link 55
Change of Seasons Data Chart for Use in the Planetarium 56
Extending the Lesson 57
Sunshine Model 57
The Analemma 57
Lesson 6 — Solar and Lunar Eclipses 58
NSES Connections & Background 58
Pre-Visit Activity 59
Umbral and Penumbral Shadows 59
The Digital Lesson: Solar and Lunar Eclipses 60
1. Introduction 60
2. Solar Eclipse 60
3. Solar Eclipse Totality 61
4. Partial Eclipse 61
5. Demonstrating a Partial Eclipse from Space 62
Web Search for Future Eclipses 65
Eclipses of the Past 65
Eclipse Photos 65
Lesson 7 — Overview of the Solar System 66
NSES Connections & Background 66
Pre-Visit Activity 67
Road Map of the Solar System 67
The Digital Lesson: An Overview of the Solar System 68
1. Introduction 68
2. Our Solar System 68
3. The Sun 69
4. Planetary Motion 69
5. Planetary Orbit 69
6. Asteroids 70
7. Planetary Orbits from Space 70
8. The Ecliptic and Kuiper Belt 71
9. The Planet Mercury 71
10. The Planet Venus 71
11. The Planet Mars 72
12. The Planet Jupiter 72
13. Moons of Jupiter 73
14. The Planet Saturn 73
15. The Planet Uranus 74
16. The Planet Neptune 74
17. Pluto 74
Starry Night High School Link 75
Extending the Lesson 75
Planetary Travel Brochures 75
How Did the Planets Get Their Names? 75
The Great Planet Debate 75
Lesson 8 — The Motion of the Planets 77
NSES Connections & Background 77
Pre-Visit Activity 78
Observing Planets 78
The Digital Lesson: Moving Out — The Motion of the Planets 79
1. Introduction 79
2. Wanderers 79
3. The Power of Prediction/Geocentric Earth 80
4. Retrograde Motion 81

6. Lunar Eclipse 63
7. Lunar Eclipse Totality 64
8. A Solar vs. Lunar Eclipse 64
Starry Night High School Link 65
Extending the Lesson 65
Eclipse Models 65
5. Demonstrating Retrograde Motion 81
6. The Heliocentric Model 81
7. Planetary Speed 82
8. Elliptical Orbit 82
Starry Night High School Link 83
Extending the Lesson 83

Retrograde Motion Model 83
Research Kepler, Copernicus, and Galileo 83
Lesson 9 — Meteors, Asteroids and Comets 84
NSES Connections & Background 84
Pre-Visit Activity 85
Moon Maps 85
Craters on Earth 85
Asteroids and Comets 85
The Digital Lesson: Meteors, Asteroids and Comets 86
1. Introduction 86
2. Defining Meteors, Asteroids and Comets 86
3. Finding An Asteroid 87
4. Asteroid Belt 87
5. Toutatis 88
6. Comets 88
7. Comet Hale-Bopp 88
8. Halley's Comet 89
9. The Orbit of Comets 89
10. Meteor Showers 90
Starry Night High School Link 91
Extending the Lesson 91
Dates of Meteor Showers 91
Make a Model Comet 91
Lesson 10 — Seasonal Constellations 92
NSES Connections & Background 92
Pre-Visit Activity 93
Rotation vs. Revolution 93
Astronomy vs. Astrology 93
The Digital Lesson: A Calendar in the Stars — Seasonal Constellations 94
1. Introduction 94
2. Ancient Constellations 94
3. Constellations in Motion 94
4. Orion 95
5. As the Earth Turns 96
6. Seasonal Constellations 96
7. Winter 96
8. Spring 97
9. Summer 97
10. Circumpolar Constellations 98
11. The Zodiac 98
12. Sun Sign 98
13. Conclusion 99
Starry Night High School Link 99
Extending the Lesson 99
Zodiac Model 99
Origins of the Zodiac 100
Star Shift 100
Lesson 11 — Properties and Life Cycles of Stars 101
NSES Connections & Background 101
Pre-Visit Activity 102
Using the H-R Diagram 102
The Digital Lesson: Star Light, Star Bright — Properties and Life Cycles of Stars 103
1. Introduction 103
2. Star Descriptions 103
3. Star Brightness 104
4. Apparent Magnitude 104
5. Absolute Magnitude 105
6. Star Size 105
7. Star Color 106
8. Nebula 106
9. Star Life Cycle 107
10. Supernova 107
11. The Sun 108
12. The Future 108
Starry Night High School Link 109
Extending the Lesson 109
Making a Magnitude Scale 109
Researching Star Types 110
The Life of our Sun — Using the H-R Diagram 110
Lesson 12 — The Milky Way Galaxy 111
NSES Connections & Background 111
Pre-Visit Activity 112
Understanding Light Years 112
Modeling the Expanding Universe 112
The Digital Lesson: The Milky Way Galaxy 113
1. Introduction 113
2. The Milky Way in Winter 113
3. Light Pollution 114
4. The Milky Way in Summer 114
5. Constellations 114
6. Measuring Distance 115
7. Shape of the Milky Way 115
8. The Andromeda Galaxy 116
Starry Night High School Link 117
Extending the Lesson 117
Observing the Milky Way 117
Hubble Classification of Galaxies 117
Modeling the Milky Way 117