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-== =/\=United Confederation of Interstellar Planets =/\= ==-
-== Science Academy Guide ==-
-== Stardate 239802.26 Ver1.0 ==-
-== Author: Lieutenant Commander Ma'bor Jetrel ==-
-== Stardate 239808.03 Ver2.0 ==-
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-== Stardate 239907.14 Ver3.0 ==-
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Table of contents:

I. Introduction

Welcome to the science course guide at the academy.
Utilizing the science definitions and procedures in the world of role-playing is a fairly easy step but yet still difficult in its adaptions. However, remember that your imagination is the key.

II. Role of Science Officer (CSO or Asst SCI)

The role of the science officer (CSO or Asst Sci) is to aid in the detection, research, and investigation of celestial objects, spatial anomalies, wormholes, space dwelling creature encounters, specialized particle detections, mapping (either planet body or spatial), locating lifeforms/lifesigns, temporal encounters and other operations deemed necessary to the situation.

III. Relation between OPS and SCI

Science is secondary to most primary operations. The Operations Manager usually takes over if science is unavaliable but science is always a relatively important aspect to the SIM environment.

IV. Duties of Science Department

As relevant to SIM missions, the science dapartment may be ordered to detect certain cloaked vessels(using such methods as Tachyon sweeps or Veteron pulses), study anomalies in space(eg. unknown nebulae, temporal debris, etc.), and/or to aid the Operations Manager in various aspects of that task. When idle, the science officer should work with Stellar Cartography to map the surrounding area, adding detail to previous mappings when necessary.

V. Utilities

Utilities such as the science labs, sensor arrays, navigational deflector(s), external probes and the ODN network are avaliable to the science officer's usage. Normally science has its own sensors, although science may allocate them, as may the OPS officer. Also, smaller equipment such as tricorders are necessary for some missions.

VI. Away Missions

Science is frequently called upon to participate in away missions. The main purpose of an away mission usually requires the science department's presence.

Planet surveys and studies of physical or geological structures may be necessary, including, but not limited to, alien interaction, cave exploration, and the like. On a mission, the science officer is required to take a tricorder, standard phaser, multiphasic adapter and mini-portable emitter. Other equipment is always included based upon the situation. During an away team, the science officer can always use the ship as a helpful device. Such things as using the ship's deflector to emit certain particles at a planet to clearing up scans to relaying data to the transporter itself are good ways to interact with the ship.

VII. Alien lifeforms

Encounters with other lifeforms allow the science officer to make a detailed investigation and collect data about the creatures using appropriate devices. Subsequent encounters also allow the science officer to update the known information about the creatures. Lifeforms range from beings (human, non-humanoid, etc.) to micro-particles(bacteria, micro-organisms, etc.). Sometimes, it may be useful to coordinate with the CMO during studies of alien life-forms.

Note: Please refer to the ALIEN RACES section of the ucip main page (http://www.ucip.org)

VIII. Supplementary Information

Note: This section of the guide includes sub-sections of information mostly related to astronomy and the study of other celestial objects. This information is useful for both new and experienced UCIP officers, and should be used as a reference in SIMs. It is important that before taking the science test, candidates gain a thorough understanding of this section.

Astronomy has several areas of studies. Below are 5 vital areas:

i) Particles - A guide to all those particles you see on Star Trek. A great way to enhance your sim and learn some real molecules.
ii) Phenomena - Those interesting celestial objects encountered in space.
iii) Types of Matter - Different kinds of matter that exist.
iv) Planetary Classifications - The basic classes of planets.
v) Types and Timeline of Stars

i) Particles

The data is too extensive to put in here. Please see this address for more information:
http://www.ucip.org/departments/academy/particles.html

ii) Phenomena

-Quantum filament-

A quantum filament is a closed loop of twisted space with interesting and unpredictable physical effects. Filaments are usually formed in supernovas and although they normally are not very dangerous, they should be avoided.

-Nebula-

A nebula is any region of space in which interstellar matter density is significantly higher than the average. Nebulas may result from stellar explosions or from "pile-up" due to passage of gravitational density waves. Supernovae are one main cause of nebulae. The life of a nebula starts out as standard formation of a concernable cloud in space that is virtually in it's large peak. From there elements, particles, molecules, gases, and other matter fuse and stabilize. Properties vary from the kind of materials collected. After the nebula forms it slowly over centuries shrinks as matter slowly begins deteriorated of energy and leaving the cloud or dispersing. During this time new stars may form which will lead to solar systems within the nebula.

-Cosmic String-

A cosmic string is somewhat similar to a quantum filament. It is gravitational well of space that contiously drags into itself in a verticle manner due to it's emense mass leading to intense gravitational pull. Energy almost rips into space-time at the core of a cosmic string and is kept there by the pull. There is little data on how it is formed and little theorization. However the most plausible explanation is that if two stars nova close enough to each other to have their expelled energy combine that the combination of energy, matter and gravitational outburst would cause a cosmic string to form. They are to be avoided at all costs. The center of a cosmic string will destroy any object.

-Space Dwelling Lifeform-

There are many space-dwelling beings that vary in structure and appearance throughout the galaxy. Some are artificially created and some presumed to have formed near the barrier of the galaxy's core where various gases are plentiful and conditions able to form one.

iii) Properties of matter

-Dark Matter-

During the late 20th century, evidence indicated that the Milky Way Galaxy mass was considerably more than could be accounted for by observed luminous or interstellar matter. Dark matter is so-called because it does not actually emit radiation. It is known as dark matter because it is matter which cannot be detected by simply looking at it. To detect it, one must use some sophisticated techniques. However, dark matter is just like any other matter, except that it doesn't radiate.

Dark matter is also called "missing mass." This is because it is believed that dark matter may be the "missing" mass required to eventually stop our universe from expanding and cause it to contract again to go through another "Big Bang".

-Protomatter-

An early form of matter. It is made up of one Proton and one electron. Very rare and valuable. Mainly found in nebulas.

-Degenerate Matter-

Degenerate matter exists under temperature and density conditions such that the Pauli exclusion principle prevents the formation of electron shells around the matter's atomic nuclei.

Such degenerate matter is found in white dwarf stars and the cores of some ordinary stars and planets. Degenerate matter is usually incredibly dense. A single teaspoonful would weigh tons.

-Negative Matter-

First postulated by the 20th-century author E. E. Smith, no reliable observation of negative matter has ever been reported. Unlike antimatter, negative matter has negative gravitons and repels ordinary matter. Upon contact, the matters would cancel each other out without release of energy due to the negative gravitons that dispense the equation of energy.

-Antimatter-

Antimatter is similar to ordinary matter except that its atoms are composed of positrons orbiting about anti-proton and anti-neutron nuclei.
Physical properties are indistinguishable from ordinary matter.
When the two types meet, they convert one another into pure energy.
The ability to construct antimatter made interstellar flight possible due to it's expending energy with deuterium.

iv) Planetary Classification.

Planets' natural characteristics, such as age, mass and distance from their sun, place them in 16 naturally bounded classes which have been assigned arbitrary alphabetic designations. Currently extending one more class.
A planet's distance from its sun, relative to that sun's luminosity, puts the planet in one of three thermal zones: hot, habitable and cold.

Normal Solar System - Planet Distances -- Relative to it's Sun

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__________________________________________________________________________
_
    --80,000,000- -70,000,000- --------350,000,000--------
     <             <            <                           <
  --- <              <            <                           <
Gravitational
      \<  Hot Zone    <  Habit     <   Cold Zone              < pull too
weak
  SUN  |              <  able      <                          < for a
planet
      /<             <   Zone     <                           < to orbit
  --- <.          ___|          _|                            <.
     < .         |              |                            <.
       .         |80,000,000 KM  |150,000,000 KM            <.
       |0 KM      -------------   --------------             |500,000,000
KM
```

A planet's mass determines its internal heat generation and in combination with its sun, its ability to hold an atmosphere. Some planets pass through distinct stages as they form and age, which may put them in separate classes: One billionth of a second of antimatter with normal matter can emit 20 megajoules.
(EXTENSION: Due to deuterium's nearly flawless state of merely matter that contains only one variable, antimatter can convert it easier to energy releasing more energy than a more complex matter, even oxygen.)

-Class A-
Gas Supergiants.
Very large, typically 300 to 1000 times the mass of Earth and are in the sun's cold zone.
Low solar radiation and high gravity have allowed them to keep thick atmospheres of hydrogen and hydrogen compounds surrounding a smaller solid planetary core. High core temperatures cause them to radiate heat. Similar to Jupiter or Saturn.

-Class B-
Gas Giants.
Large, typically 10 to 100 times the mass of Earth, and are in there sun's cold zone.
Low solar radiation and high gravity allowed them to keep thick atmospheres of hydrogen and hydrogen compounds.
Similar to Neptune or Uranus.

-Class C-
Typically of about the mass of Earth.
Located in their sun's habitable zone.
Due to the greenhouse effect of dense atmospheres heavy in carbon dioxide, their surfaces are very hot and water is only found in vapor form, if present at all. Could have formed into class M but location was too near the sun in the habitable zone to induce hydrogen fusion.
Similar to Venus.

-Class D-
Typically of about the mass of Earth.
Located in their sun's habitable zone.
They are newly formed, and their surfaces are still molten. Their atmospheres still retain many hydrogen compounds, as well as reactive gases and rock vapors. These planets will cool, becoming class E.

These are "proto-planets" in relatively new star systems. Very rare.

-Class E-
Typically of about the mass of Earth.
Located in their sun's habitable zone.
They are recently formed, and their surfaces are thin. Their atmospheres still retain many hydrogen compounds. These planets will cool, becoming class F.
These are "proto-planets" in relatively new star systems. Very rare.

-Class F-
Typically of about the mass of Earth.
Located in their sun's habitable zone.
They are younger then Earth, and their surfaces are still crystallizing. Their atmospheres retain small amounts of toxic gasses.
As these planets continue cooling, they may become class C, M or N.
These are "proto-planets" in relatively new star systems. Very rare.

-Class G-
Typically of about the mass of Earth.
Located in their sun's hot zone.
Their gravity allows them to retain an atmosphere of heavy gasses and metal vapors, but due to strong solar radiation, their surfaces are very hot.

-Class H-
Typically 1 to 1/10 the mass of Earth.
Located in their sun's cold zone.
They are newly formed, and their surfaces are still molten. Their atmospheres still retain many hydrogen compounds, as well as reactive gases and rock vapors. These planets will cool, becoing class L.

-Class I-
Typically 1/100 the mass of Earth, or less.
Located in various parts of their sun zones.
Due to low gravity, they have lost their atmospheres. Their surfaces, directly exposed to radiation and meteor impact, are typically lifeless and heavily cratered. Normally planetoids in asteroid fields or moons.

-Class J-
Typically 1/10 the mass of Earth.
Located in their sun's hot zone.
Due to combination of weak gravity and strong solar radiation, their

atmospheres are very tenuous, with few chemically active gases, and there surfaces are extremely hot.
Similar to Mercury.

-Class K-
Typically 1/5 to 1/10 the mass of Earth.
Located in their sun's habitable zone. Due to weak gravity their atmospheres are tenuous, but water is usually present.

-Class L-
Typically 1 to 1/10 the mass of Earth.
Are in their sun's cold zone. Due to a combination of low solar radiation and little internal heat, their atmospheres are permanently frozen as well as the surface itself. Similar to Pluto or a Uranus type climate.
Appeared on "The Sound of Her Voice" DS9

-Class M-
Typically of about the mass of Earth.
Are in their sun's habitable zone. Their atmospheres contain significant oxygen, nitrogen and liquid water is a significant surface feature, and lifeforms are abundant. With more water, they would be class N.
Earth or better know as Sol III is class M
Basic universal planet with lifeforms.

-Class N-
Typically of about the mass of Earth.
Are in their sun's habitable zone. Their atmospheres contain significant oxygen, liquid water cover over 97 percent of the surface, and lifeforms are generally abundant. With less water, they would be class M. During the planet's formation less hydrogen left the surface.
If both oxygen and hydrogen left in few amounts it would be Class C
Similar to Romulus's inhabited moon, Remus.

-Class S-
Gas Ultragiants.
Typically 10,000 times the mass of Earth, and are in their sun's cold zone. Low solar radiation and high gravity have allowed them to keep thick atmospheres of hydrogen and hydrogen compounds. High core temperatures cause them to radiate visible light. These are the largest possible planets, as more massive bodies would collapse upon themselves to form into stars themselves.

-Class T-
Gas Supergiants.
Typically 3,000 times the mass of Earth, and are in their sun's cold

zone. Low solar radiation and high gravity heave allowed them to keep thick atmospheres of hydrogen and hydrogen compounds that surround a solid core. Infrared radiation is present due to high core temperatures, which cause them to radiate enough heat that liquid water is present.

-Class Y-
Gas Supergiant.
Typically 300 to 1,000 times the mass of Earth.
Located in their sun's hot zone. Very similar to class C but it's greenhouse effect caused solar wind to trap within it's thick atmosphere to form thermionic storms. Contains sulfuric and volanic gases. Very inhospitable to all lifeforms and can degrade any protective suiting within hours. Nicknamed "Demon-Class".

v) Types and Timelines of Stars

Spectral Types
There are seven major spectral types of stars, forming a continuous band of types from O through M:

O B A F G K M

These are divided into ten numbered subtypes, for example:

A0 A1 A2 A3 A4 A5 A6 A7 A9 F0

Stars at the "0" end of this band are hotter (around 50,000 degrees K), bluer in color and more massive; those at the other end are cooler (around 2,000 degrees K), redder in color and less massive. A conventional code for star color is:

Lighting Order

Type	Color	Temperature	Mass	Radius
O	Violet-white	30,000-50,000K	10-30 solar masses	2.5-3.0 solar radii
B	Blue-white	10,000-30,000K	3-5 solar masses	2.0-3.5 solar radii
A	White	7,500-10,000K	2-3 solar masses	1.5-2.0 solar radii
F	Yellow-white	6,000-7,500K	1-2 solar masses	1.0-1.5 solar radii
G	Yellow	4,500-6,000K	.8-1 solar masses	0.8-1.0 solar radii
K	Orange	3,500-4,500K	.5-.8 solar masses	0.5-0.8 solar radii
M	Red	2,000-3,500K	.02-.5 solar masses	0.1-.5 solar radii

While a "Giant" star may have a radius of up to 1,000 times that of Sol and be up to 100,000 times as luminous, most stars are in the "main sequence" portion of their lifetimes and have values near the typical main sequence ones for their type. Type O stars may live for as little as a few hundred million years, while it is believed that type M stars may live for as long as 30 or 40 billion years.

Sol, Earth's sun, is type G. Its spectrum, as filtered by Earth's atmosphere, is the basis for standard illumination in Human quarters.

Chronical Diagram of a Star's Life:

```
                Nebula
                   |
         Gravitational collapse
          creates central mass
                   |
       Central mass begins fusion
        of Hydrogen (now a star)
                     |
         Formed Sun/Star System
                     |
              Red Giant
                 /       \
              /    (Massive[>~3 solar masses])
             |          |
             |        Supernova
           White       /   \
           Dwarf   Black  Neutron Star(3-~5 solar masses)
             |     Hole
           Black  (>~10 solar masses)
           Dwarf
```

Celestial bodies that form from a Supernova include nebulas, new stars, planets, elements and particles.

POPULATION

Population 1 stars are old stars well down the main sequence (class F, G, K, and M stars) and short on heavier elements.
Planetary systems accompanying Population 1 stars primarily consist of gas giants without accompanying satellites.
Population 2 stars are younger stars showing traces of heavier elements, hydrogen and helium.
Planetary systems accompanying Population 2 stars include gas giants, stony worlds, satellite companions and planetoid and comet shells.

STAR PHASES

-Dwarfs-
Dwarfs are relatively classified as the small dim-lited stars because they have gone through two gravitational collapses.

-Sun-
Term describing the medium sized to medium small stars in the universe that normally has at least one Class-M planet. Sol, the Earth's sun is a medium sized star. They normally burn for five billion years, at which point they move onto the next phase of star development.
At the point that the star uses up the hydrogen in the core, it will begin to contract, re-igniting the shell around the core, and creating a Red Giant. However, a nova is something completely different, and is unrelated to the actual lifecycle of a star.

-Red Giant-
The red giant phase is common in the evolution of many less massive stars. When core hydrogen is exhausted, gravitational collapse ignites hydrogen shell burning outside the core. The star's envelope expands far beyond the photosphere limit. The star's atmosphere is extremely tenuous and relatively cool.
Following Red Giant stage for stars less than 3 Solar masses, the outer shell of the star will continue to cool and move out to form a ring around the remaining white dwarf star. This ring is what is known as a Planetary Nebula.
For stars of 3 solar masses and greater, this stage is followed by a supernova.

-Blue Straggler-
Hot, massive, bright blue stars found in the cores of a few globular clusters, stragglers are formed by the head-on collision of two red giant stars. The increase of mass and fresh hydrogen mixture from the envelope into the new star's core causes the star to behave like an extremely massive young star, no matter the age of its progenitors.

-Red Supergiant-
If the shell outside the core is high enough in hydrogen, the envelope may expand even farther.

-Supernova-
When a massive young star exhausts it's core hydrogen, it undergoes second-stage gravitational collapse. The resulting core temperature increase leads to runaway nuclear burning. This causes the fusion of heavier and heavier elements(Helium, Carbon, Oxygen, up to Iron). However, when the fusion gets to the point that Iron os present in the core, it is no-longer able to fuse the atoms. At this point, the star

begins an irreversible collapse. The mass of the star falls down onto the star, including the outer layers previously making the red giant. Because of the violence of this collapse, as well as the abundance of lighter elements inthe outer layers, fusion begins again, except that this time it cannot sustain the weight of the star. This fusion causes the explosion of the star in an extremely powerful explosion. If any planets exist around such a star, they now are dead, if they weren't already dead from the Red Giant stage. Supernova explosions are the major source of metals and other heavy galactic elements. Supernovae are also responsible for high neutrino emissions which can be detected from far away shortly after the explosion.

-Neutron Star-

A neutron star is usually type B-0 and measures only a few kilometers in diameter.

A neutron star is formed when a star of about 3 to about 5 solar masses undergoes gravitational collapse at the end of its lifetime. During the gravitational collapse, the star begins the runaway fusion of elements as stated in the Supernova description, and continues until it reaches iron, since Iron cannot be fused. At the point Iron is reached, the mass of the star collapses upon itself, and reignites in a spectacular explosion, thus causing a supernova. This violent contraction forces the electrons of the Iron into the cores and drives them into the protons, thus creating neutrons. As the nebula which is the remnants of the star disperses at high speed, the neutron core is left spinning at extremely high velocity. This rate of spin is also what creates the radio waves which we are able to detect.

-Black Hole-

A black hole is the other possible result of a supernova. A black hole forms in a similar fashion to a Neutron Star. However, there are a few differences. In the case of a black hole, what happens is that the star undergoes the violent gravitational collapse seen in the formation of a Neutron star. However, in the rebounding explosion, there is sufficient implosion force due to the sheer mass involved that the atomic forces are overcome and all the matter is forced into a singularity. Around this singularity is what is known as an Event Horizon. At the Event Horizon, the escape velocity from the star is equal to the speed of light. Anything travelling slower than the speed of light which passes through this horizon will be pulled into the black hole. Additionally, the tidal forces across an object in the vicinity of a black hole are so extreme that a person falling toward the black hole feet-first would have their feet and legs ripped off before even reaching the event horizon.

Because it is nearly impossible to get close enough to one to conduct an exhaustive study, very little is known about them. However, we do know a few things. Black holes are called black because of the fact that no light escapes from inside them, and because of the fact that they seem to be able to engulf an infinite amount of mass without filling up. Further, we know that they exist because matter falling into them does radiate. Matter falling into a black hole radiates X-rays in large amounts, which are detectible. Additionally, black holes can also be detected because of the "lensing effect". This is an effect which is found near large gravity wells. If a large gravity well is placed between a light source and an observer, that light source will appear to form a ring around the gravity well. Additionally, if the observer or the light source moves one way or the other, the light source will appear as if it were being viewed through a lens. The deeper the gravity well, the greater the distortion.

-Lazarus Star-

A Lazarus Star is a supernova remnant which, instead of being forced inward into neutron-star mode, survives as a normal star. After expansion into red giant phase, Lazarus stars collapse and undergo supernova for a second time.

-Nova-

Start with two stars. Usually, one is much smaller and dimmer than the other. These two stars are in a binary pair and are spinning around each-other. As they spin, some of the mass leaves the larger of the two stars and accretes on the smaller of the two. This continues until there is sufficient mass on the smaller to ignite nuclear fusion, at which point the smaller star gets extremely bright in a very large nuclear reaction. This brightening is known as a Nova, because people in ancient years on Sol III believed that they were seeing a new star in the heavens. After a number of days, the nuclear reaction has consumed the fuel available and the cycle begins again. Usually, the recipient of the falling matter is either a white dwarf or a small, dim-lighted star; however, this can also happen with a normal-sized star, similar to Sol.

DWARF STARS

"Dwarf" is a category comprising various small and dim energy-radiating or formerly energy-radiating celestial objects.

-White Dwarf-

Primarily degenerate matter, this main sequence star, usually of type G-late A, has completed nuclear burning processes and has collapsed into a configuration roughly the size of a small planet which takes a very long significant time.

White dwarfs radiate at various levels of intensity through self-gravitational collapse. Nuclear burning occurs only on the surface through accretion of unburned matter from other sources; in such cases, nuclear ignition can regularly occur and is the source of the "recurrent nova" effect.

The spectral class of white dwarf stars is usually prefixed with a D.

-Red Dwarf-

A red dwarf is a main sequence star of a type M. A red dwarf is a small star which was able to ignite. However, these stars usually have very low solar masses, and, as a result, burn for a very long time. Also, these stars, due to the slow burn rate and low temperature, tend to burn with a red color, hence the label red.

-Brown Dwarf-

A brown dwarf is a gaseous body producing much more energy through self-gravitation than it recieves from the ambient medium, but which may not be massive enough to initiate internal fusion reaction and, therefore, not truly a star. These stars are usually only hot enough to produce infrared emissions, or a very deep red light.

Brown dwarfs hot enough to produce visible light ("substellar objects") are listed as Class S planets. Those producing infrared ("thermal edens") are listed as Class T planets. They are both also known as supergiant gas planets. Some gas giant planets (Class A) may produce slightly more energy than they receive, but they are not generally considered to be brown dwarfs.

-Black Dwarf-

A black dwarf is the remains of a white dwarf once it has cooled down to the point that it is no-longer radiating. As the white dwarf cools, it finally cools to the point that it is no longer radiating in the visible spectrum, and at that point, is designated a black dwarf.

-RELATED PARALLEL: Dyson Sphere-

A Dyson sphere is an artificially constructed sphere surrounding a star. Creation of such a sphere is beyond current Federation technology, but one such sphere has been discovered by the U.S.S. Enterprise-D and visited as well as the U.S.S. Vindicator. Infrared signatures presumed to belong to several such spheres have been observed in Federation astrometric surveys. The canonical Dyson sphere would have an internal surface area many times the total surface area of all the Federation's inhabited planets.

IX) Final Words on the Course Guide

To all those new officers new to Science, remember:

"The most important thing is not about passing and getting the ribbon,
It's about having fun while simming.
So, don't worry about failing and just try your best.."

During your service in the science field, your expertise or learning-on-the-way studies will be very important so that everyone can have fun with new and innovative ideas. Science can open up new barriers and

discoveries. Knowing the above Trek ideals and real life scientific theorems
and subjects is a great way to expand your knowledge.

So search and find whats out there.