WESTERN SYDNEY
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A Multifrequency Study of the Magellanic Clouds

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Dedication

There is abundant evidence of a widened and deepened interest in modernscience. How could it be otherwise when we think of the magnitude and the eventfulness of recent advances?

The work presented in this thesis is, to the best of my knowledge and belief, original except as acknowledged in the text.

I hereby declare that I have not submitted this material, either in full or in part, for a degree at this or any other institution.

....

Evan Johnston Crawford February 15, 2019

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Abstract

There is abundant evidence of a widened and deepened interest in modern science. How could it be otherwise when we think of the magnitude and the eventfulness of recent advances?

But the interest of the general public would be even greater than it is if the makers of new knowledge were more willing to expound their discoveries in ways that could be "understanded of the people." No one objects very much to technicalities in a game or on board a yacht, and they are clearly necessary for terse and precise scientific description. It is certain, however, that they can be reduced to a minimum without sacrificing accuracy, when the object in view is to explain "the gist of the matter." So this OUTLINE OF SCIENCE is meant for the general reader, who lacks both time and opportunity for special study, and yet would take an intelligent interest in the progress of science which is making the world always new.

List of Abbreviations

MC	Magellanic Cloud
LMC	Large Magellanic Cloud
SMC	Small Magellanic Cloud
ATNF	Australia Telescope National Facility
ATCA	Australia Telescope Compact Array
RA	Right Ascension
DEC	Declination
$\boldsymbol{\alpha}$	Spectral index

Chapter 1

Preface

A first chapter.

Chapter 2

Introduction

2.1 The First Section

This is the first section.

2.1.1 The First Subsection

This is the first subsection.

2.2 Acronym Test

These are acronyms, Magellanic Cloud (MC), introduced for the first time, and the second: MC. Some others: Large Magellanic Cloud (LMC), Small Magellanic Cloud (SMC), Australia Telescope National Facility (ATNF), Australia Telescope Compact Array (ATCA), Right Ascension (RA) and Declination (DEC).

The second use of the others: LMC, SMC, ATNF, ATCA, RA and DEC.

Note that the abbreviation for this one is different to its display, look above for how to do this. First time: Spectral index (α), and second α.

2.3 A figure

An image figure appears next but LaTeX will put it where it wants.

The rest of this chapter is junk text to pad it out.

The story of the triumphs of modern science is one of which Man may well be proud. Science reads the secret of the distant star and anatomises the atom; foretells the date of the comet's return and predicts the kinds of chickens that will hatch from a dozen eggs; discovers the laws of the wind that bloweth where it listeth and reduces to order the disorder of disease. Science is always setting forth on Columbus voyages, discovering new worlds and conquering them by understanding. For Knowledge means Foresight and Foresight means Power.

The idea of Evolution has influenced all the sciences, forcing us to far since Darwin's day. The solar system, the earth, the mountain ranges, and the great deeps, the rocks and crystals, the plants and animals, man himself and his social institutions–all must be seen as the outcome of a long process of Becoming. There are some eighty-odd chemical elements on the earth to-day, and it is now much more than a suggestion that these are the outcome of an inorganic evolution, element giving rise to element, going back and back to some primeval stuff, from

Figure 2.1: A figure

which they were all originally derived, infinitely long ago. No idea has been so powerful a tool in the fashioning of New Knowledge as this simple but profound idea of Evolution, that the present is the child of the past and the parent of the future. And with the picture of a continuity of evolution from nebula to social systems comes a promise of an increasing control–a promise that Man will become not only a more accurate student, but a more complete master of his world.

2.4 Two

It is characteristic of modern science that the whole world is seen to be more vital than before. Everywhere there has been a passage from the static to the dynamic. Thus the new revelations of the constitution of matter, which we owe to the discoveries of men like Professor Sir J. J. Thomson, Professor Sir Ernest Rutherford, and Professor Frederick Soddy, have shown the very dust to have a complexity and an activity heretofore unimagined. Such phrases as "dead" matter and "inert" matter have gone by the board.

The new theory of the atom amounts almost to a new conception of the universe. It bids fair to reveal to us many of nature's hidden secrets. The atom is no longer the indivisible particle of matter it was once understood to be. We know now that there is an atom within the atom–that what we thought was elementary can be dissociated and broken up. The present-day theories of the atom and the constitution of matter are the outcome of the comparatively recent discovery of such things as radium, the X-rays, and the wonderful revelations of such instruments as the spectroscope and other highly perfected scientific instruments.

The advent of the electron theory has thrown a flood of light on what before was hidden or only dimly guessed at. It has given us a new conception of the framework of the universe. We are beginning to know and realise of what matter is made and what electric phenomena mean. We can glimpse the vast stores of energy locked up in matter. The new knowledge has much to tell us about the origin and phenomena, not only of our own planet, but other planets, of the stars, and the sun. New light is thrown on the source of the sun's heat; we can make more than guesses as to its probable age. The great question to-day is: is there have been evolved?

But the discovery of electrons is only one of the revolutionary changes which give modern science an entrancing interest.

Chapter 3

Other Things

3.1 A table

A table is defined here, but LaTeX will put it where it wants (just like the figure).

3.2 Referencing Fun

This is a first reference (**?**) is in parenthesis. The next is in text, viz **?** say something really interesting. You can also add bits before and after (before **?**, after) but you should use it for things like (**?**, section 2) or (**?**, page 7). See the natbib package documentation for more information.

3.3 The `split_refs.py` script

This uses the listings package to format the code, see the CTAN documentation for details on how to control how the code looks.

```
#!/usr/bin/env python

import sys


if len(sys.argv) != 2:
        print "Usage: split_ref.py filename"
        sys.exit()
```

Table 3.1: A Table for the caption

Col 1	Col 2
blah	blah
blah	blah
blah	blah
blah	blah
blah	blah
blah	blah

```
refs={}
f=open("references.bib")
n=f.read()
f.close()
o=n.split('@')
for p in o:
        if p and not p.startswith('%'):
                key=p.split('{')[1].split(',')[0]
                refs[key]=p


#print refs


f2=open("%s.aux"%sys.argv[1].split('.')[0])
cited=f2.read().split('\n')
f2.close()

for l in cited:
        if l.startswith("\citation{"):
                key=l.split('{')[1].split('}')[0]
#               print key
                if key.find(',')>=0:
                        print 'many'
                        for nkey in key.split(','):
                                if nkey in refs:
                                        del refs[nkey]
                else:
                        if key in refs:
                                del refs[key]
import os
os.system("cp bibliography.bib bibliography-%i.bib"%os.getpid())
f3=open("bibliography.bib","w")
for k in refs:
        f3.write( "@%s" % refs[k])
f3.close()
```

3.4 Padding Text

The rest of this chapter is junk text to pad out the pages.

The story of the triumphs of modern science naturally opens with Astronomy. The picture of the Universe which the astronomer offers to us is imperfect; the lines he traces are often faint and uncertain. There are many problems which have been solved, there are just as many about which there is doubt, and notwithstanding our great increase in knowledge, there remain just as many which are entirely unsolved.

The problem of the structure and duration of the universe [said the great astronomer Simon

Newcomb] is the most far-reaching with which the mind has to deal. Its solution may be regarded as the ultimate object of stellar astronomy, the possibility of reaching which has occupied the minds of thinkers since the beginning of civilisation. Before our time the problem could be considered only from the imaginative or the speculative point of view. Although we can to-day attack it to a limited extent by scientific methods, it must be admitted that we have scarcely taken more than the first step toward the actual solution.... What is the duration of the universe in time? Is it fitted to last for ever in its present form, or does it contain within itself the seeds of dissolution? Must it, in the course of time, in we know not how many millions of ages, be transformed into something very different from what it now is? This question is intimately associated with the question whether the stars form a system. If they do, we may suppose that system to be permanent in its general features; if not, we must look further for our conclusions.

3.5 The Heavenly Bodies

The heavenly bodies fall into two very distinct classes so far as their relation to our Earth is concerned; the one class, a very small one, comprises a sort of colony of which the Earth is a member. These bodies the Earth, and they all circle round the sun. Their names, in the order of their distance from the sun, are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and of these Mercury, the nearest to the sun, is rarely seen by the naked eye. Uranus is practically invisible, and Neptune quite so. These eight planets, together with the sun, constitute, as we have said, a sort of little colony; this colony is called the Solar System.

solar system. Every one of those glittering points we see on a starlit night is at an immensely greater distance from us than is any member of the Solar System. Yet the members of this little colony of ours, judged by terrestrial standards, are at enormous distances from one another. If a shell were shot in a straight line from one side of Neptune's orbit to the other it would take five hundred years to complete its journey. Yet this distance, the greatest in the Solar System as now known (excepting the far swing of some of the comets), is insignificant compared to the distances of the stars. One of the nearest stars to the earth that we know of is Alpha Centauri, estimated to be some twenty-five million millions of miles away. Sirius, the brightest star in the firmament, is double this distance from the earth.

We must imagine the colony of planets to which we belong as a compact little family swimming in an immense void. At distances which would take our shell, not hundreds, but millions of years to traverse, we reach the stars–or rather, a star, for the distances between stars are as great as the distance between the nearest of them and our Sun. The Earth, the planet on which we live, is a mighty globe bounded by a crust of rock many miles in thickness; the great volumes of water which we call our oceans lie in the deeper hollows of the crust. Above the surface an ocean of invisible gas, the atmosphere, rises to a height of about three hundred miles, getting thinner and thinner as it ascends.

Appendix A

This is an example appendix

This is the appendix.

Appendix B

Another Example

This is a second example.