

N=2 Supersymmetric Dynamics for Pedestrians. Yuji Tachikawa. Hindustan Book Agency (India), P19, Green Park Extension, New Delhi 110 016. 2015. xviii + 224 pp. Price: Rs 500. ISBN 978-93-80250-70-0.

This book is mainly an authentic account of $N=2$ supersymmetric quantum theories in four-dimension. It is divided into 13 chapters and 2 appendices.

In chapter 1, electromagnetic duality of $U(1)$ gauge theory is introduced and reviewed. Under the S and the T transformations, in order to preserve the quantization of the electric and magnetic charge, the dual field strength F_D and dual coupling e_D are defined so that $F_D = (4\pi/e^2)F$, and $(4\pi/e^2)(4\pi/e_D^2) = 1$ and the Dirac pairing is preserved under the operation. The 't Hooft–Polyakov monopole is also explained with its classical as well as super-symmetry features.

In chapter 2, the Lagrangian with $N=2$ supersymmetry is constructed and the total Lagrangian, which is the sum of the vector multiplet and the hypermultiplets is given (equation (2.1.16)). The supersymmetric vacua solution is stated as conditions. When the mass terms $\mu_j^i = 0$, there is a class of vacuum configurations given by just demanding conditions equation (2.2.6) and equation (2.2.3), and setting $\Phi = 0$. This is called Higgs branch. There is a Coulomb field remaining in the infrared; these vacua are called the Coulomb branch. Finally, quantum BPS mass formula is obtained as an inequality $M \geq |Z|$. In chapter 3, basically the Lagrangian of $N=2$ supersymmetric field theory constructed as in chapter 2 is seen through different field theoretic methods such as one-loop

renormalization and anomalies. The presentation is less clear as background knowledge is assumed. However, $N=1$ pure supersymmetric Yang–Mills theory with gauge group $SU(N)$ with the vector-multiplet-Lagrangian is considered to explain confinement and gaugino condensate. This theory is believed to confine, with nonzero gaugino condensate $\langle \lambda \alpha \lambda^\alpha \rangle$.

In chapter 4, Seiberg–Witten solution to pure $SU(2)$ theory is explained. Schematic diagram for running coupling for the pure $SU(2)$ theory is provided. The matrix M_∞ is called the monodromy at infinity is obtained. The supersymmetric vacuum, parametrized by u , is called u -plane and is drawn showing the monodromy at infinity. Behaviour in the strongly coupled region is explored with the u diagram and solution is found to be in terms of M_+ and M_- matrices. In order to study the Seiberg–Witten solution, the Sieberg–Witten curve $\Sigma: \Lambda^2 z + (\Lambda^2/z) = x^2 - u$ and Sieberg–Witten differential $\lambda = x(dz/z)$ are introduced. The ultraviolet (UV) curve C of pure $SU(2)$ theory and sheets of the Sieberg–Witten curve Σ of $SU(2)$ theory are illustrated by diagrams. The Sieberg–Witten curve, the u -plane diagram and the UV curve are vital to study the theory. The Sieberg–Witten curve of the pure $SU(2)$ theory, when smoothed out, is torus. In chapter 5, $N=2$ supersymmetric $SU(2)$ gauge theory with one hypermultiplet in the doublet representation is described. This is often called the $SU(2)$ theory with one flavour, or more simply $N_f=1$. The presentation in this chapter is full of diagrams using u -plane, Sieberg–Witten curve and UV curve and hence it is easy to understand. The main fact is that there are three singularities in the u -plane and these are called quark-point, monopole point and dyon point. In chapter 6, the physical meaning of the Sieberg–Witten curve and the UV curve is given in terms of six-dimensional theory. The advantage of this is that it is easy to guess the solutions to $SU(2)$ gauge theory. The ideas presented here are borrowed from string theory, and M -theory – these theories are a prerequisite to understanding this chapter. It is found that the string of six-dimensional $N=(2,0)$ theory gives rise to both electrically charged objects such as W-boson and magnetically charged objects such as monopoles. In chapter 7, the Higgs branch is studied in more detail. Basically the curves obtained via the

six-dimensional construction have the correct properties to describe the respective four-dimensional theories is checked for the Higgs branch of $N=2$ theories.

In chapter 8, the solutions of $SU(2)$ gauge theories with two and three flavours is considered. One of the aims in this chapter is to perform various checks to see that they do produce expected properties, and to study strong coupling dynamics using them. For $N_f=2$, totally four singularities are expected in the u -plane. This can be checked by studying the discriminant of the Seiberg–Witten curve. Massless case $\mu_1 = \mu_2 = 0$ is studied and that four branch points meet in pairs when $u=0$ or $u=-4\Lambda^2$ is shown in the u -plane (figure 8.3). R -symmetry is studied for this too. Chapter 6 shows that low energy behaviour at $u=0$ and $u=-\Lambda^2$ is related by the discrete R -symmetry combined with the flavour parity. It is uniquely concluded that there are two hypermultiplets with charge 1. Quantum and classical moduli of $N_f=2$ are shown by diagrams. For $N_f=3$, totally five singularities are expected in the u -plane. Massless case $\mu=0$ is the studied. There is an u -independent branch point and two other branch points move with z and are found to be the solutions of $\Lambda^2 z^2 - \Lambda^2 z + u - \Lambda^2 = 0$. In chapter 9, $SU(2)$ gauge theory for $N_f=4$ flavours as guessed in eq. (6.4.12) is discussed. The six singularities in the u -plane are discussed. The S duality acts on the $SO(8)$ flavour symmetry via its outer-automorphism. The analysis is generalized to arbitrary theories with gauge group of the form $SU(2)^n$ and this is known as Gaiotto's duality. The presentation of topic in this chapter is complete and illustrative compared other available books on the same topic.

In chapter 10, various superconformal field theories of the type first found by Argyres and Douglas, which arise when electrically and magnetically charged particle become simultaneously very light. In chapter 5 it is observed that there is a singular point of the Coulomb branch of the $N_f=1$ theory and chapter 10 is devoted to the study of the physics of that singular point and its generalization. The Argyres–Douglas point on the Coulomb branch is detected when $u \sim \Lambda^2$. Such a point was identified first in the case of pure $SU(3)$ theory and extended to $SU(2)$ theories with flavours. The Argyres–Douglas CFTs of rank 1 from $SU(2)$ with flavours are tabulated. The

author has tried to provide a naming system for the Argyres–Douglas theories, too. In chapter 11, the solutions to $SU(N)$ and $SO(2N)$ theories with and without hypermultiplets in the fundamental representation is described. The theory is analysed using the Sieberg–Witten curves and semi-classical analysis. For $SU(N)$ theory mass of monopole is identified in eq. (11.2.13). Similar study for $SO(2N)$ led to running coupling as in eq. (11.4.24). The Argyres–Douglas CFTs are obtained for these theories and the Sieberg–Witten solutions to the theories are mentioned in this chapter. The presentation in this chapter is satisfactory. In chapter 12, the S -duality of the $SU(N)$ gauge theory with $2N$ flavours and its generalization are well presented. Crucial roles would be played by punctures on the UV curve labelled by Young diagrams with N boxes whose relation to the Higgs branch will be explained. As an application to the superconformal field theories with exceptional flavour symmetries $E_{6,7,8}$ are constructed. Appendix A discusses prepotential and the instanton computation, while Appendix B discusses the Zoo of $N = 2$ theories. Both appendices are illustrated well.

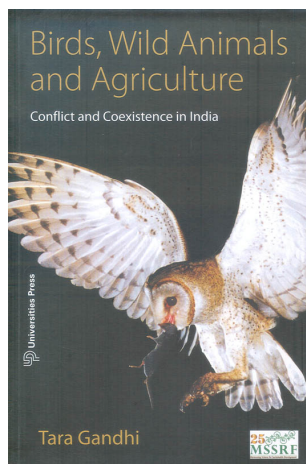
Chapter 13 summarizes the whole book. The book is authentic as far as valuable references are concerned. Most importantly, this book mentions the open problems and issues which are missing in most other such books. Some unsolved problems are as follows (p. 204):

- $N = 2$ supersymmetric $SU(7)$ gauge theory with a hypermultiplet in the three-index anti-symmetric tensor representation.
- $N = 2$ supersymmetric $SU(2)^3$ gauge theory with a massive full hypermultiplet in the trifundamental (Q_{aiu}, \bar{Q}^{aiu}) , have not been solved yet.

Overall the book is excellent and is easy reading for an advanced researcher of this field.

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Birds, Wild Animals and Agriculture: Conflict and Coexistence in India. Tara Gandhi. Universities Press (India), Private Limited, 3-6-747/1/A and 3-6-754/1, Himayatnagar, Hyderabad 500 029. 2015. viii + 216 pp. Price: Rs 500. ISBN 978-81-7371-9516.

Competition for resources between species is one of the key drivers of the dynamics of biological communities and ecosystems. As a result, competition in biological communities has been the most widely researched aspect of ecology. However competition between humans and other animals has come to be known as ‘human–animal conflict’, thereafter limiting the scope of research on the subject throughout the world. Currently, the subject of human–animal conflict has a narrow focus, and only attracts the attention of wildlife biologists and reserve managers.

A wide range of resource-use conflicts between humans and other animals is known. Over the past couple of weeks I have been watching the desperate attempts of a pair of Scaly-breasted Munias to build a nest behind the air-conditioner in my neighbour’s balcony. After a day’s hard work, the birds are left only to start from where they began when the man of the apartment promptly removes the nest and throws it away. This is just one form of conflict. There are other forms, where in the affected animal retaliates resulting even in death of one or both involved in the conflict.

Human–animal conflicts that result in loss of lives and property are seen as detrimental to society as well as wildlife conservation. Governments have established various schemes for compensating the loss of human lives and property.

While the system of monetary compensation for the loss of human life and property is widely practised in the country, it has failed to complement wildlife conservation. Consequently governments and conservation biologists are seeking answers in traditional systems of human–animal conflict mitigation and harmonious co-existence.

Traditional systems of conflict mitigation in India evolved in agro-ecosystems. Birds, rodents and a variety of other wild animals damage crops irrespective of the agro-ecology of the region. Historically humans have devised numerous simple means to minimize the damage and also prevent direct conflicts with the animals involved. Several traditional and ingenious methods of conflict resolution in agro-ecosystems persist all over India; the book under review has made an attempt to document some of the more explicit ones.

The book is the outcome of the author’s five years of travel, and documentation of conflicts and co-existence in agro-ecosystems across the country, while being associated with the M.S. Swaminathan Research Foundation, Chennai. Many photographs presented by the author in the book suggest this. The book is organized as four parts: the first deals with aspects of human–wildlife conflicts and co-existence; the second deals with birds in agriculture; the third is focused on wild animals as crop depredators, and the fourth is a selection of case studies on birds and mammals in agriculture.

The book is well illustrated with numerous photographs and a handful of maps. Although mammals are also dealt with, the focus of the book has been on birds. The author has discussed birds as pollinators, as predators of insect pests, as dispersers of seeds and also as crop-raiders. The fact that the proportion of Indian birds that play a helpful role in the



Purple Sunbird drinking flower nectar (photograph © K. Gnanaskandan).