

Preface

The Sant Cugat Forum on Astrophysics¹ is a framework designed to host international meetings of scientists directed to analyze violent phenomena in the universe. The forum workshops focus on a specific aspects of astrophysics, are held every 2 years with a typical attendance of up to 100 scientists, and have a duration of 3–4 days. This book gives account of the 2nd forum session: “Workshop on cosmic-ray induced phenomenology in star-forming environments” and was held on April 16–19, 2012.

During the last few years, we witnessed how the newest facilities observing gamma rays of high ($>100\text{ MeV}$) and very high energy ($>100\text{ GeV}$), among them, the GeV-satellites Fermi and AGILE and the ground-based TeV telescopes MAGIC, VERITAS, and H.E.S.S., established interesting facts concerning cosmic-ray-induced phenomenology in stellar environments. Indeed, observations of closer, normal galaxies, like the LMC, have revealed an inner structure that allows comparing with the position, and studying the influence, of star-forming regions directly. The first detections ever of starbursts galaxies in gamma rays were achieved both in GeV and TeV bands, followed by the first population analysis of infrared luminous galaxies. Discussions of the relationship between central AGNs and starbursts as origins of the high-energy emission are starting to be possible, as well as a more detailed analysis of the cosmic ray environment in galaxies other than our own. Also, the relationship between cosmic ray acceleration in shells and their interaction in nearby molecular clouds can at last be studied observationally, with an increasing degree of precision, shedding light on the diffusion properties of cosmic rays in different galactic environments. Additionally to this traditional astroparticle focus for understanding the propagation of the highest energy cosmic rays, molecular abundance ratios could turn out to be a new way to trace the presence of cosmic rays and to infer their fluxes, given that observed abundance enhancements could be due to ionization by X-rays and/or interactions of low-energy CRs with gas and dust. Finally, the fluorescent Fe $K\alpha$ line at 6.4 keV is also

¹<http://www.ice.csic.es/research/forum>

detected from molecular clouds in the galactic center region and can be accounted for in terms of the impact of low-energy CRs with neutral gas in the clouds. These are the topics of this book.

In a sense, this workshop built up on a very interesting meeting held at the Lorenz Center in Leiden, earlier in 2011: “Cosmic Ray Interactions: Bridging High and Low Energy Astrophysics,” and was organized by S. Markoff, J. Martín Pintado, J. Vink, F. Yusef-Zadeh, and one of us (D. F. Torres). It was clear in that meeting that the topic deserved further discussion, as well as a reference book. We hope that this volume could help filling this gap.

We would like to warmly thank the Scientific Organizing Committee (SOC), who have helped us shape the content and direction of the workshop. The SOC was formed by:

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