EP 1: Astrophysik

Time: Monday 14:00–16:00 Location: DO24 1.103

Invited Talk EP 1.1 Mon 14:00 DO24 1.103

The gaseous outskirts of the Milky Way — •Philipp Richter — University of Potsdam

Galaxies like the Milky Way are surrounded by large amounts of diffuse gas that connects the stellar body of a galaxy with the surrounding cosmological large-scale structure. This diffuse gas component, commonly referred to as circumgalactic medium (CGM), plays a key role in the on-going formation and evolution of galaxies in the local Universe. In this talk I will review our current understanding of the distribution and physical nature of the circumgalactic gas surrounding the Milky Way and discuss recent observational and theoretical studies of the local CGM that provide important new information on the past and future evolution of our Galaxy.

EP 1.2 Mon 14:30 DO24 1.103

Evidence for the Stochastic Acceleration in Supernova Remnants — •Alina Wilhelm[1,2] and Igor Telezhinsky[1] — [1]Desy, Zeuthen, Deutschland — [2]Universität Potsdam, Deutschland

Observationally deduced particle spectra in Supernova Remnants (SNR) often do not fit to expectations based on cosmic-ray modified Diffusive Shock Acceleration theory. Here we are concerned with the Second Order Fermi Acceleration process; we discuss its benefits and argue why introducing such a mechanism is the most natural solution. We solve the full transport equation for cosmic rays in the test-particle regime and investigate the consequences of Stochastic Acceleration. We infer that Second Order Fermi Acceleration strongly modifies the particle spectrum and that its contribution is sufficient to generate the observed radio emission flux. We therefore conclude that Stochastic Acceleration is an essential part of the particle dynamics in SNR.

EP 1.3 Mon 14:45 DO24 1.103

Cosmic-ray pitch-angle scattering and isotropization — •Robert C. Tautz — Technische Universität Berlin

Spacecraft observations have revealed the necessity to refine the modeling of the transport of charged energetic particles to allow for phase-space distributions that are strongly pitch-angle anisotropic, which cannot be properly accounted for by the diffusion approximation. Central to such a modeling refinement is the determination of the pitch-angle diffusion coefficient that occurs in the Fokker-Planck transport equation and is frequently used to determine the parallel mean-free path. In addition, the process of pitch-angle isotropization is important for many applications ranging from diffusive shock acceleration to large-scale cosmic-ray transport. In the talk, both a systematic comparison and new results are shown from analytical predictions of the Fokker-Planck coefficient of pitch-angle scattering and from numerical test-particle simulations.

EP 1.4 Mon 15:00 DO24 1.103

Understanding the anisotropy of cosmic rays — •Robert Rettig — Universität Potsdam, Institut für Physik und Astronomie, Karl-Liebknecht-Strasse 24/25, 14476 Potsdam-Golm

The anisotropy in the distribution of cosmic-ray arrival directions measured in the TeV-energy range by several experiments shows both large and small-scale structures. While the large-scale anisotropy can be explained within the framework of a diffusive propagation of cosmic rays, the origin of the small-scale structures remains unclear. We investigate the arrival directions of charged particles using numerical three-dimensional Monte-Carlo test-particle simulations, in which the test-particles propagate in a time-independent spatially fluctuating magnetic field derived from a three-dimensional isotropic turbulence power spectrum. Is has been recently argued that the turbulent magnetic field itself generates the small-scale structures of the anisotropy if a global cosmic-ray dipole moment is present. Using our test-particle approach, we can test the reliability of that hypothesis.

EP 1.5 Mon 15:15 DO24 1.103

Reconstruction of externally triggered radio events with AERA 124 — •Qader Dorosti Hasankiadeh — Institut für Experimentelle Kernphysik, Karlsruher Institut für Technologie, Hermann-von-Helmholtz-Platz 1, Geb. 425 76344 Eggenstein-Leopoldshafen

The Auger Engineering Radio Array (AERA) aims to detect air showers caused by the interactions of ultra-high energy cosmic rays with the Earth atmosphere, providing complementary information on the direction, energy and composition of the cosmic rays to the Auger surface and fluorescence detectors. The second stage of the AERA, currently consisting of 124 radio stations, has been completed at the Pierre Auger Observatory in early 2013, resulting in a larger detection area. Compared with the first stage of the AERA, i.e. AERA 24, AERA 124 exploits a larger detection area, which consequently results in a larger event rate. However, a larger detection area increases the probability of noise contaminations in radio signal. We have developed a robust reconstruction strategy to select radio signals with high purity by largely suppressing noise contaminations. The selection method relies on the causality relation between the arrival time of radio signals and the incoming direction of air showers independently measured by the Auger surface detector. To this end, we have applied the reconstruction strategy on the AERA experimental data externally triggered by the surface detector. The initial analysis of the externally triggered radio events measured by AERA 124 will be presented in this talk.

EP 1.6 Mon 15:30 DO24 1.103

Studies of Blazar emission regions and their morphology — •Stephan Richter[1] and Felix Spanier[2] — [1]Lehrstuhl für Astronomie, Universität Würzburg, Germany — [2]Centre for Space Research, North-West University, Potchefstroom, South Africa

The so called Synchrotron-Self-Compton (SSC) models have been quite successful in explaining the broad spectral energy distributions (SEDs) emitted by Blazars. They are, however, unable to explain the observed radio emission. Furthermore the assumption of a finite emission region imposes artificial boundary conditions for most of the high energy particle content.

In this talk we present studies aiming to resolve both of the above issues. We adopt the so called shock-in-jet model and track the accelerated particles downstream up to scales of VLBI observations. We find that most of the SED, except the highest energies, is strongly dependent on the imposed morphology and can be used to constrain the radial confinement and magnetic field structure behind the shock.

The full time dependence of our approach can be used to further constrain the model by comparison with radio and high energy lightcurves and their time lags.

EP 1.7 Mon 15:45 DO24 1.103

Transport of magnetic turbulence in the vicinity of Supernova Remnant shock fronts — •Robert Brose[1,2] and Igor Telezhinsky[2,3] — [1]Humboldt-Universität zu Berlin, Institute of Physics, Unter den Linden 6, 10099 Berlin, Germany — [2]DESY, Platanenallee 6, 15738 Zeuthen, Germany — [3]University of Potsdam, Institue of Physics & Astronomy, Karl-Liebknecht-Straße 24/25, 14476 Potsdam, Germany

To model the acceleration of cosmic rays in Supernova Remnants, we solve a time-dependent transport equation for magnetic turbulence accounting for advection and cascading of waves traveling in upstream or downstream direction. This is combined with prior simulations by Telezhinsky, et al., which modeled CR acceleration by solving the CR transport equation in a test-particle approach combined with 1-D hydrodynamical simulations of the Remnant evolution. This way we account for the amplification of magnetic turbulence, which is thought to be needed to confine particles close enough to the shock to participate in the acceleration process. Both transport equations are coupled via the diffusion coefficient respectively the energy density of the magnetic turbulence and the growth rates. Here first self-consistent particle and turbulence spectra for type Ia Supernova Remnants are going to be presented.