EP 9: Astrophysik

Zeit: Donnerstag 14:30–16:30 Raum: G.10.02 (HS 9)

Hauptvortrag EP 9.1 Do 14:30 G.10.02 (HS 9)

Galactic Winds — •Dominik Bomans — Astronomical Institute of the Ruhr-University Bochum — RUB Research Department Plasmas with Complex Interactions

The combined action of ionizing radiation and winds of massive stars together with the supernova explosions at the end of the live of massive stars can pump prodigious amounts of energy in the interstellar medium of their host galaxy. As a result large over-pressured bubbles form and material is ejected out of the galaxy. These galactic winds are key ingredients for the physics of birth and evolution of galaxies in the intergalactic medium. Via galactic winds the halos of galaxies are structured, heated, and enriched with heavy elements. In some galaxies, also winds driven by the radiation and mass outflows from super-massive black holes contribute.

In this talk I will explore the properties and frequency of galactic winds in the local universe and use these results to extrapolate on the physics at high redshift during the formation epoch of galaxies. Key data for the analysis are based on integral field spectroscopy (especially from the CALIFA survey, the new MUSE instrument at the ESO VLT, and Fabry-Perot interferometers), with additional information provided by data from the Hubble Space Telescope, as well the CHANDRA and XMM-Newton X-ray satellites, and radio synthesis telescopes.

EP 9.2 Do 15:00 G.10.02 (HS 9)

Cosmic rays in astrosphere — •Klaus Scherer[1,2], August van der Schyff[3], Domink Bomans[4], Stefan Ferreira[3], Horst Fichtner[1,1], Jens Kleimann[1], DuToit Strauss[4], Kerstin Weis[3], Tobias Wiengarten[1], and Thomas Wodzinski[4] — [1]Institut für Theoretische Physik IV: Weltraum- und Astrophysik, Ruhr-Universität Bochum, Germany — [2]Research Department, Plasmas with Complex Interactions, Ruhr-Universität Bochum, Germany — [3]Center for Space Research, North-West University, 2520 Potchefstroom, South Africa — [4]Astronomische Institute, Ruhr-Universität Bochum, Germany

We model the cosmic ray ux in a stellar wind cavity of a O or B type star using a transport model based on stochastic differential equations. The required parameters, for example the coffiecients of the dffusion tensor, are determined from an underlying hydrodynamical model with a kinematic describtion of the magnetic field. We discuss the transport in the astrosphere of lambda Cephei with varying parameters for the transport co- efficients. We will argue that large stellar wind cavities can act as sinks for the galactic cosmci ray flux.

EP 9.3 Do 15:15 G.10.02 (HS 9)

Modellierung der Hochenergie-Emission Aktiver Galaxienkerne — •Felix Spanier[1], Matthias Weidinger[2] und Stephan Richter[3] — [1]North-West University, Potchefstroom, Südafrika — [2]Theoretische Physik IV, Ruhr-Universität Bochum, Bochum, Deutschland — [3]Ice-Cube Collaboration, Südpol

Aktive Galaxienkerne können durch Experimente wie HESS, MAGIC oder Fermi in viel größerem Umfang und mit viel besserer Energieauflösung beobachtet werden als noch vor einem Jahrzehnt. Dies erlaubt einerseits, ein vollständiges Bild der möglichen Emissionen von AGN abzubilden, wirft aber auch neue Fragen auf.

Hier soll auf neue Ansätze der Modellierung eingegangen werden, die ein umfassendes Verständnis der physikalischen Prozesse in AGN ermöglicht. Insbesondere soll hier auf die Frage der hadronischen Komponente eingegangen werden, aber auch auf die Modellierung der Radioemission von ausgedehnten Komponenten.

EP 9.4 Do 15:30 G.10.02 (HS 9)

Characterizing the Kelvin-Helmholtz instability in interstellar jets using radiation — •Richard Pausch[1,2], Alexander Debus[1], Axel Huebl[1,2], Klaus Steiniger[1,2], René Widera[1], Michael Bussmann[1], and Ulrich Schramm[1,2] — [1]Helmholtz-Zentrum Dresden - Rossendorf — [2]Technische Universität Dresden

We present a new diagnostic method to determine the presence of the Kelvin-Helmholtz instability (KHI) in interstellar jets and measuring its main property, the exponential growth rate, using radiation observable on Earth.

Our findings are based on simulations of the relativistic KHI using the 3D3V particle-in-cell code PIConGPU. With its in-situ computation of the emitted far field radiation, we determined angularly resolved radiation spectra for all billions of particles simulated.

We will explain how measuring the electromagnetic radiation from particle jet allows for identifying the stages of the instability and provides a method to settle the question whether the KHI occurs in astrophysical particle jets or not. By identifying these stages, determining the characteristic growth rate of the KHI becomes possible thus providing quantitative insides to the jet dynamics using only the radiation observed on Earth.

EP 9.5 Do 15:45 G.10.02 (HS 9)

Reacceleration of electrons in supernova remnants — Martin Pohl[1,2], •Alina Wilhelm[1,2], and Igor Telezhinsky[1,2] — [1]DESY, 15738 Zeuthen, Germany — [2]Institute of Physics and Astronomy, University of Potsdam, 14476 Potsdam, Germany

The radio spectra of many shell-type supernova remnants show deviations from those expected on theoretical grounds. In this work we determine the effect of stochastic reacceleration on the spectra of electrons in the GeV band and at lower energies, and we investigate whether or not reacceleration can explain the observed variation of radio spectral indices. Noting that low-energy particles are efficiently coupled to the quasi-thermal plasma, a simplified cosmic-ray transport equation can be formulated and is numerically solved. Using a synchrotron emissivity that accurately reflects a highly turbulent magnetic field, we calculate the radio spectral index and find that soft spectra with index $\alpha \lesssim 0.6$ can be maintained over more than 2 decades in radio frequency, even if the electrons experience reacceleration for only one acceleration time. A spectral hardening is possible but considerably more frequency-dependent. The spectral modification imposed by stochastic reacceleration downstream of the forward shock depends only weakly on the initial spectrum provided by, e.g., diffusive shock acceleration at the shock itself.

EP 9.6 Do 16:00 G.10.02 (HS 9)

Gemeinsame Detektion von Radioemission und Myonen ausgedehnter Luftschauer am Pierre-Auger-Observatorium — •Ewa M. Holt[1,2] und Frank G. Schröder[1] — [1]Institut für Kernphysik, Karlsruher Institut für Technologie — [2]ITeDA - CNEA - CONICET - UNSAM, Buenos Aires

Die separate Messung der elektromagnetischen und myonischen komponente eines ausgedehnten Luftschauers ermöglicht die komplementäre Bestimmung verschiedener Schauerparameter. Damit lässt sich z.B. die Masse des Primärteilchens abschätzen. Durch die Kombination verschiedener Detektortypen am Pierre-Auger-Observatorium ist diese komplementäre Messung möglich. Die geladene elektromagnetische Komponente des Luftschauers sendet in der Atmosphäre Strahlung im MHz-Bereich aus. Die Atmosphäre ist für diese Strahlung durchlässig, so dass sie mit den Radioantennen des 'Auger Engineering Radio Arrays' (AERA) am Erdboden nachgewiesen werden kann. Die myonische Komponente wird mit den Szintillatoren des 'Auger Muon and Infill for the Ground Array' (AMIGA) nachgewiesen. Um die elektromagnetischen Teilchen abzuschirmen, sind diese in 2,20 m Tiefe vergraben. In diesem Vortrag werden erste Ergebnisse einer kombinierten Analyse der Daten dieser beiden Detektoren vorgestellt.

EP 9.7 Do 16:15 G.10.02 (HS 9)

Effect of night sky background on H.E.S.S. observations — •Eva Leser — Universität Potsdam

Imaging atmospheric Cherenkov telescopes like the H.E.S.S. experiment in Namibia have to deal not only with a high background rate due to air showers produced by hadrons but also with the background light of stars. This night sky background ranges between around 40 MHz for extragalactic target regions and around 300 MHz in the most luminous parts of the galactic plane. It can affect the energy threshold of observations, the sensitivity, and potentially adds to the systematic uncertainties of a measurement. This talk will explore the influence of night sky background variations on the overall background rate and the acceptance of the H.E.S.S. detector.