EP 14: Astrophysics III - Magnetic Fields, Stellar Clusters, Cosmic Rays and Cosmology

Zeit: Freitag 11:00–12:15 Raum: BSZ - Pabel HS

EP 14.1 Fr 11:00 BSZ - Pabel HS

Interacting multiple stellar winds in stellar clusters — •Alexander Noack[1], Klaus Scherer[1], Horst Fichtner[1], Jens Kleimann[1], and Kerstin Weis[2] — [1]Ruhr-Universitaet Bochum, Institut fuer Theoretische Physik IV, Universitaetsstrasse 150, 44780 Bochum — [2]Ruhr-Universitaet Bochum, Astronomisches Institut, Universitaetsstrasse 150, 44780 Bochum

Several studies have investigated large-scale cluster winds resulting from an intra-cluster interaction of multiple stellar winds, but as yet no details of the bordering flows inside a given cluster have been provided. The present work aims at exploring the principal structure of the combined flow resulting from the interaction of multiple stellar winds inside stellar clusters. The theory of complex potentials is applied to analytically investigate stagnation points, boundaries between individual outflows, and the hydrodynamic structure of the asymptotic large-scale cluster wind. In a second part, these planar considerations are extended to fully three-dimensional, asymmetric configurations of wind-driving stars. It is found (i) that one can distinguish regions in the large-scale cluster wind that are determined by the individual stellar winds, (ii) that there exist comparatively narrow outflow channels, and (iii) that the large-scale cluster wind asymptotically approaches spherical symmetry at large distances. In summary, the combined flow inside a stellar cluster resulting from the interaction of multiple stellar winds is highly structured.

EP 14.2 Fr 11:15 BSZ - Pabel HS

Solenoidal improvements for the JF12 Galactic magnetic field — •Jens Kleimann[1,2], Timo Schorlepp[1,2], Lukas Merten[1,2], and Julia Becker Tjus[1,2] — [1]Theoretische Physik IV, Ruhr-Universität Bochum, Germany — [2]Ruhr Astroparticle and Plasma Physics (RAPP) Center

The popular JF12 (Jansson & Farrar 2012) analytic model provides a quantitative description of the Galaxy's large-scale magnetic field that is widely used in various astrophysical applications. However, both the poloidal X-type component and the spiral disk component of JF12 exhibit regions in which the magnetic divergence constraint is severely violated. We first propose a cure for this problem, resulting in a truly solenoidal large-scale field. Second, the otherwise straight field lines of the X-type component exhibit kinks in the Galactic plane that, while not unphysical, pose difficulties for, e.g., numerical tracing of cosmic-ray particles. We propose and discuss two possible strategies to mitigate this problem. All corrections are kept as minimal as possible in order not to destroy the agreement to observational data that the unmodified JF12 field was based on. Furthermore, the performance of our improved version of the field model is quantitatively assessed by test simulation using the CRpropa Galactic cosmic-ray propagation code.

EP 14.3 Fr 11:30 BSZ - Pabel HS

MHD simulation of the interplanetary solar magnetic field — •Edin Husidic — Ruhr-Universität Bochum, Lehrstuhl für Weltraum- und Astrophysik

Results of 3D magnetohydrodynamic (MHD) simulations of the interplanetary magnetic field (IMF) of the Sun are presented. To this end the MHD equations were solved numerically by using the Cronos code. After a few tests validating the correct performance of Cronos (Parker's solar wind model (Parker, 1965) and the Brio and Wu shock tube (Brio and Wu, 1988)), the actual model for the IMF was implemented. Using this as a background, following Akasofu's work (Akasofu et al., 1983), two-dimensional simulations of propagating disturbances caused by a single solar flare were performed. Finally, these simulations were extended to three spatial dimensions.

EP 14.4 Fr 11:45 BSZ - Pabel HS

Measurement of the Cosmic-ray Proton Spectrum with the Fermi Large Area Telescope — •David Green for the The Fermi Large Area Telescope-Collaboration — Max Planck Institut für Physik, Munich, DE

We present the measurement of the cosmic-ray proton spectrum between 54 GeV and 9.5 TeV using 7 years of Pass 8 flight data from the Fermi Large Area Telescope (LAT). We developed a dedicated proton event selection with an acceptance of 0.25 m^2 sr. Our event selection yields a large dataset with a statistical uncertainty under 2% and residual contamination less than 5% across the entire energy range. The systematic errors associated with the acceptance, energy measurement, and GEANT4 Monte Carlo simulations are an order of magnitude larger than the statistical uncertainty. The resulting event selection and spectral measurement create the opportunity for additional proton analyses with the LAT, such as a dedicated proton anisotropy search.

EP 14.5 Fr 12:00 BSZ - Pabel HS

Explanation of Cosmic Inflation by Quantumgravitation — Hans-Otto Carmesin[1,2,3] and •Matthias Carmesin[4] — [1]Universität Bremen, Fachb. 1, Pf. 330440, 28334 Bremen — [2]Studienseminar Stade, Bahnhofstr. 5, 21682 Stade — [3]Gymnasium Athenaeum, Harsefelder Str. 40, 21680 Stade — [4]Universität Göttingen, Fak. f. Physik, 37077 Göttingen

From the Cosmic Microwave Background CMB the flatness problem and the horizon problem arose. An extraordinarily rapid increase of distances in the early universe, the Cosmic Inflation, was proposed by Guth in 1981 as a possible solution, whereby suggested mechanisms for such an increase have been criticized (Steinhardt: Scientific American 2011). We propose a theory that explains the Cosmic Inflation by Gravitation and Quantum Physics (Carmesin, H.-O.: Vom Big Bang bis heute mit Gravitation, Model for the Dynamics of Space. Berlin: Verlag Dr. Köster 2017.). We discover a sequence of dimensional phase transitions at critical densities. Our theory applies fundamental constants only, namely the gravitational constant G, the velocity of light c and the Planck constant h. Our results are in excellent quantitative agreement with observations, namely the critical density, the duration of cosmic inflation, the temperature fluctuations and the factor of increase correspond to the CMB. The flatness and horizon problems are solved. More precise observations would be particularly interesting concerning the factor of increase and possible scattering at dark matter.